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AAPOS Past Presidents

Marshall M. Parks, MD  1974-75  Lake Tahoe
Robert D. Reinecke, MD  1975-76  Bermuda
Jack C. Crawford, MD  1976-77  San Francisco
Robison D. Harley, MD  1977-78  Williamsburg
David S. Friendly, MD  1978-79  Toronto
Phillip Knapp, MD  1979-80  San Diego
Webb Chamberlain, MD  1980-81  Orlando
Arthur Jampolsky, MD  1981-82  Monterey
Alfred G. Smith, MD  1982-83  Vancouver
John A. Pratt-Johnson, MD  1983-84  Vail
Eugene R. Folk, MD  1984-85  Puerto Rico
Thomas D. France, MD  1985-86  Maui
Gunter K. von Noorden, MD  1986-87  Scottsdale
Arthur L. Rosenbaum, MD  1987-88  Boston
William E. Scott, MD  1988-89  Kiawah
Eugene M. Helveston, MD  1989-90  Lake George
Henry S. Metz, MD  1990-91  Montreal
John T. Flynn, MD  1991-92  Maui
Forrest D. Ellis, MD  1992-93  Palm Springs
David L. Guyton, MD  1993-94  Vancouver
Malcolm L. Mazow, MD  1994-95  Orlando
John D. Baker, MD  1995-96  Snowbird
Earl A. Palmer, MD  1996-97  Charleston
John W. Simon, MD  1997-98  Palm Springs
Marilyn T. Miller, MD  1998-99  Toronto
Maynard B. Wheeler, MD  1999-2000  San Diego
Albert W. Biglan, MD  2000-01  Orlando
Jane D. Kivlin, MD  2001-02  Seattle
Joseph H. Calhoun, MD  2002-03  Hawaii
George S. Ellis, Jr., MD  2003-04  Washington DC
Susan H. Day, MD  2004-05  Orlando
Michael X. Repka, MD  2005-06  Keystone
Christie L. Morse, MD  2006-07  Seattle
Edward G. Buckley, MD  2007-08  Washington DC
Bradley C. Black, MD  2008-09  San Francisco
C. Gail Summers, MD  2009-10  Orlando
David A. Plager, MD  2010-11  San Diego
Steven E. Rubin, MD  2011-12  San Antonio
K. David Epley, MD  2012-13  Boston
Sharon F. Freedman, MD  2013-14  Palm Springs
Sherwin J. Isenberg, MD  2014-15  New Orleans
AAPOS Board of Directors

President
M. Edward Wilson, MD
Executive Vice President
Christie L. Morse, MD
Vice President
Robert E. Wiggins, Jr., MD
Vice President-Elect
Derek T. Sprunger, MD
Secretary-Treasurer
Katherine A. Lee, MD, PhD
Secretary for Program
Sean P. Donahue, MD, PhD
Director-At-Large
Pamela E. Williams, MD
Director-At-Large
Mohamad S. Jaafar, MD
Director-At-Large
Stephen P. Christiansen, MD
Past President
Sherwin J. Isenberg, MD
AAPOS Councilor to the AAO
David A. Plager, MD

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Scientific Program Committee Chair
Sean P. Donahue, MD, PhD
Scientific Program Committee Members
Oscar A. Cruz, MD
K. David Epley, MD
Katherine J. Fray, CO
Nancy A. Hamming, MD
Scott A. Larson, MD
Tina Rutar, MD
Scientific Program Coordinator
Maria A. Schweers, CO
Program Manager, CME, AAO
Sian Hillier, MSc, CHCP

AAPOS Staff

AAPOS Client Services Manager
Jennifer Hull
AAPOS Client Services Coordinator
Brooke Lyon
AMS Communications Manager
Gina Minato
AMS Meetings Manager
Michael Paulos
### AAPOS Lifetime Achievement Award

George S. Ellis, Jr, MD  
Alex V. Levin, MD, MHSc  
Sharon F. Freedman, MD  
Richard A. Saunders, MD

### AAPOS Senior Honor Awards

Jonathan M. Holmes, MD  
Lawrence Tychsen, MD

### AAPOS Honor Awards

Dean J. Bonsall, MD, MS, FACS, FAAP  
Shira L. Robbins, MD  
Todd A. Goldblum, MD  
Gavin J. Roberts, MD  
Denise A. Hug, MD  
David L. Rogers, MD  
Melanie A. Kazlas, MD  
Miho Sato, MD  
Ramesh Kekunnaya, MD, FRCS  
Carol L. Shields, MD  
Garima Lal, MD  
Kristina Tarczy-Hornoch, MD, DPhil  
Sharon S. Lehman, MD  
Federico G. Velez, MD  
Andrea Molinari, MD  
Patrick Watts, MBBS  
Paul H. Phillips, MD  
Michale B. Yang, MD  
Stacy L. Pineles, MD

### AAPOS Committee Meetings (All rooms are in the Vancouver Convention Center East Building)

#### Wednesday, April 6, 2016

<table>
<thead>
<tr>
<th>Time</th>
<th>Committee</th>
<th>Room</th>
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<tbody>
<tr>
<td>7:00 AM - 8:30 AM</td>
<td>Finance Committee</td>
<td>Rooms 19 &amp; 20</td>
</tr>
<tr>
<td>12:15 PM - 2:15 PM</td>
<td>Council of Committee Chairs</td>
<td>Rooms 19 &amp; 20</td>
</tr>
<tr>
<td>3:30 PM - 4:30 PM</td>
<td>IPOS C Council</td>
<td>Rooms 19 &amp; 20</td>
</tr>
<tr>
<td>3:30 PM - 5:00 PM</td>
<td>Pediatric Low Vision Rehabilitation Committee</td>
<td>Room 4</td>
</tr>
<tr>
<td>4:00 PM - 5:00 PM</td>
<td>Adult Strabismus Task Force</td>
<td>Room 16</td>
</tr>
<tr>
<td>4:00 PM - 5:00 PM</td>
<td>Membership Committee</td>
<td>Room 5</td>
</tr>
<tr>
<td>4:30 PM - 6:00 PM</td>
<td>Interorganizational Relations Committee</td>
<td>Room 17</td>
</tr>
<tr>
<td>4:30 PM - 6:00 PM</td>
<td>Learning Disabilities and Vision Therapy Task Force</td>
<td>Room 6</td>
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#### Thursday, April 7, 2016

<table>
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<tr>
<td>2:30 PM - 3:30 PM</td>
<td>Vision Screening Committee</td>
<td>Room 16</td>
</tr>
<tr>
<td>2:30 PM - 3:30 PM</td>
<td>Corporate Relations Committee</td>
<td>Room 6</td>
</tr>
<tr>
<td>3:00 PM - 4:00 PM</td>
<td>Fellowship Directors Committee</td>
<td>Room 1</td>
</tr>
<tr>
<td>3:30 PM - 5:00 PM</td>
<td>IPOS CROP Africa Task Force</td>
<td>Room 4</td>
</tr>
<tr>
<td>4:00 PM - 5:00 PM</td>
<td>Young Ophthalmology Committee</td>
<td>Room 16</td>
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<tr>
<td>4:15 PM - 5:30 PM</td>
<td>Socioeconomic Committee</td>
<td>Room 17</td>
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<tr>
<td>4:30 PM - 5:30 PM</td>
<td>Public Information Committee</td>
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#### Friday, April 8, 2016

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<tr>
<td>12:00 PM - 1:00 PM</td>
<td>JAAPPOS Editorial Board</td>
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#### Saturday, April 9, 2016

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<tr>
<th>Time</th>
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<tr>
<td>10:00 AM - 11:00 AM</td>
<td>Research Committee</td>
<td>Room 16</td>
</tr>
<tr>
<td>10:15 AM - 11:15 AM</td>
<td>Professional Education Committee</td>
<td>Room 17</td>
</tr>
<tr>
<td>1:00 PM - 2:00 PM</td>
<td>Legislative Committee</td>
<td>Room 6</td>
</tr>
<tr>
<td>1:00 PM - 2:30 PM</td>
<td>International Affairs Committee</td>
<td>Room 17</td>
</tr>
<tr>
<td>2:00 PM - 3:30 PM</td>
<td>Subspecialty Training Task Force</td>
<td>Room 4</td>
</tr>
<tr>
<td>2:00 PM - 5:00 PM</td>
<td>International Program Committee</td>
<td>Room 5</td>
</tr>
</tbody>
</table>
Specific Learning Objectives

1. Cite most recent data from randomized controlled clinical trials in the diagnosis and management of amblyopia.
2. Describe new preoperative evaluation techniques and surgical strategies to improve outcomes in patients with comitant, non-paretic strabismus.
3. Compare new surgical techniques for complicated strabismus (restrictive, paretic, miswiring syndromes, scarring, incomitance, etc) to decrease reoperation rate.
4. Outline up-to-date patient selection criteria to identify children undergoing cataract surgery who should receive intraocular lenses.
5. Recognize new treatment techniques for pediatric glaucoma, retinal, and oculoplastic and orbital disease and make appropriate sub-specialty referrals for such cases.
6. Describe new treatment strategies to decrease the incidence of significant visual loss from high risk ROP.
7. Recognize pediatric ophthalmic disease of neurologic origin and describe the process for appropriate referrals to pediatric neurology.
8. Utilize the latest resources for discussion of visual development, epidemiology of pediatric eye disease, learning disabilities, vision screening strategies with other physicians and members of the lay community.
9. Identify current coding rules and regulations for pediatric eye diseases.
10. Recognize current laboratory research with potential translation applicability to pediatric ophthalmology.
11. Describe the role of OCT imaging in the diagnosis of optic nerve and retinal diseases.

FDA Status Disclaimer: The FDA has stated that it is the responsibility of the physician to determine the FDA status of each drug or device he or she wishes to use in clinical practice, and to use these products with appropriate patient consent and in compliance with applicable law. The AAPOS provides the opportunity for material to be presented for educational purposes only. The material represents the approach, ideas, statement, or opinion of the presenter and/or author, not necessarily the only or best method or procedure in every case, nor the position of AAPOS. The material is not intended to replace a physician's own judgement or give specific advice for case management. AAPOS specifically disclaims any and all claims that may arise out of the use of any technique demonstrated or described in any material by any presenter and/or author, whether such claims are asserted by a physician or any other person. Please note: The AAPOS requires all presenters and/or authors to disclose any drug or device that is not approved for use by the FDA in the manner discussed during any oral presentation and/or on all written materials.
AAPOS Educational Mission Statement

The purpose of the American Association for Pediatric Ophthalmology and Strabismus’ (AAPOS) educational activities is to present pediatric ophthalmologists and strabismologists with the highest quality lifelong learning opportunities that promote improvement and change in physician practices, performance, or competence through joint sponsorship with the American Academy of Ophthalmology (AAO), thus enabling such physicians to maintain or improve the competence and professional performance needed to provide the best possible eye care for their patients.

Due to the nature of the subspecialty, the largest component of AAPOS’ educational program focuses on strabismus, amblyopia, visual development and binocular function. However, the content also emphasizes the other Practice Emphasis Areas (PEAs) that have been defined by the American Board of Ophthalmology (ABO) for their Maintenance of Certification (MOC) process with emphasis on these disease processes in children, and adults with strabismus and eye movement disorders. These include:

- Cataract and Anterior Segment
- Cornea and External Disease
- Glaucoma
- Neuro-ophthalmology and Orbit
- Oculoplastics and Orbit
- Refractive Management and Intervention
- Retina and Vitreous
- Uveitis

Additionally, AAPOS’ educational program provides content for topics such as effective management of a pediatric ophthalmology practice, medical ethics, risk management, and other areas deemed relevant by the needs of the membership.

Types of educational activities provided at the annual AAPOS meeting include:

- Didactic lectures
- Original research in the form of free papers and posters
- In-depth focused workshops and symposia on specific topics
- Small-group discussion opportunities with speakers and researchers

All meeting content is reviewed by the AAPOS Program Committee and Secretary for Program with respect to education quality and utility. Members are routinely queried regarding their assessment of quality and content, as well as needs for future meetings, and comments are reviewed by the Program Committee and Board of Directors, with necessary changes incorporated into future programs.

The expected result of AAPOS’ educational activities is a broad array of ophthalmic knowledge that contributes to the lifelong learning of members and advances physician performance or competence. Ongoing assessment of the impact of AAPOS’ educational program is important in determining modifications to existing activities and the development of new activities. Specific expected results include increased knowledge across the ophthalmic community, activities designed to increase competence and performance with evidence-based standards, current practices, and methods of diagnosis, therapies, and disease prevention.
A Chronicle of Surgical Thinking and Doing for Exotropia: Innovations and Rediscoveries

Edward L. Raab, MD, JD

Thursday, April 7, 2016 - 8:20 - 8:45 am

The Costenbader Lecture is supported by the Children's Eye Foundation

Dr. Edward L. Raab is Professor of Ophthalmology and Pediatrics at the Icahn School of Medicine at Mount Sinai in New York. He has been Director of its Pediatric Ophthalmology and Strabismus Service since completion of his fellowship at Children's National Medical Center in Washington, DC. He has trained fellows and approximately 200 resident physicians at Mount Sinai and in Volunteer Faculty missions in India, China, Uganda, and Uzbekistan.

Dr. Raab presently serves on the Board of Governors and the Ophthalmology Advisory Council of the American College of Surgeons and is Past President of the American Orthoptic Council, the Greater New York Society for Pediatric Ophthalmology and Strabismus, the New York Pediatric Society, and the Costenbader Alumni Society. He is a member of the American Ophthalmological Society, and one of the founders of the American Association for Pediatric Ophthalmology and Strabismus, serving several terms as a Director and its representative to the American Academy of Ophthalmology Advisory Council. Dr. Raab has served on more than 20 occasions as an Associate Examiner for the American Board of Ophthalmology and as an item writer. He is a section Editor of Survey of Ophthalmology, a member of the American Orthoptic Journal Editorial Board, and recent Chair of the Pediatric Ophthalmology and Strabismus volume of the Academy's Basic and Clinical Science Course.

Dr. Raab’s primary professional practice includes childhood and adult strabismus, infant and child glaucoma and ophthalmic plastic surgery in children. He is the author of 67 peer-reviewed papers, 58 book chapters, and 26 other medical publications. Dr. Raab also holds a Doctor of Laws degree from Fordham University, and is a member of the Bar in New York and Connecticut.

Dr. Raab received the Lifetime Achievement and Senior Honor Awards of the American Academy of Ophthalmology, the Lifetime Achievement Award of the American Association for Pediatric Ophthalmology and Strabismus, and the New York State Ophthalmological Society’s Hobart A. Lerner Award for exceptional and extraordinary contributions to the profession. He presented the Marshall M. Parks Lecture at the 2005 Annual Meeting of the American Academy of Ophthalmology, and the 2009 Richard G. Scobee Memorial Lecturer of the American Association of Certified Orthoptists. He has been listed among the Best Doctors nationally and regionally on several occasions.

Wife Rosanne is a highly respected lecturer and curator of American craft and design, specializing in silver objects. The Raabs are the proud parents of Barbara, presently Director of Media Grants at the Ford foundation after twenty years as chief writer at NBC Nightly News; Renee, author of books for children and winner of Golden Lion awards as an advertising agency producer; and Steven, a career sports marketer who is now President of Sportsnet New York, the cable network of the New York Mets. Completing the family are four very lovable grandchildren.

Dr. Raab’s interests, in addition to travel, are tennis and American history, best pursued during summers at their second home on the Maine coast.
The Frank D. Costenbader Lecture

The Frank D. Costenbader Lecture was inaugurated in 1974 at the Annual Meeting of the Costenbader Society to honor Dr. Costenbader. The American Association for Pediatric Ophthalmology, later the American Association for Pediatric Ophthalmology and Strabismus was created at this meeting. From its inception, AAPPOS undertook to sponsor the Costenbader Lecture as the keynote presentation at its annual meeting. Due to failing health, Dr. Costenbader was unable to attend any of the lectures which honored him.

Dr. Costenbader was born and educated in Virginia and was a true Virginia Gentleman. He received his undergraduate education at Hampton-Sydney College, his medical degree from the University of Virginia and completed his residency at the Episcopal Eye, Ear and Throat Hospital in Washington, DC.

Dr. Costenbader started practice in 1932 in the depression and began a lifetime commitment to teaching, which set the stage for the tremendous influence he had on ophthalmology when he began to only see children. In 1933, Dr. Costenbader was appointed Instructor in Ophthalmology at Georgetown University and he became Special Lecturer and Conferree there in 1964. He also was on the faculty of George Washington University advancing to the rank of Clinical Professor. He was known for his enormous patience, generous with his time, always offering complete answers to even the weakest questions, and he rarely lost his equanimity. He changed the Children's Hospital Clinic from one of service only to teaching and clinical care. He committed a full day a week to teaching for many years, spending Tuesday afternoons at Children's and another half day a week at the Episcopal EET Hospital. In 1946, the Episcopal residents started rotating at Children's, and he was able to focus his teaching efforts there.

Dr. Costenbader is referred to as the Father of Pediatric Ophthalmology. That designation is because of his decision in 1943 to limit his practice to pediatric ophthalmology, and he was the first ophthalmologist to do so. He moved his office to a stately brownstone townhouse on 22nd Street in Washington, DC. His waiting room was referred to as Dr. Costenbader's living room by many of his young patients because of its small furniture. He had two exam rooms on the first floor, which he used, and there were additional exam rooms on the lower level for his orthoptist, Ms. Dorothy Bair, and associates, fellows and preceptors. It was a center for wonderful patient care and the first real education or training center for pediatric ophthalmology. His exam tools were limited. Dr. Costenbader had a picture of an airplane and a phone on a rotating box at the end of his room and kids would beg to come in and see his airplane and talk to him about it. The patient's examination chair was a kitchen chair placed on a small wooden platform.

When asked why he limited his practice to pediatrics, the first thing Dr. Costenbader would say was that kids are just so much more fun. He also was fascinated with the eye problems of children and at that time, ophthalmologists interested in strabismus were more interested in adults and older children and in cosmetic alignment.

Dr. Costenbader was an advocate for children. His concern for their health and the financial welfare of families in providing for the health of their children led him to establish and financially support the Eye Fund at Children's Hospital to pay for indigent patient surgery. This fund is now used to support the training program at the Children's National Medical Center in Washington, DC.

Continuing with his concern for providing for children's health care, he was co-founder of the Medical Service Plan (today Blue Shield) of the District of Columbia and was the first president from 1946 to 1951. He remained on the board for many years. In addition, he started having parents be with their child in the anesthesia induction room before surgery, he eliminated bandages on eyes following strabismus surgery, and he changed strabismus surgery from two inpatient nights to same-day surgery. Dr. Costenbader was Chief of Ophthalmology at Children's Hospital of Washington, DC, now The Children's National Medical Center from 1938 to 1965. He had a remarkable effect on children's eye care and children's health in general.

This lecture memorializes the man who had the foresight and the courage to begin a subspecialty in ophthalmology and the talent and dedication to train and mold the next generation according to his ideals.

Past Costenbader Lectures

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Speaker</th>
<th>Location</th>
<th>Speaker</th>
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<tr>
<td>1974</td>
<td>Los Angeles</td>
<td>Marshall M. Parks, MD</td>
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<td>Lake Tahoe</td>
<td>Robert N. Shaffer, MD</td>
<td>1996</td>
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<td>Bermuda</td>
<td>Lorenz E. Zimmerman, MD</td>
<td>1997</td>
<td>Charleston</td>
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<td>1977</td>
<td>San Francisco</td>
<td>T. Keith Lyle, MD</td>
<td>1998</td>
<td>Palm Springs</td>
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<td>1978</td>
<td>Williamsburg</td>
<td>Jules Francois, MD</td>
<td>1999</td>
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<td>David G. Cogan, MD</td>
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<td>Philip Knapp, MD</td>
<td>2002</td>
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<td>1982</td>
<td>Monterey</td>
<td>Joseph Lang, MD</td>
<td>2003</td>
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<td>Jack C. Crawford, MD</td>
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<td>Alan B. Scott, MD</td>
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<td>Kiawah</td>
<td>Kenneth C. Swan, MD</td>
<td>2010</td>
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<td>Henry S. Metz, MD</td>
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<td>1994</td>
<td>Vancouver</td>
<td>William E. Scott, MD</td>
<td>2015</td>
<td>New Orleans</td>
</tr>
</tbody>
</table>
Dr Pradeep Sharma was born in Gwalior, a fort town in central India, though his parents hail from the princely desert state of Rajasthan. He received his medical education at the All India Institute of Medical Sciences, New Delhi, a premier medical institute of the country, where he continued to do his Masters in Ophthalmology as also specialization in Strabismus and Pediatric Ophthalmology. His postgraduate doctoral thesis was on saccadic underactions in concomitant esotropia, an electrophysiological study of infantile esotropia, which was awarded the prestigious Col Rangachari medal for the best paper of the All India Ophthalmological Society in 1984. He worked as a senior research officer in the Indo-US project on Age-related cataract, before he joined as a faculty at his alma- mater in the field of Strabismus. He had Dr Prem Prakash, the pioneer in the country as his mentor with whom he took lots of guest lectures, all over the country, raising awareness about strabismus and pediatric ophthalmology. He had the privilege of doing an Advanced Strabismus travel fellowship offered by International Strabismological Association in 2001 at Jules Stein Eye Institute, LA, Wills Eye institute, Philadelphia and Richmond Eye Institute Richmond VA, where he fine tuned his skills in strabismus with the stalwarts like Rosenbaum, Isenberg, Demer, Reinecke, Calhoun, Nelson, McNeer and Velez. He has mentored several fellows and residents at his Institute which has the largest residency training program (100 residents and 53 senior residents/fellows in ophthalmology at any one time, under one roof). In addition, he has popularized the subject through his book “Strabismus Simplified”, which is the most sought after book in strabismus for the residents and fellows in the country for the last decade and a half. He must have performed over 30 thousand strabismus procedures and published over 90 publications in peer reviewed journals, over 60 chapters in books, authored three books and guided 63 postgraduate theses. His special interest has been in oblique muscle surgery, management of complex strabismus, adjustable muscle transpositions and childhood nystagmus. The thrust of his talks has been to restore stereopsis in all cases of strabismus through the efforts of raising awareness and early and more precise alignment for each and every child in his country and of the world. The talk for the 2016 Knapp lecture is also on this Pursuit of Stereopsis. His wife, Anuradha is an Obstetrician - Gynecologist in New Delhi and their daughter Anudeepa is pursuing residency in Pediatrics in New York and is soon to join neonatology fellowship at Cleveland Clinic, Ohio. He is a poet, enjoys music and meditation and along with his wife, pursues the spiritual quest under their spiritual Guruji at Sirsa India.
The Philip Knapp Lecture

The Philip Knapp Lecture was established by action of the Board of Directors of the American Association for Pediatric Ophthalmology and Strabismus and is supported by funds generously donated by AAPOS members in his honor. Doctor Knapp was a founding member of the American Association for Pediatric Ophthalmology and Strabismus and was president of the Association in 1979. Doctor Knapp was the son and grandson of internationally renowned ophthalmologists. He himself developed an international reputation for his contributions to the field of ocular motility. He limited his practice to strabismus and was best known for his management of superior oblique palsy. Much of Dr. Knapp’s work was done in conjunction with Professor Sally Moore, CO.

Doctor Knapp was an astute clinical observer and a man of inflexible integrity. He discussed his clinical disasters as well as his successes when they were relevant to case discussion. He valued clinical work that was complete in detail, long in follow up, and honest in attribution. He tolerated fools poorly and was particularly scornful of colleagues whose techniques or ideas were presented as original when he knew them to be otherwise. He insisted on honesty from his colleagues and demanded it of himself. Dr. Knapp was an innovator, and although he had many publications, his true joy was to participate in symposia and discussions of ocular motility topics and difficult patients.

Doctor Knapp was educated at Harvard and then Columbia College of Physicians and Surgeons. His residency was at the University of Iowa and was followed by three two-month fellowships with Doctors Kenneth Swan, Richard Scobee, and Hermann Burian. He then joined the staff of the Edward S. Harkness Eye Institute of Presbyterian Hospital and the Ophthalmology Department of the Columbia University College of Physicians and Surgeons.

The American Association for Pediatric Ophthalmology and Strabismus warmly remembers Doctor Philip Knapp with this lectureship given in the field of ocular motility by a non-North American ophthalmologist. This lectureship honors Doctor Knapp’s love of strabismus and his joy in participating with and learning from international colleagues.

Past Knapp Lectures

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>Palm Springs</td>
<td>Anthony D. N. Murray, FRCS</td>
</tr>
<tr>
<td>1999</td>
<td>Toronto</td>
<td>Annette Speilmann, MD</td>
</tr>
<tr>
<td>2001</td>
<td>Orlando</td>
<td>Alberto O. Ciancia, MD</td>
</tr>
<tr>
<td>2002</td>
<td>Seattle</td>
<td>John Lee, FRCS, FRC, FRCOphth</td>
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<tr>
<td>2004</td>
<td>Washington, DC</td>
<td>David S. I. Taylor, FRCS, FRC</td>
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<tr>
<td>2006</td>
<td>Keystone</td>
<td>Carlos Souza-Dias, MD</td>
</tr>
<tr>
<td>2008</td>
<td>Washington, DC</td>
<td>Emilio C. Campos, MD</td>
</tr>
<tr>
<td>2010</td>
<td>Orlando</td>
<td>Jan Tjeerd H. N. de Faber, MD</td>
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<tr>
<td>2012</td>
<td>San Antonio</td>
<td>John J. Sloper, FRCOphth</td>
</tr>
<tr>
<td>2014</td>
<td>Palm Springs</td>
<td>Gillian G. W. Adams, FRCS, FRCOphth</td>
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### Participant Financial Disclosures

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Consultant/Advisor</td>
<td>C</td>
<td>Consultant fee, paid advisory boards or fees for attending a meeting (for the past 1 year)</td>
</tr>
<tr>
<td>Employee</td>
<td>E</td>
<td>Employed by a commercial entity</td>
</tr>
<tr>
<td>Lecture Fees</td>
<td>L</td>
<td>Lecture fees (honoraria), travel fees or reimbursements when speaking at the invitation of a commercial entity (for the past 1 year)</td>
</tr>
<tr>
<td>Equity Owner</td>
<td>O</td>
<td>Equity ownership/stock options of publicly or privately traded firms (excluding mutual funds) with manufacturers of commercial ophthalmic products or commercial ophthalmic services</td>
</tr>
<tr>
<td>Patents/Royalty</td>
<td>P</td>
<td>Patents and/or royalties that might be viewed as creating a potential conflict of interest</td>
</tr>
<tr>
<td>Grant Support</td>
<td>S</td>
<td>Grant support for the past 1 year (all sources) and all sources used for this project if this form is an update for a specific talk or manuscript with no time limitation</td>
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</tbody>
</table>

The following individuals have relevant financial interests to disclose:

**AAPOS Program Committee**  
Donahue, Sean  
*C - Retrophin, Welch Allyn*  
*O - Gobiquity*

Paper #18  
Scott, Alan  
*P - Medical treatment of muscles by exposure to anesthetic drugs. Patent US 7,632,848,B1, filed 2007.10.04, issued 2009.12.15*  
*and Patent (Method of changing muscle lengths with anesthetic drugs. Patent US 8,193,220,B1, filed 2009.08.20, issued*  

Paper #26  
Drack, Arlene  
*S - Spark Therapeutics*  
Chung, Daniel  
*E, O - Spark Therapeutics*  
Russell, Stephen  
*C - Spark Therapeutics*  
Wellman, Jennifer  
*E, O, P - Spark Therapeutics*  
High, Katherine  
*E, O, P - Spark Therapeutics*  
Yu, Zi-Fan  
*C, S - Spark Therapeutics*  

Paper #31  
Bex, Peter  
*P - Co-inventor on a provisional patent: Kown, Wiecek, Dakin, Bex (2014) Quantification of interocular suppression in binocular vision impairment*  

Paper #34  
Seitz, Aaron  
*O - Founder and Stakeholder in Carrot Neurotechnology, which developed the ULTIMEYES program described in the manu-＊script. This conflict of interest was reviewed and the research approved by the University of California - Riverside*  

Poster #14  
de Alba Campones, Alejandra  
*S - Bayer, Pan-American Ophthalmological Foundation*  
Binenbaum, Gil  
*S - Bayer, Pan-American Ophthalmological Foundation*
All participants and AAPOS and AAO staff not listed have no relevant financial relationships to disclose.

The American Academy of Ophthalmology and the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) have determined that a financial relationship should not restrict expert scientific, clinical, or non-clinical presentation or publication, provided that appropriate disclosure of such relationship is made. As an ACCME accredited provider of CME, the Academy and AAPOS Joint Provider seeks to ensure balance, independence, objectivity, and scientific rigor in all individual or jointly provided CME activities.

FINANCIAL RELATIONSHIP DISCLOSURE

For purposes of this disclosure, a known financial relationship with a commercial interest is any entity producing, marketing, re-selling, or distributing health care goods or services consumed or used on patients and is defined as any financial gain or expectancy of financial gain brought to the Contributor or the Contributor’s immediate family (defined as spouse, domestic partner, parent, child or spouse of child, or sibling or spouse of sibling of the Contributor) by:

- Direct or indirect compensation;
- Ownership of stock in the producing company;
- Stock options and/or warrants in the producing company, even if they have not been exercised or they are not currently exercisable;
- Financial support or funding to the investigator, including research support, device manufacturers, and or pharmaceutical companies; or
- Involvement with any for-profit corporation that is likely to become involved in activities directly impacting the Academy where the Contributor or the Contributor’s family is a director or recipient of a grant from said entity, including consultant fees, honoraria, and funded travel.
# Program Schedule

All scientific sessions and social events are held at the Vancouver Convention Center East Building unless otherwise noted.

## Wednesday, April 6, 2016

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Venue</th>
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<tbody>
<tr>
<td>8:30 AM - 2:30 PM</td>
<td>Board of Directors Meeting</td>
<td>Room 19 &amp; 20</td>
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<tr>
<td>12:00 PM - 8:00 PM</td>
<td>AAPOS Registration</td>
<td>Lobby Level</td>
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<tr>
<td>1:00 PM - 4:00 PM</td>
<td>Poster Set Up (First Set of Hard Board Posters)</td>
<td>Ballroom C</td>
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<tr>
<td>4:00 PM - 6:00 PM</td>
<td>Poster Viewing (First Set of Posters &amp; All E-Posters)</td>
<td>Ballroom C</td>
</tr>
<tr>
<td>6:15 PM - 7:15 PM</td>
<td>International Attendees Reception</td>
<td>Pan Pacific Hotel</td>
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<td></td>
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<td>Coal Harbour Suite</td>
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<tr>
<td>7:00 PM - 9:00 PM</td>
<td>Opening Reception</td>
<td>Pan Pacific Hotel</td>
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<td>Crystal Pavilion Ballroom</td>
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## Thursday, April 7, 2016

<table>
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<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>6:30 AM - 5:00 PM</td>
<td>Registration</td>
<td>Lobby Level</td>
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<tr>
<td>6:30 AM - 7:55 AM</td>
<td>Poster Viewing (First Set of Posters &amp; All E-Posters)</td>
<td>Ballroom C</td>
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<tr>
<td>6:30 AM - 7:55 AM</td>
<td>Breakfast</td>
<td>Ballroom A/B</td>
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<tr>
<td>7:55 AM - 8:00 AM</td>
<td>Introduction and Welcome</td>
<td>Exhibition Hall A</td>
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<tr>
<td></td>
<td>Sean P. Donahue, MD, PhD</td>
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<tr>
<td>8:00 AM - 8:15 AM</td>
<td>President’s Remarks, Honor Awards, Senior Honor Awards, Lifetime</td>
<td>Exhibition Hall A</td>
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<td></td>
<td>Achievement Awards, Champion for Vision Award</td>
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<td></td>
<td>M. Edward Wilson, MD</td>
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<tr>
<td>8:15 AM - 8:48AM</td>
<td>Scientific Session Strabismus</td>
<td>Exhibition Hall A</td>
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<tr>
<td>8:15 AM - 8:20 AM</td>
<td>Introduction of Costenbader Lecturer</td>
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<td></td>
<td>John D. Baker, MD</td>
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<tr>
<td>8:20 AM - 8:45 AM</td>
<td>Costenbader Lecture (Supported by the Children’s Eye Foundation)</td>
<td>Exhibition Hall A</td>
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<tr>
<td></td>
<td>A Chronicle of Surgical Thinking and Doing for Exotropia: Innovations</td>
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<td></td>
<td>and Rediscoveries</td>
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<td></td>
<td>Edward L. Raab, MD, JD</td>
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<tr>
<td>8:45 AM - 8:48 AM</td>
<td>Presentation Ceremony</td>
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<td>George R. Beauchamp, MD</td>
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<tr>
<td>8:50 AM - 10:00 AM</td>
<td>Moderators: M. Edward Wilson, MD &amp; Sean P. Donahue, MD, PhD</td>
<td>Exhibition Hall A</td>
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<tr>
<td>8:50 AM - 9:26 AM</td>
<td>Scientific Session Strabismus</td>
<td>Exhibition Hall A</td>
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<tr>
<td>8:50 AM - 8:57 AM</td>
<td>A Pilot Randomized Trial of Overminus Spectacles versus Observation</td>
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<td>Children with Intermittent Exotropia</td>
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<td></td>
<td>Jonathan M. Holmes</td>
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<td></td>
<td>Angela M. Chen; Danielle L. Chandler; Reena Patel; Michael E. Gray;</td>
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<td></td>
<td>Allison A. Jensen; Sergul A. Erzurum; David K. Wallace; Raymond T.</td>
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<td>Kraker</td>
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<td>8:57 AM - 9:04 AM</td>
<td>Diffusion Tensor Imaging in Infantile Strabismus Shows a Lack of</td>
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<td>Axon Pruning and Asymmetry in the Corpus Callosum</td>
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<td>Marcel M. ten Tusscher, MD, PhD</td>
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<td></td>
<td>Peter P. Van Schuerbeek, MSc; AnneCees A. Houtman, MD</td>
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<tr>
<td>9:04 AM - 9:08 AM</td>
<td>DISCUSSION OF PREVIOUS PAPER</td>
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<td></td>
<td>Gena Heidary, MD, PhD</td>
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<tr>
<td>9:08 AM - 9:15 AM</td>
<td>Accuracy of Optical Coherence Tomography Measurements of Extraocular</td>
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<td>Rectus Muscle Insertions in Patients with Prior Strabismus Surgery</td>
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<td>Julia D. Rossetto, MD</td>
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<td>Hilda Capo, MD</td>
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</table>
9:15 AM - 9:22 AM  
Paper #5  
The Effect of Oral Statin Therapy on Strabismus in Patients with Thyroid Eye Disease  
Andrew L. Reynolds, MD  
Monte A. Del Monte, MD; Steven M. Archer, MD

9:22 AM - 9:26 AM  
DISCUSSION OF PREVIOUS PAPER  
Oscar A. Cruz, MD

9:26 AM - 10:00 AM  
Scientific Session  
Public Health  
Exhibition Hall A

9:26 AM - 9:33 AM  
Paper #6  
Time Requirements for Pediatric Ophthalmology Documentation with Electronic Health Records (EHRs): A Time-Motion and Big Data Study  
Michael F. Chiang, MD  
Sarah Read-Brown, BA; Michelle R. Hribar, PhD; Jessica B. Wallace; Thomas R. Yackel, MD; Leah G. Reznick, MD

9:33 AM - 9:37 AM  
DISCUSSION OF PREVIOUS PAPER  
K. David Epley, MD

9:37 AM - 9:44 AM  
Paper #7  
Is There a Decline in Interest in Pediatric Ophthalmology and Strabismus as a Career?  
Gad Dotan  
Daniel J. Karr; Alex V. Levin

9:44 AM - 10:00 AM  
PANEL DISCUSSION  
All Presenters

10:00 AM - 11:00 AM  
Interactive Poster Session - Author Presentation and Q/A  
First Set of Hard Board Posters (1-27)  
See Hard Board Poster Tab Section for Complete List of Posters  
Authors Present: Odd Numbered Posters from 10:00 - 10:35  
Even Numbered Posters from 10:25 - 11:00

10:00 AM - 11:00 AM  
Electronic Poster Viewing  
First Set of Electronic Posters (1-46)  
See Electronic Poster Tab Section for Complete List of Electronic Posters  
Authors Present: 1-12 from 10:00 - 10:15; 13-24 from 10:15 - 10:30; 25 - 36 from 10:30 - 10:45; 36 - 46 from 10:45 - 11:00

11:05 AM - 1:00 PM  
Moderators:  
Stephen P. Christiansen, MD & Kathy A. Lee, MD, PhD  
Exhibition Hall A

11:05 AM - 11:25 AM  
Presentation of Parks Medals, Silver Medals and Children's Eye Foundation Update  
George R. Beauchamp, MD  
Exhibition Hall A

11:25 AM - 12:50 PM  
Scientific Session  
Retinopathy of Prematurity  
Exhibition Hall A

11:25 AM - 11:32 AM  
Paper #8  
Pilot Study of a Tiered Approach to ROP Screening (TARP) Using a Weight Gain Predictive Model and a Telemedicine System  
Jaclyn Gurwin  
Graham E. Quinn; Gui-shuang Ying; Agnieszka Baumritter; Lauren Tomlinson; Gil Binenbaum

11:32 AM - 11:39 AM  
Paper #9  
Design of the Postnatal Growth and Retinopathy of Prematurity (G-ROP) Study  
Lauren Tomlinson  
Gil Binenbaum

11:39 AM - 11:46 AM  
Paper #10  
Plus Disease: Is it More than Meets the ICROP?  
John P. Campbell, MD, MPH  
Esra Ataer-Cansizoglu, PhD; Veronica Bolon-Canedo, PhD; Deniz Erdogmus, PhD; Jayashree Kalpathy-Cramer, PhD; Samir Patel, BS; RV P Chan, MD; Michael F. Chiang, MD, PhD
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenters</th>
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<tbody>
<tr>
<td>11:53 AM - 12:00 PM</td>
<td>Paper #12: Treatment of Type 1 Retinopathy of Prematurity with 0.25 mg Intravitreal Bevacizumab</td>
<td>Terry S. Kang, MD, Radha Ram, MD, Amit R. Bhatt, MD</td>
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<tr>
<td>12:00 PM - 12:07 PM</td>
<td>Paper #13: Complications Following ROP Treatment in the Postnatal Growth and Retinopathy of Prematurity (G-ROP) Study</td>
<td>David Morrison, James Shaffer, Gil Binenbaum</td>
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<tr>
<td>12:07 PM - 12:14 PM</td>
<td>Paper #14: Longitudinal Refractive Development in Pre-Term Children Following Treatment of Retinopathy of Prematurity (ROP) with Intravitreal Bevacizumab (IVB)</td>
<td>Joel N. Leffler, MD, Jingyun Wang, PhD, Sarah E. Morale, BS, Angie De La Cruz, BS, Kathryn M. Haider, MD, Rand Spencer, MD, Eileen E. Birch, PhD</td>
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<tr>
<td>12:14 PM - 12:18 PM</td>
<td>DISCUSSION OF PREVIOUS PAPER</td>
<td>Graham E. Quinn, MD</td>
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<tr>
<td>12:18 PM - 12:25 PM</td>
<td>Paper #15: Validation of the CHOP Model for Detecting High-Grade Retinopathy of Prematurity in a Cohort of Colorado Infants</td>
<td>Emily A. McCourt, Anne Lynch, Brandie Wagner, Ashlee Cerda, Jennifer Jung, Jasleen Singh, Robert Enzenauer, Rebecca Braverman</td>
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<tr>
<td>12:32 PM - 12:45 PM</td>
<td>PANEL DISCUSSION</td>
<td>All Presenters</td>
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<tr>
<td>1:00 PM - 2:30 PM</td>
<td>AAPOS Business Meeting</td>
<td>Exhibition Hall A</td>
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<tr>
<td>2:45 PM - 4:00 PM</td>
<td>OMIC Risk Management Workshop: Pediatric Malpractice Claims Alleging Failure to Diagnose</td>
<td>Wiggins, Menke, See Workshop Tab Section for Details</td>
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<tr>
<td>3:00 PM - 4:00 PM</td>
<td>Interactive Poster Session - Review and Commentary from the Program Committee (First Set of Hard Board &amp; Electronic Posters)</td>
<td>Sean P. Donahue, MD, PhD, Scott A. Larson, MD, David K. Wallace, MD, MPH</td>
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<td>4:00 PM - 6:00 PM</td>
<td>Exhibitor Cocktail Reception</td>
<td>Ballroom A/B</td>
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<tr>
<td>5:30 PM - 6:30 PM</td>
<td>Administrators Meet &amp; Greet</td>
<td>Room 14</td>
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<tr>
<td>5:30 PM - 7:00 PM</td>
<td>Parks Medal Reception (by Invitation)</td>
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<td>Time</td>
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<td>6:30 AM - 5:30 PM</td>
<td>Registration</td>
<td>Lobby Level</td>
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<td>6:30 AM - 8:00 AM</td>
<td>Poster Viewing (First Set of Posters &amp; All E-Posters)</td>
<td>Ballroom C</td>
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<tr>
<td>6:30 AM - 8:00 AM</td>
<td>Breakfast</td>
<td>Ballroom A/B</td>
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<tr>
<td>8:00 AM - 4:00 PM</td>
<td>Practice Management Workshop - Administrators Program</td>
<td>Room 14</td>
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<tr>
<td>7:00 AM - 8:15 AM</td>
<td>Workshop Session A - See Workshop Tab Section for Details</td>
<td>Room 10-12</td>
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<tr>
<td></td>
<td>The Evolving Multimodal Imaging Approach to the Pediatric Eye</td>
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<td>Lope, Nischal, Zuccoli, Sylvester, Mitchell</td>
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<td>Size Matters! The Management of Extra-large (XXL) Strabismus</td>
<td>Room 1-3</td>
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<td>Parulekar, Kekunnaya, Plager, Hunter, Kowal, Rao</td>
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<td>Struggling Resident Surgeons: Educational Strategies for Success</td>
<td>Room 8 &amp; 15</td>
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<td>Siatkowski, Yanovitch, Collinge, Motley, Quinn</td>
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<td>8:30 AM - 9:45 AM</td>
<td>Workshop Session B - See Workshop Tab Section for Details</td>
<td>Exhibition Hall A</td>
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<td></td>
<td>Adult Strabismus Workshop</td>
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<td>Granet, Guyton, Buckley, Archer, Hunter, Stager, Jr., Ellis</td>
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<td>Dyslexia: What Pediatric Ophthalmologists and Families Need to Know</td>
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<td>Handler, Fiersen, Rainey, Cooper</td>
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<td>Pediatric Retina: Pearls to Diagnose and Treat</td>
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<td>Ramasubramanian, Hartnett, Shulman, Lee</td>
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<td>Intraoperative Signs and Findings that Change Surgical Algorithms in</td>
<td>Room 8 &amp; 15</td>
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<td></td>
<td>Pediatric Cataract Surgery</td>
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<td>Tartarella, Kekunnaya, VanderVeen, Nischal</td>
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<td>9:45 AM - 10:30 AM</td>
<td>Refreshment Break and Exhibit Viewing</td>
<td>Ballroom A/B</td>
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<td>10:30 AM - 11:45 AM</td>
<td>Workshop Session C - See Workshop Tab Section for Details</td>
<td>Room 8 &amp; 15</td>
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<tr>
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<td>AAP Workshop: Myopia - Pathogenesis, Control and Treatment - A</td>
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<td></td>
<td>Practical Update for the Clinician</td>
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<td>Lehman, Nischal, Paysse, Leo, Chia, Granet</td>
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<td>Management of Childhood Nystagmus - Knapp Lecturer Workshop</td>
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<td>Sharma, Hertle, Kowal, Kekunnaya, Pandey</td>
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<td>The Use of Ocular Coherence Tomography in Pediatric Ophthalmology</td>
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<td>Siegel, Lee</td>
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<td>I Made a Mistake: Presentation and Discussion of Cases in Pediatric</td>
<td>Exhibition Hall A</td>
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<tr>
<td></td>
<td>Ophthalmology and Strabismus when the Unexpected Happened.</td>
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<td>Learned from It?</td>
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<td>Wygnanski-Jaffe, Levin, Freedman, Demer, Ben-Zion, Lueder, Kraft</td>
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<td>11:30 AM - 12:00 PM</td>
<td>Poster Removal (First Set of Hard Board Posters)</td>
<td>Ballroom C</td>
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<tr>
<td>11:45 AM - 1:00 PM</td>
<td>Lunch Break - On Your Own</td>
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1:15 PM - 2:30 PM  Workshop Session D - See Workshop Tab Section for Details

AOC/AACO/AAPOS Workshop - Things We Were Never Taught in Training - Lessons From the School of Hard Knocks
Christiansen, Hahn-Parrott, Kushner, Arnoldi, West, Gilligson, Nischal, Mehta, Kerr
Exhibition Hall A

Order in the Court: The Art and Ethics of the Witness Stand and Other Legal Issues in Pediatric Ophthalmology
Prakalapakorn, Cauvoto, Bohra, Collinge, Leenheer, Gold, Menke, Pelton, Wiggins, Morse
Room 8 & 15

How to Avoid a Disaster in the Operating Room?
Suh, Farzavandi, Olitsky, Weaver, Coats
Room 1-3

Controversies in Retinopathy of Prematurity
Wallace, Chiang, Good, Freedman, Mintz-Hittner, Lee
Room 10-12

2:45 PM - 4:00 PM  Workshop Session E - See Workshop Tab Section for Details

How Recent Technology Should Change your Practice Patterns
Bradfield, Kushner, Struck, Schmitt
Exhibition Hall A

Stump the Chump! Case-Based Classification and Management Controversies in Childhood Glaucoma
Freedman, Beck, Levin
Room 8 & 15

Strategies for the Successful Management of Complex Strabismus Resulting from Orbital Pathology and Iatrogenic Causes
Kekunnaya, Dagi, Granet, Lambert, Parulekar, Velez
Room 1-3

Five Cases in Pediatric Corneal Disease You Don’t Want to Miss
Nischal, Tartarella, Reiser, Stahl
Room 10-12

3:45 PM - 4:15 PM  Poster Set Up (Second Set of Hard Board Posters)
Ballroom C

4:00 PM - 4:30 PM  Pre-Symposium Refreshments
Lobby Level

4:30 PM - 6:00 PM  Symposium: Fun is Good - How to Create Joy and Passion in your Pediatric Ophthalmology Office and your Career
Mike Veeck
Exhibition Hall A

6:30 PM - 7:30 PM  Young Ophthalmologists and New Members Reception
South Foyer

Saturday, April 9, 2016

6:30 AM - 5:00 PM  Registration
Lobby Level

6:30 AM - 8:00 AM  Poster Viewing (Second Set of Posters & All E-Posters)
Ballroom C

6:30 AM - 8:00 AM  Breakfast (Until 8:30 for Runners)
Ballroom A/B

6:30 AM  Sixth Annual AAPPOS Run/Walk
Lobby Level

8:00 AM - 10:00 AM  Moderators: Derek T. Sprunger, MD & Pamela E. Williams, MD
Exhibition Hall A

8:00 AM - 8:28 AM  Knapp Lecture
Exhibition Hall A

8:00 AM - 8:05 AM  Introduction of the Knapp Lecturer
Erick D. Bothun, MD

8:05 AM - 8:25 AM  Paper #17
Knapp Lecture
Pursuit of Steropsis
Pradeep I. Sharma, MD, FAMS

8:25 AM - 8:28 AM  Presentation Ceremony
Erick D. Bothun, MD
### 8:30 AM - 9:20 AM  
**Strabismus Surgery**  
Exhibition Hall A

<table>
<thead>
<tr>
<th>Time</th>
<th>Paper #</th>
<th>Title</th>
<th>Authors</th>
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<tbody>
<tr>
<td>8:30 AM - 8:37 AM</td>
<td>#18</td>
<td>Bupivacaine Injection Treatment of Comitant Strabismus</td>
<td>Iara Debert, Joel M. Miller, Kenneth K. Danh, Alan B. Scott</td>
</tr>
<tr>
<td>8:37 AM - 8:41 AM</td>
<td>#19</td>
<td>DISCUSSION OF PREVIOUS PAPER</td>
<td>Stephen P. Christiansen, MD</td>
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<tr>
<td>8:41 AM - 8:48 AM</td>
<td>#19</td>
<td>Outcome of Ocular Alignment Following Rectus Muscle Plication Compared to Resection</td>
<td>Maan S. Alkharashi, MD, David G. Hunter, MD, PhD</td>
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<tr>
<td>8:48 AM - 8:52 AM</td>
<td>#20</td>
<td>DISCUSSION OF PREVIOUS PAPER</td>
<td>Federico G. Velez, MD</td>
</tr>
<tr>
<td>8:52 AM - 8:59 AM</td>
<td>#20</td>
<td>Long Term Outcomes of Surgical Treatment for Large-Angle Esotropia in Children</td>
<td>Matthew C. Weed, MD, Miriam Di Menna, CO, Christina L. Donaghy, BS, Dimitra Triantafilou, CO, Scott A. Larson, MD</td>
</tr>
<tr>
<td>8:59 AM - 9:06 AM</td>
<td>#21</td>
<td>Effectiveness of Lateral Rectus Resection for Residual Esotropia in Dysthyroid Ophthalmonopathy</td>
<td>Oscar A. Cruz, MD, Gillian Roper-Hall, DBOT, Eric Y. Kim, BA, MS-3</td>
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<tr>
<td>9:06 AM - 9:13 AM</td>
<td>#22</td>
<td>Relationship Between Binocular Summation and Stereoacuity After Strabismus Surgery</td>
<td>Jaffer M. Kattan, BA, Federico G. Velez, MD, Joseph L. Demer, MD, PhD, Stacy L. Pineles, MD</td>
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<tr>
<td>9:13 AM - 9:20 AM</td>
<td>#23</td>
<td>Sizes and Pulley Locations of Rectus Extraocular Muscles in Concomitant and Pattern Exotropia</td>
<td>Joseph L. Demer, MD, PhD, Rui Hao, MD</td>
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### 9:20 AM - 10:00 AM  
**Cataract and Genetics**  
Exhibition Hall A

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<tr>
<th>Time</th>
<th>Paper #</th>
<th>Title</th>
<th>Authors</th>
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<tbody>
<tr>
<td>9:20 AM - 9:27 AM</td>
<td>#24</td>
<td>Refractive Error and Anisometropia After Unilateral Intraocular Lens Implantation in Infants Under 7 Months of Age - Results at 5 Years of Age from the Infant Aphakia Treatment Study (IATS)</td>
<td>David R. Weakley, Jr., Scott R. Lambert, M. Edward Wilson, David A. Plager, Edward G. Buckley, Michael Lynn</td>
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<tr>
<td>9:34 AM - 9:41 AM</td>
<td>#26</td>
<td>Results of Phase III Clinical Trial Subretinal Gene Therapy for RPE65-Mediated Leber Congenital Amaurosis (LCA)</td>
<td>Arlene V. Drack, MD, Daniel Chung, DO, Stephen Russell, MD, Jean Bennett, MD, PhD, Jennifer Wellman, BS, Zi Fan Yu, ScD, Albert Maguire, MD, Edwin M. Stone, MD, PhD, Katherine High, MD</td>
</tr>
</tbody>
</table>
10:00 AM - 11:00 AM  Interactive Poster Session - Author Presentation and Q/A  
Second Set of Posters (28-55)  
See Hard Board Poster Tab Section for Complete List of Posters  
Authors Present: Odd Numbered Posters from 10:00 - 10:35  
Even Numbered Posters from 10:25 - 11:00

10:00 AM - 11:00 AM  Electronic Poster Viewing  
Second Set of Electronic Posters (47-90)  
See Electronic Poster Tab Section for Complete List of Electronic Posters  
Authors Present: 47-58 from 10:00 - 10:15; 59-70 from 10:15 - 10:30; 71-82 from 10:30 - 10:45; 83-90 from 10:45 - 11:00

11:05 AM - 12:50 PM  Moderators: Sean P. Donahue, MD, PhD & Robert E. Wiggins, Jr., MD  
Exhibition Hall A

11:05 AM - 11:25 AM  Updates  
11:05 AM - 11:09 AM  J AAPOS Update  
William V. Good, MD

11:09 AM - 11:13 AM  MOC Update  
Julia L. Stevens, MD

11:13 AM - 11:17 AM  American Academy of Pediatrics Update  
Sharon S. Lehman, MD

11:17 AM - 11:21 AM  Surgical Scope Fund Update  
Kenneth P. Cheng, MD

11:21 AM - 11:25 AM  IPOSC Update & International Meetings Update  
Derek T. Sprunger, MD

11:25 AM - 1:00 PM  Scientific Session  
Vision and Amblyopia  
Exhibition Hall A

11:25 AM - 11:32 AM  Paper #28  
Visual Outcomes Following Perinatal Ischemic Stroke  
Erin C. Kiskis, BA  
Lori Billinghurst, MD, MSc; Rebecca Ichord, MD; Laura Jastrzab, BS; Gil Binenbaum, MD, MSCE

11:32 AM - 11:39 AM  Paper #29  
Analysis of Sensory Substitution Ambulation Using the Brainport Device in Blind Children Versus Controls  
Nancy Hanna, MD  
Richard W. Hertle, MD; Kelley Culp, RN; MaryBeth Doerr, OTR/L; Mona True, OTR/L; Brittany Holmes, MS, OTR/L; Giovanna Difranko, MS, OTR/L

11:39 AM - 11:46 AM  Paper #30  
Reimbursement Rates for Photoscreening by Insurance Provider  
Cherie A. Fathy  
Sean P. Donahue

11:46 AM - 11:53 AM  Paper #31  
Assessing Suppression in Amblyopia with a Dichoptic Eyechart  
Eileen E. Birch, PhD  
Sarah E. Morale, BS; Reed M. Jost, MS; Angie De La Cruz, BS; Krista R. Kelly, PhD; Yi-Zhong Wang, PhD; Peter J. Bex, PhD

11:53 AM - 12:00 PM  Paper #32  
Decreased Binocular Summation in Strabismic Amblyopes and Effect of Strabismus Surgery  
Melinda Y. Chang  
Joseph L. Demer; Sherwin J. Isenberg; Federico G. Velez; Stacy L. Pineles
12:00 PM - 12:07 PM  Paper #33  Randomized Clinical Trial of Binocular iPad Treatment for Amblyopia versus Patching
Reed M. Jost, MS
Krista R. Kelly, PhD; Lori Dao, MD; Joel N. Leffler, MD; Cynthia L. Beauchamp, MD; Eileen E. Birch, PhD

12:07 PM - 12:14 PM  Paper #34  Perceptual Learning Treatment of Amblyopia in Adults
Stacy L. Pinea
Steven Thurman; Jenni Deveau; Joseph Demer; Federico Velez; Aaron Seitz

12:14 PM - 12:21 PM  Paper #35  Amblyopia Treatment Outcomes Assessment Using AAO’s IRIS-7 Measure
Constance E. West, MD
Patricia I. Cobb, MS; Denise L. White, PhD

12:21 PM - 12:28 PM  Paper #36  Implantation of the Phakic Intraocular Collamer Lens (ICL) for Correction of Pediatric Myopia
Lawrence Tychen
Nicholas Faron; James Hoekel

12:28 PM - 12:35 PM  Paper #37  Uncorrected Hyperopia and Preschool Early Literacy: Results of the Vision in Preschoolers - Hyperopia in Preschoolers (VIP-HIP) Study
Gui-shuang Ying, PhD
Graham E. Quinn, MD

12:35 PM - 12:42 PM  Paper #38  Ocular Congenital Anomalies in Infants with Microcephaly and Presumable Zika Virus Infection
Virginia Vilar Sampaio
Sarah Rogeria Martins Moura; Luciana Portella Rabelo; Maria Cecilia Santos Cavalcante Melo; Carlos Teixeira Brandt

12:42 PM - 1:00 PM  PANEL DISCUSSION
All Presenters

2:00 PM - 3:15 PM  SEC Contracting and Benchmarking Workshop: I Never Learned This in Residency: Contracting with Insurance Companies and Hospitals (SEC Administrators Program & AAPOS attendees)
Robbins, Gross, Lichtenstein, Stass-Isern Wiggins, Bohra, Bartiss
See Workshop Tab Section for Details

3:15 PM - 4:15 PM  Interactive Poster Session - Review and Commentary from the Program Committee (Second Set of Hard Board Posters)
Oscar Cruz, MD & David Epley, MD & Tina Rutar, MD

3:30 PM - 5:30 PM  Coding - A Day in the Life of the Pediatric Ophthalmologist (Separate Registration - Additional Fee for non-administrators/managers)
Edgar, Bartiss, Gold, Dunn
See Workshop Tab Section for Details

7:00 PM - 10:00 PM  Closing Reception
Fairmont Waterfront Hotel
Waterfront Ballroom
<table>
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<tr>
<th>Time</th>
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<tr>
<td>6:30 AM - 12:00 PM</td>
<td>Registration</td>
<td>Lobby Level</td>
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<td>6:30 AM - 8:00 AM</td>
<td>Poster Viewing (Second Set of Posters &amp; All E-Posters)</td>
<td>Ballroom C</td>
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<tr>
<td>6:30 AM - 8:00 AM</td>
<td>Breakfast</td>
<td>Ballroom A/B</td>
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</table>
| 7:15 AM - 10:35 AM | Scientific Session  
Moderator: **Sean P. Donahue, MD, PhD** | Exhibition Hall A |
| 7:15 AM - 8:15 AM | Video Demonstrations of Signs, Diseases, and Complex Surgical  
Procedures in Pediatric Ophthalmology and Strabismus  
*Velez, Freedman, Demer, VanderVeen, Lyons, Capo*  
See Workshop Tab Section for Details | Exhibition Hall A |
| 8:25 AM - 9:25 AM | Difficult Non-Strabismus Problems in Pediatric Ophthalmology  
*Traboulsi, Drack, El-Dairi, Berrocal, Bothun*  
See Workshop Tab Section for Details | Exhibition Hall A |
| 9:35 AM - 10:35 AM | Difficult Problems: Strabismus  
*Dagi, Buckley, Molinari, Kowal, Pineles, Lueder*  
See Workshop Tab Section for Details | Exhibition Hall A |
| 10:35 AM        | End of 2016 Meeting                                                   |          |
| 10:35 AM - 10:50 AM | Poster Removal (Second Set of Hard Board Posters)                    | Ballroom C |

*Indicates CME designated activities*
**2016 Frank D. Costenbader Lecture**

**A CHRONICLE OF SURGICAL THINKING AND DOING FOR EXOTROPIA: INNOVATIONS AND REDISSCOVERIES**

Edward L. Raab, MD, JD

Icahn School of Medicine at Mount Sinai, New York, NY

**Introduction:** This presentation details the evolution of surgery for exotropia beginning in the early 19th century and extending to the present time. It traces the theories and practices concerning this disorder as expressed in the writings of recognized authorities in several eras.

**Methods:** Major ophthalmology texts and selected references were reviewed to discover experience and thinking concerning the causes of comitant intermittent and constant exotropia as reflected by various corrective surgical approaches.

**Results:** Some operations discarded as unreliable or dangerous remain so today. Others have survived and continue to be well accepted, whether or not relating to advances in understanding of this condition. There also are procedures known and practiced in former times that have regained popularity.

**Discussion:** As inferred from published sources in each of the chosen eras, the relatively recent concern for the characteristics of extraocular muscle structure and function has led to surgical thinking that goes beyond consideration only of direction and prism diopters of deviation. We now have sophisticated devices that give heretofore unavailable information consistent with this new approach.

**Conclusion:** The history of progress in surgery for exotropia is mixed. While some of the procedures now employed are new, others currently in favor had been well known and formerly utilized by ophthalmologists over many decades. These should be regarded as rediscoveries or revivals rather than as novel. In addition, there is a need to address how to better report retrospective studies.


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**A pilot randomized trial of overminus spectacles versus observation in children with intermittent exotropia**

Jonathan M Holmes  Angela M Chen  Danielle L Chandler  Reena Patel  Michael E Gray  Allison A Jensen  Sergul A Erzurum  David K Wallace  Raymond T Kraker for the Pediatric Eye Disease Investigator Group

Mayo Clinic, Rochester MN, Southern California College of Optometry, Fullerton, CA, Jaeb Center for Health Research, Tampa, FL, Cincinnati Children’s Hospital Medical Center, Cincinnati, OH, Greater Baltimore Medical Center, Baltimore, MD, Eye Care Associates, Inc., Poland, OH, Duke Eye Center, Durham, NC

**Introduction:** To evaluate the short-term effectiveness of overminus spectacles in improving control of childhood intermittent exotropia (IXT)

**Methods:** We conducted a pilot randomized clinical trial enrolling 58 children 3 to <7 years old with IXT. Eligibility criteria included a distance control score of 2 or worse (mean of 3 measures during a single examination) on a scale of 0 (phoria) to 5 (constant) and spherical equivalent refractive error between -6.0 diopters (D) to +1.0D. Children were randomly assigned to either overminus spectacles (-2.50D over cycloplegic refraction) or observation (non-overminus spectacles if needed, or no spectacles). The primary outcome measure was distance control score for each child (mean of 3 measures during a single examination) assessed by masked examiner at 8 weeks. Outcome testing was conducted with children wearing their study spectacles or plano spectacles for observation group children who did not need spectacles. The primary analysis compared mean 8-week distance control score between treatment groups using an analysis of covariance model which adjusted for baseline distance control. Treatment side effects were evaluated using questionnaires completed by parents.

**Results:** At 8 weeks, mean distance control was better in the 27 children treated with overminus spectacles than in the 31 children who were observed without treatment (2.0 vs 2.8 points, difference = -0.80 points (95% CI = -1.49 to -0.11 points), P = 0.01 for one-sided test). Side effect profiles regarding headaches, eyestrain, avoidance of near activities, and blur appeared similar between treatment groups.

**Discussion:** In a pilot randomized clinical trial, overminus spectacles improved distance control over 8 weeks in children 3 to <7 years old with IXT.

**Conclusion:** A larger and longer randomized trial is warranted to assess the long-term effectiveness of overminus spectacles in treating IXT, particularly the effect on control after overminus treatment has been discontinued.
**Diffusion Tensor Imaging in Infantile Strabismus shows a lack of Axon Pruning and asymmetry in the Corpus Callosum.**

Marcel M ten Tusscher MD, PhD Peter P Van Schuerbeek MSc AnneCees A Houtman MD
University Hospital; Vrije Universiteit Brussel, Brussels, Belgium

**Introduction:** Inter-cortical visual transfer through the corpus callosum has been shown important in mammalian binocularity. In cats with artificial strabismus, crossed dominance and lack of pruning have been shown in the callosal visual pathways. We aimed at analysing these pathways in humans (with and without infantile strabismus).

**Methods:** Diffusion Tensor Imaging (DTI) was used in 14 subjects, to show nerve fibres connecting both visual cortices through the corpus callosum (CC). Structural scans were processed for automatic white and gray matter segmentation. Anatomical parameters were used to delineate V1 and V2. The number and morphology of fibres was studied.

**Results:** With DTI from 0 to 39 (mean 16) callosal fibre tracts were visualised between both primary visual cortices (V1) in binocular individuals, whereas 110 to 146 fibre tracts appeared in individuals with infantile strabismus. Also fibres from the right V1 to the left V2 and to the entire left visual cortex were more than five times as numerous in individuals with infantile strabismus. Between binocular and strabismic individuals, quantitative differences in callosal fibres from the left visual cortex were far less evident.

**Discussion:** Callosal visual fibres appeared more numerous and asymmetrical in individuals with infantile strabismus.

**Conclusion:** Normal visually guided axonal pruning of callosal fibres on one side of the cortex appeared to occur less in infantile strabismus. These results corroborate neuroanatomical studies in cats. Moreover, in cats these pathways were found to be dominated by the contralateral eye. The callosal asymmetry in humans suggests a similar organisation and a possible pivotal role in motor fusion.

**Accuracy of optical coherence tomography measurements of extraocular rectus muscle insertions in patients with prior strabismus surgery**

Julia D Rossetto MD Hilda Capo MD
University of Miami - Miller School of Medicine, Bascom Palmer Eye Institute
Miami - Florida

**Introduction:** Information regarding the location of extraocular muscles facilitates strabismus surgery planning, particularly in patients with prior eye muscle surgery in which previous surgical data may not be available or muscle location may be unknown.

**Methods:** Prospective, double-masked, observational study of the distance between extraocular rectus muscle insertions and the limbus measured with anterior segment optical coherence tomography (AS-OCT) preoperatively and compared with intraoperative measurements with calipers. Seventy-three adult patients, 33 (45.2%) with previous strabismus surgery were included, mean age was 45 (18-77); 52.05% were female, the mean number of previous surgeries was 1.57 (1-9).

**Results:** Among the 150 muscles that were evaluated, 144 (96%) were imaged, including 61 medial (17 reoperations), 63 lateral (13 reoperations), 12 superior and 14 inferior (1 reoperation) rectus muscles. The longest distance from the limbus that the insertions were imaged were 11.87 mm for the medial rectus and 12.95 mm for the lateral rectus. The difference between the two measurements was <1 mm in 58.62% of previously operated muscles, increasing to 68.42% for muscles found at ≤11 mm from the limbus. Without previous surgery, the difference was <1 mm in 83.48% of the muscles.

**Discussion:** Our study includes the largest series of AS-OCT measurement of insertions of reoperated muscles. [1-3] The accuracy is less in reoperated muscles, and decreases with increased distance from the limbus.

**Conclusion:** In spite of certain limitations, AS-OCT remains a clinically useful tool on planning strabismus surgery on patients with previous surgery.

**The effect of oral statin therapy on strabismus in patients with thyroid eye disease**

Andrew L Reynolds MD Monte A Del Monte MD Steven M Archer MD
Kellogg Eye Center/University of Michigan
Ann Arbor, Michigan

**Introduction:** Statins are known to possess anti-inflammatory characteristics. They have recently been identified as potentially reducing the risk of developing Thyroid Eye Disease (TED) in Graves’ disease patients. Our study investigates the effect of oral statin therapy on strabismus related to TED.

**Methods:** This is a retrospective review of patients with a diagnosis of both Thyroid Eye Disease and restrictive strabismus. Oral statin users and non-users were analyzed for smoking status, previous RAI, thyroidectomy, number of decompressions, motility restriction, amount of strabismus, the number and millimeters of strabismus surgeries, and number of muscles involved radiographically.

**Results:** 30 patients (avg age 63.9, 50% male, 59% current/former smokers) were included with 12 statin users and 18 non-users. Statin users averaged fewer decompressions, (1.3 in users vs 2.39 in non-users; p=0.04). Statin users on average had 15mm of total strabismus surgery vs 21.4mm in the non-statin group (p=.09), and had fewer muscles involved radiographically (4.25 vs 5.12, p=.08)

**Discussion:** Statin users tended to have fewer decompressions, less restriction, fewer strabismus surgeries, and fewer muscles involved despite having more current smokers (36% vs 5%), more males, more RAI and fewer thyroidectomies, all of which are associated with worse TED.

**Conclusion:** In patients with thyroid eye disease and strabismus, use of statin therapy significantly reduced the number of orbital decompressions. Oral statin therapy also trended towards reducing the number and amount of strabismus surgeries, as well as radiographic involvement of muscles, although these did not meet statistical significance.

**References:**

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**Time requirements for pediatric ophthalmology documentation with electronic health records (EHRs): a time-motion and big data study**

Michael F Chiang MD Sarah Read-Brown BA Michelle R Hribar PhD Jessica B Wallace Thomas R Yackel MD Leah G Reznick MD
Oregon Health & Science University - Casey Eye Institute, Portland, OR

**Introduction:** Pediatric ophthalmologists have raised concerns about EHRs regarding increased time required for documentation and interference with patient-doctor interaction. Little published work has studied this issue. This study examines time demands for pediatric ophthalmology documentation using an institution-wide EHR (EpicCare; Verona, WI).

**Methods:** A pediatric ophthalmology provider was observed for 102 patient visits. Rules were defined to categorize provider activities with patients: examining, talking, and documenting. Observers recorded times for all ophthalmologist activities using mobile device software developed by the authors. EHR databases and audit logs were used to identify time required for all clinical documentation during 1 year (2558 patient visits), using software developed by the authors.

**Results:** Mean±SD time spent by the ophthalmologist was 14.0±7.5 minutes/patient (3.7±2.3 minutes (26%) examining, 6.4±4.6 minutes (46%) talking, 3.5±3.4 (25%) documenting). EHR documentation required a total of 5.4±2.4 minutes/patient (2.5±1.4 minutes [47%] during patient exams, 2.0±1.9 minutes [38%] during business hours but outside patient exams, and 0.8±1.2 minutes [16%] outside business hours).

**Discussion:** Based on study findings, EHR documentation would require 162 minutes/day, in a typical 30-patient day. Time requirements for the pediatric ophthalmologist in this study were comparable to that of 4 ophthalmologists from other sub-specialties (n=291 patients observed, n=10,522 patients in audit logs). Time demands for EHRs in this study are longer than previously-published paper documentation times.

**Conclusion:** EHR documentation time requirements are significant, and occupy a large proportion of the overall pediatric ophthalmology patient encounter. Studies toward improving EHR interfaces and integrating EHRs into the patient encounter are warranted.

**References:**
Is there a decline in interest in pediatric ophthalmology and strabismus as a career?

Gad Dotan  Daniel J Karr  Alex V Levin
Tel Aviv Medical Center, Will Eye Hospital, Oregon Health & Science University

Introduction: Recent resident matches left several pediatric ophthalmology fellowship programs unfilled, raising the question as to whether there is declining interest in the specialty. Concurrently, many centers and practices are recruiting for attendings pediatric ophthalmologists.

Methods: On behalf of the AAPOS Fellowship Training and Compliance Committee, we sought to identify trends in applications to and match results for pediatric ophthalmology fellowships. We analyzed the San Francisco Match Program outcomes for 2000-2004 versus 2010-2014, and surveyed pediatric ophthalmology Program Directors about factors that may influence interest in our field including faculty contact, exposure time of residents and students to our field, fellows’ salary, and job opportunities.

Results: Mean number of pediatric ophthalmology fellowship program positions offered increased from 45.6 to 59 and mean number positions filled increased from 26.6 (61%) to 44.2 75%, (p=0.0003). Foreign medical graduates (FMGs) fill more fellowship positions, increasing from 28% in 2008 to 37% in 2013. Seventy percent of respondents accept FMGs. Mean salary of fellows is 55,000$. In nearly all programs didactic instructions in pediatric ophthalmology for residents begins in PGY2. Residents spend on average 16 weeks (range 8-34 weeks) in pediatric ophthalmology rotations.

Discussion: While an increasing proportion of fellowship positions are filling, there are declining applications to pediatric ophthalmology and lower matching rates among American ophthalmology graduates.

Conclusion: There appears to either be a decline in interest in pediatric ophthalmology amongst American graduates, an increase in FMG interest or an increase in fellowship training opportunities that is disproportionate to the number of American applicants.

Pilot Study of a Tiered Approach to ROP Screening (TARP) using a Weight Gain Predictive Model and a Telemedicine System

Jaclyn Gurwin  Graham E Quinn  Gui-shuang Ying  Agnieszka Baumritter
Lauren Tomlinson  Gil Binenbaum
e-ROP Study Group  G-ROP Study Group
The Children’s Hospital of Philadelphia, Philadelphia, PA

Introduction: The e-ROP Study telemedicine system of remote fundus image grading and the CHOP-ROP postnatal-weight-gain predictive model are two approaches for improving the efficiency of retinopathy of prematurity (ROP) screening. Since current screening has low specificity for severe ROP, we sought to develop a tiered approach for identifying children who develop severe ROP (TARP) by using these two modalities synergistically.

Methods: Secondary analysis of data from the e-ROP and G-ROP studies. Four screening approaches were evaluated: ROUTINE (only diagnostic examinations), MODEL (BW, GA, weight gain calculated weekly initiates examinations when risk cut-point surpassed), IMAGING (trained-reader grading of type 1 or 2 ROP initiates examinations), and TARP (CHOP-ROP alarm initiates imaging, image finding of severe ROP initiates examinations).

Results: The study included 242 infants, median BW 858g (range 690-1035). Sensitivity for type 1 ROP (32 (13%) infants) was 100% (95% CI 89.3%-100%) with all four approaches. With ROUTINE, 242 infants had 877 examinations. With MODEL, 184 infants had 730 examinations. With IMAGING, 242 infants had 532 imaging sessions, and 94 of these had 345 examinations. With TARP, 182 infants had 412 imaging sessions, and 87 infants had 322 examinations.

Discussion: The MODEL alone reduced infants requiring exams by 24% and exams by 17%. Telemedicine required image acquisition and grading, but reduced infants receiving exams by 61% and exams by 60%. TARP reduced infants imaged 25%, imaging sessions 23%, infants examined 63%, and exams 63%.

Conclusion: Applying a postnatal-growth model and telemedicine system in a tiered approach may improve ROP screening efficiency more than either approach alone. Further validation is needed.
**Design of the Postnatal Growth and Retinopathy of Prematurity (G-ROP) Study**

Lauren Tomlinson  Gil Binenbaum  The G-ROP Study Group  
The Children's Hospital of Philadelphia  
Philadelphia, PA

**Introduction:** Postnatal-growth-based predictive models demonstrate strong potential for improving specificity of retinopathy of prematurity (ROP) screening. Prior studies are limited by inadequate sample size. We sought to study a sufficiently large cohort of at-risk infants to enable development of a model with highly precise estimates of sensitivity for severe ROP.

**Methods:** The Postnatal Growth and ROP (G-ROP) Study is an NEI/NIH-funded multi-center retrospective cohort study of infants undergoing ROP screening in 2006 to 2012. Sixty-five certified abstractors from 30 North American hospitals submitted data to a secure, web-based database. Data included ROP examination findings, treatments, complications; daily weight measurements; daily oxygen supplementation; maternal/infant demographics; medical comorbidities; surgical events; weekly nutritional status. Data quality was monitored with system validation rules, data audits, and discrepancy algorithms.

**Results:** Of 11,262 screened infants, 8,335 were enrolled, and 2,927 had insufficient data due to transfer, discharge, or death. Of those enrolled, 7,484 (90%) infants had a known ROP outcome and were included in the study. Median (range) birth weight was 1070g (310-3000); gestational age, 28 weeks (22-35). Severe (ETROP type 1 or 2) ROP developed in 933 (12.5%) infants.

**Discussion:** Successful incorporation of a predictive model into ROP screening requires confidence that it will capture cases of severe ROP. This dataset provides power to estimate sensitivity with half-CI width of only 0.5%, determined by the high number of severe ROP cases.

**Conclusion:** The G-ROP Study represents a large, diverse cohort of infants undergoing ROP screening. It will facilitate evaluation of growth-based algorithms to improve efficiency of ROP screening.

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**Plus disease: is it more than meets the ICROP?**

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**Introduction:** Published definitions of “plus disease” in retinopathy of prematurity (ROP) reference only arterial tortuosity and venous dilation within the posterior pole. However, subsequent research has suggested that additional retinal features should be considered. This project uses a computer-based image analysis system (Imaging and Informatics in ROP, i-ROP) to identify features considered by experts when classifying plus disease.

**Methods:** The i-ROP system was evaluated using a set of 77 RetCam images, each with a reference standard diagnosis (RSD) based on consensus of 3 experts and the clinical diagnosis. Images were manually segmented into arterial and venous segments, and cropped into circles from 1-6 disc diameters (DD). Using previously-published algorithms quantifying tortuosity and dilation, the system was trained to classify images as normal, pre-plus, or plus.

**Results:** The i-ROP system had highest accuracy (73/77, 95%) using the 6DD image crop and a measurement combining arterial and venous tortuosity. Accuracy fell to <86% (<66/77) when using only arterial tortuosity, to <81% (<62/77) using a 3DD crop similar to the standard published photograph, and to <80% (<61/77) when using dilation features.

**Discussion:** The i-ROP system performed optimally when the largest image crop was analyzed, and when the tortuosity of both arteries and veins were considered. Diagnostic accuracy of i-ROP was comparable to that of 3 experts (92-96%), and better than that of non-experts (mean 81%).

**Conclusion:** These data suggest that mid-peripheral retinal vascular features, and both arterial and venous tortuosity, are relevant to clinical plus disease diagnosis.

Characteristics of retinal hemorrhage in premature infants in the telemedicine system for the evaluation of acute-phase retinopathy of prematurity (e-ROP) Study

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Introduction: Retinal hemorrhage is not an uncommon feature in premature infants at risk for ROP, the morphology of which has not been adequately characterized.

Methods: All image sets from eyes in the e-ROP study that were ever noted for retinal hemorrhage on either eye examination or image grading were selected for hemorrhage grading. Trained readers graded presence, location, type (dot, blot, flame, pre-retinal and vitreous), number, total area, and location of hemorrhage to ROP.

Results: Hemorrhages occurred in 267 (22%) of 1239 infants (<1251g birth weight) and included, dot 8.2%, blot 12.3%, flame 3.4%, pre-retinal 12.3% and vitreous 1.6%. 56% of the hemorrhages were observed at first visit at a median postmenstrual age of 34 weeks (Q1 33, Q3 36). Most hemorrhages were unilateral (83%) with only one type of hemorrhage (78%). Hemorrhage was located in zone 1 only (40%), zone 2 only (35%) or in both zones (23%). When pre-retinal hemorrhages were associated with ROP, 63% were anterior, 52% posterior and 37% were atop the retinopathy. Hemorrhage resolved 38% by week 2, 56% by week 4 and 76% by week 8, with pre-retinal resolving rapidly (57% by week 2, 98% by week 6). Lower birth weight (p<0.001) and gestational age (p<0.001) were associated with retinal hemorrhage in a dose-response manner.

Discussion: Retinal hemorrhage in premature infants, typically resolve within a short time period. In eyes with ROP, pre-retinal hemorrhages are generally posterior to the retinopathy.

Conclusion: Intraocular hemorrhages, common in premature infants, are more likely to be seen in smaller, less mature infants.


Treatment of Type 1 Retinopathy of Prematurity with 0.25 mg Intravitreal Bevacizumab

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Introduction: Purpose of this study is to determine the effectiveness of low dose bevacizumab as primary treatment for type 1 ROP in zone 1 and posterior zone 2.

Methods: Retrospective analysis of 25 patients, 49 eyes between March 2013 to December 2014 who underwent bevacizumab injection (0.25 mg) as primary treatment for posterior type 1 ROP. Primary outcome was rate of recurrence requiring retreatment, and secondary outcome was eyes requiring PPV.

Results: 43/49 eyes (87.8%) had no recurrence requiring retreatment after one injection. 4/29 eyes (8.2%) required subsequent laser. Only 2/49 eyes (4.1%) required PPV, one for retinal detachment and one for retinal traction.

Discussion: The data shows a high success rate with 0.25 mg bevacizumab in treating type 1 ROP in zone 1 and posterior zone 2 with a low rate of unfavorable outcomes. Comparing with previous studies of bevacizumab at doses of 0.625 mg (96% success) and 0.375 mg (98% success), our patients also have high success. Our outcomes compare favorably with ET-ROP, where 9% of eyes had unfavorable structural outcomes (RD or requiring retinal surgery). Lower doses can be effective in treating ROP and help reduce the risk of systemic absorption or side effects.

Conclusion: Our results show that low dose bevacizumab can be used as a successful treatment of posterior type 1 ROP. It has a high efficacy rate similar to higher doses of bevacizumab. Comparing our outcomes to ET-ROP standards, the outcomes are not statistically worse. This warrants prospective studies to determine the lowest effective dose.

Complications following ROP treatment in the Postnatal Growth and Retinopathy of Prematurity (G-ROP) Study

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Introduction: The G-ROP Study is a multicenter study evaluating growth algorithms in the detection of ROP. We describe ROP treatment complications from the G-ROP Study cohort.

Methods: Retrospective cohort of infants screened for ROP at 30 North American NICUs. Complications following ROP treatment were analyzed by eye and treatment modality.

Results: Of 7,484 infants in the study, 1004 eyes were treated for ROP: 963 received laser (L), 26 received bevacizumab (B), 15 received both (L+B). Median follow-up post-treatment was 18 weeks (IQR 5,39). Overall, 135 (14%) eyes in group L had a complication, no (0%) eyes in group B (comparison L versus B, p=0.039, Fisher exact) and 7 (47%) eyes in group L+B. Vitreous hemorrhage occurred in 52 (5.4%) eyes in group L, none in group B, and 4 (27%) in group L+B. Other treatment-related complications (cataract, hyphema, glaucoma, corneal abrasion/opacity) occurred in 25 (2.6%) eyes in group L and in no eyes in groups B or L+B. Disease progression (retinal fold, dragging, or stage 4 or 5 detachment) occurred in 89 (9.2%) eyes in group L, none in group B, and 4 (27%) in group L+B.

Discussion: Panretinal photocoagulation has been the mainstay of ROP treatment in recent decades. Anti-VEGF agents are becoming more common as a first-line therapy for ROP.

Conclusion: Treatment-associated complications are uncommon (<10% of eyes) following ROP laser. Although use of bevacizumab in this study was low, the use of anti-VEGF agents in the treatment of ROP appears to have a lower complication profile in comparison to laser retinal photocoagulation.

Longitudinal Refractive Development in pre-Term Children Following Treatment of Retinopathy of Prematurity (ROP) with Intravitreal Bevacizumab (IVB)

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Introduction: The prevalence of high myopia in children with ROP has been reported to be significantly lower with IVB treatment than with laser treatment.1 Data on moderate myopia post-treatment is conflicting and there are no longitudinal cycloplegic retinoscopy data. Here we report longitudinal refractive error during the first 3 years for a prospective cohort treated with IVB.

Methods: Preterm infants (BW<1000g, GSA 24-26 weeks) treated for Type 1 ROP with IVB were eligible (IVB Group: N=30). Preterm infants who met the same eligibility criteria treated with laser provided an historical comparison group (Laser Group: N=28).2 Cycloplegic retinoscopy was conducted at 0.5y adjusted age and every 0.5-1.0y thereafter.

Results: Children in the IVB Group had less myopia at 0.5y (-0.13±0.46D), 1.5y (-1.86±0.91D), and 2.5y (-2.02±1.38D) than in the Laser Group (-4.02 ±0.64D, -6.42±0.91D, and -7.78±1.16D, respectively; p<0.001, p=0.0009, and p=0.02, respectively). Regardless of treatment modality, the most rapid increase in myopia occurred during the first 1.5y. The incidence of high myopia (≥-6.00D) was 8X lower in the IVB Group (7%) than in the Laser Group (57%; p<0.0001). There was no significant difference in the prevalence of moderate myopia (<-6.00D; 37% vs. 32%).

Discussion: Compared with laser treatment, treatment of severe ROP with IVB is associated with less severe myopia, and a striking 8X lower incidence of high myopia.

Conclusion: We propose that the reduced incidence of high myopia is due to differences in the effects of bevacizumab vs. laser treatment on anterior segment development. Confirmation awaits assessment of biometric components.

Validation of the CHOP model for detecting high-grade retinopathy of prematurity in a cohort of Colorado infants

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Introduction: To validate the CHOP postnatal weight gain, birth weight, and gestational age retinopathy of prematurity risk model (CHOP-ROP) in a Colorado cohort of infants.

Methods: The CHOP-ROP model was applied to 1,225 preterm infants. Sensitivities and specificities for detection of high grade ROP, low grade, and overall ROP with corresponding 95% confidence intervals were calculated using exact Clopper Pearson type test.

Results: Of the 1,225 infants, 75 (6.2%) developed Type 1 ROP, 50 (4.1%) developed Type 2 ROP, and 294 (24.0%) developed low grade ROP. Application of the CHOP-ROP model to our infants would have triggered screening for 633 infants and reduced the number of infants screened compared to 2013 national criteria by 48.3%. In our cohort, application of the CHOP-ROP model had a sensitivity of 99.2% (95%CI 95.6-99.9%) for detecting high grade ROP and 85.9% (82.2-89.1%) for detecting any ROP. The specificity of CHOP-ROP for detecting ROP when applied to our cohort was 66.1%. The CHOP-ROP model missed 1/125 infants with high grade ROP (1 baby with type 2 ROP).

Discussion: The CHOP-ROP model has the potential to improve ROP screening efficiency and would eliminate almost half of the babies who are currently examined for ROP. The CHOP-ROP model missed one infant with high grade ROP in our Colorado cohort.

Conclusion: Our study highlights the importance of balancing the sensitivity of a screening model with the reduction in infants needing exams. Further validations with larger and more diverse patient populations are needed to find the ideal model before implementation.

Validation Study of the CHOP ROP Postnatal Weight Gain Model

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Introduction: The CHOP ROP model uses birth weight (BW), gestational age (GA), and weight-gain rate to predict risk of severe retinopathy of prematurity (ROP). We sought to evaluate the model’s performance in a large multicenter cohort of at-risk infants.

Methods: Retrospective cohort study (G-ROP Study) of infants from 30 North American hospitals between 2006-2012. All infants had a known ROP outcome. The CHOP ROP model was applied weekly to predict risk of ETROP type 1 or 2 ROP. If risk was above a cut-point level (high-risk), examinations were indicated.

Results: The study included 7,416 infants. The original model correctly predicted 433 of 439 infants with type 1 ROP (sensitivity 98.6%, 95%CI 96.8%-99.4%), reducing infants requiring examinations by 35% if only high-risk infants received examinations. Lowering the cut-point to capture all type 1 ROP cases (sensitivity 100%, 98.9%-100%) resulted in only 12% of infants not requiring examinations. However, if low-risk infants were examined at 37 weeks post-menstrual age and followed only if there was ROP, all type 1 ROP cases would be captured and the number of examinations performed among infants with GA>27 weeks would be reduced by 29%.

Discussion: The CHOP ROP model demonstrated high but not 100% sensitivity and may be better used to reduce number of examinations.

Conclusion: The CHOP ROP model can be used reliably to guide a modified ROP screening schedule and reduce the number of examinations performed. Additional G-ROP Study analysis of alternative modeling approaches and medical conditions causing false negative signals may further improve screening efficiency.
Introduction: 3D movies and TV are demanding pediatric ophthalmologists to promote, preserve and restore binocular vision more effectively. The goal is not just 20/20 vision in each eye but good stereopsis. Can we rise to the occasion?

Methods: Clinical studies in amblyopia, esotropia, exotropia and complex strabismus.

Results: Regarding amblyopia, the role of perceptual training with computers and videogames and medical treatment is optimistic. Functional MRI shows the cortical changes with occlusion in vivo. A study of acquired esotropia showed that achievement of fusion was 89.5% vs 40% and stereocuity 52.6% vs 3.3% in deviation < 8 PD vs > 10 PD (P = 0.000). In surgical management of intermittent exotropia, FD2 (Frisby Davis distance) stereotest indicated surgery if stereopsis worse than 20 arcsec. Functional improvement is possible if it is up to 70 arc sec.

Discussion: Vision is a cortical language best learnt in childhood! A horizontal deviation up to 8 PD and shorter duration is compatible with stereopsis in esotropia and early detection of abnormal distance stereocuity helps to decide proper timing of surgery in intermittent exotropia. Cases poorer (> 70 arc sec) are less likely to improve stereopsis after surgery. Adjustable partial vertical rectus transpositioning in cases of Exo Duane and lateral rectus palsy adds additional control in the hands of the surgeon to ensure alignment and thus restore binocular single vision and stereopsis.

Conclusion: We cannot just be content correcting strabismus, but have to be aligning eyes in time and restoring stereopsis! And, Yes we can!

References:

Bupivacaine Injection Treatment of Comitant Strabismus

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Introduction: Bupivacaine injection of extraocular muscles, initially an accidental event causing unwanted strabismus following retrobulbar anesthesia, has been used since 2006 to treat over 100 cases of strabismus. We report here the magnitude and stability of alignment corrections achieved by injecting bupivacaine (BPX) and botulinum toxin into extraocular muscles using EMG guidance in 55 adult patients with comitant horizontal strabismus.

Methods: In this prospective observational clinical series, BPX was injected into the lateral rectus of 31 patients with esodeviations, and into the medial rectus of 24 patients with exodeviations. A second BPX injection was given to 24 patients who had residual strabismus, and a third BPX injection was given to one patient. Epinephrine was added to the BPX in 30% of injections; botulinum toxin was injected into the antagonist in 68% of injections. Alignment was measured at 6 months and at 1, 2, 3, 4 and 5 years after treatment. Average follow-up was 28 months.

Results: Average initial misalignments of 24 PD were reduced at 28 months by 16 PD, with residual deviations < = 10 PD in 56% of patients. For patients with initial misalignment larger than 25 PD, treatment correction averaged 21 PD. Alignments were stable over follow-ups as long as 5 years.

Discussion: Stability of outcomes was the striking feature in this series. Large alignment corrections were achieved by large BPX and botulinum toxin doses. Epinephrine may have increased BPX effectiveness.

Conclusion: Bupivacaine injection treatment effects stable, clinically significant corrections in comitant horizontal strabismus, providing an alternative to conventional strabismus surgery.

References:
Outcome of Ocular Alignment Following Rectus Muscle Plication Compared to Resection

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Introduction: To evaluate the surgical success of rectus muscle plication compared to rectus muscle resection and to compare the short and long term changes in ocular alignment after both procedures.

Methods: Retrospective medical record review of all patients with simple or complex strabismus who underwent a rectus muscle tightening procedure (resection or plication) at our institute by a single surgeon. Binocular alignment was recorded before surgery and at the immediate, 6-12 wk, and final follow-up visits. We evaluated surgical success, reoperation rate, and postoperative alignment drift. Surgical success was defined as distance alignment of 10PD or less for horizontal strabismus and 6PD or less for vertical strabismus.

Results: The record review identified 72 procedures (48 resections and 24 plications.) At the 6-12 wk post-operative visit, surgical success was significantly higher in the resection group (89%) compared to the plication group (58%) (P=0.004). At final follow-up (mean, 19 months (range, 3-56 months)), there was more post-operative drift in the plication group (15PD) than in the resection group (11PD). Reoperations were required in 3 patients in the plication group (12.5%), all for undercorrection, vs. 0 in the resection group.

Discussion: Rectus muscle plication may have the advantage of sparing the ciliary vessels. However, we found that patients who underwent plication had lower surgical success rates and more post-operative drift than patients treated with resection.

Conclusion: In our experience, rectus muscle plication was not as effective as resection as a muscle tightening procedure.


Long Term Outcomes of Surgical Treatment for Large-Angle Esotropia in Children

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Introduction: Debate exists regarding whether two-muscle (‘uniform approach’) or three/four-muscle surgery (“selective approach”) is the better initial surgical management of large-angle esotropia (1-3).

Methods: Chart review of patients from a 47-year period at a single center who presented with large-angle esotropia (≥45 prism diopters at either distance or near), had strabismus surgery before age 7, and had at least two years of follow-up data available.

Results: 379 patients were included. The mean age at first surgery was 2.03 years (range 0.42-6). Surgical success was defined as orthotropia ±10 prism diopters. Patients treated with the uniform approach had smaller average preoperative deviations than those treated with the selective approach. The single-surgery success rate was statistically equivalent between these groups (31.8% and 30.3%). Undercorrection was more common with the uniform approach (p=0.0099) while overcorrection was more common with the selective approach (p=0.0013). The number of reoperations was not different between these two groups when accounting for the presence of systemic syndromes or other ocular disease (found in 106/379). While the presence of these other conditions did not affect the single-surgery success rate, patients without them were more likely to ultimately achieve surgical success (55% vs. 43%, p=0.05).

Discussion: While our study did not achieve sufficient power to determine whether the uniform or selective approach was superior, it suggests that success rates are similar.

Conclusion: Rates of long term satisfactory alignment after surgery for large-angle esotropia are moderate regardless of surgical approach. The presence of other ocular diseases or systemic syndromes heralds a poorer prognosis.

**Effectiveness of lateral rectus resection for residual esotropia in dysthyroid ophthalmopathy**

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**Introduction:** Strabismus occurs in 17-51% of patients with dysthyroid ophthalmopathy and is most commonly restrictive in nature. Strabismus surgery has traditionally focused on recession to minimize duction limitations and alleviate restriction.

**Methods:** Twenty-seven patients underwent a bimedial rectus recession in a three-year period from June 2012 - June 2015. Nine patients had a residual esotropia. We performed bilateral lateral rectus resection on nine patients with residual esotropia following initial bimedial rectus recession. No vertical muscle surgery was performed on any patients in this study.

**Results:** Seven of nine patients had successful outcome with fusion in primary and reading gaze without prism.

**Discussion:** The resections generally had predictable results with more effect at distance than near (as expected). The procedure did not create any exodeviations at near. Both failures had initial deviations of greater than 60PD prior to medial rectus recession and persistent limitation of ductions prior to lateral rectus resection.

**Conclusion:** Bimedial rectus recession may successfully correct esotropia in most patients with dysthyroid ophthalmopathy. Bilateral lateral rectus resection can be effective for residual esotropia.

**References:**

**Relationship Between Binocular Summation and Stereoacuity After Strabismus Surgery**

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**Introduction:** Given that binocular summation (BiS) can be easily measured without monocular cues that confound testing of stereoacuity, and that BiS can also be measured in patients without potential for stereopsis, we sought to describe the relationship between stereopsis and BiS.

**Methods:** Subjects were recruited from patients at their post-operative month two visit after strabismus surgery at the Jules Stein Eye Institute. High-Contrast Visual Acuity was tested using the Early Treatment Diabetic Retinopathy Study (ETDRS) protocol. Sloan acuity was tested at low-contrast levels of 2.5%, followed by 1.25%, using the ETDRS protocol. Stereoacuity was measured at both near and distance (3m) using Randot Stereotest.

**Results:** A total of 130 patients were studied. BiS was calculated by subtracting the better visual acuity eye score from the binocular score. Significant correlations were found between BiS for 2.5% LCA with near and distance stereoacuity (Spearman correlation, p=0.006 and 0.009). BiS for 1.25% LCA was also significantly correlated with near stereoacuity (p=0.04). Near stereoacuity and BiS for 2.5% and 1.25% LCA were significantly dependent (Pearson Chi Squared, p=0.006 and p=0.026). Patients with stereoacuity demonstrated significantly more BiS in 2.5% LCA of 2.7 (p=0.022) and 3.1 (p=0.014) letters than did those without near or distance stereoacuity, respectively.

**Discussion:** The present study demonstrates that BiS and stereopsis are interrelated, providing further evidence of a common neural connection that has been previously hypothesized (1).

**Conclusion:** These findings demonstrate that stereopsis and binocular summation are significantly correlated in strabismus patients and that BiS may be a useful measure of binocularity in this population.

**References:**
Sizes and Pulley Locations of Rectus Extraocular Muscles in Concomitant and Pattern Exotropia
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Introduction: We used magnetic resonance imaging (MRI) to measure rectus extraocular muscle (EOM) size, contractility, and pulley locations in normal control subjects and subjects with concomitant and pattern exotropia to determine whether these factors contribute to exotropia.

Methods: High-resolution, quasicoronal plane MRI was performed in 9 subjects with concomitant exotropia, six with pattern exotropia, and 21 normal volunteers. Rectus pulley locations were determined in central gaze in oculocentric coordinates. Cross sections in multiple contiguous image planes were summed and multiplied by the 2-mm slice thickness as indicators of EOM volumes.

Results: Rectus pulleys locations shifted differently in subjects with A, versus V and Y pattern exotropia. The LR pulleys were significantly displaced superiorly, MR pulleys were displaced inferiorly, and IR pulleys were displaced laterally in A pattern exotropia. In opposite fashion, the array of all rectus pulleys was excyclorotated in V and Y pattern exotropia. The PPV of the medial rectus muscle was statistically subnormal by about 29% in concomitant exotropia (P<0.05). The ratio of the PPV of lateral to medial rectus muscles in concomitant exotropia was significantly greater than in normal subjects and pattern exotropia (P<0.05).

Discussion: Rectus pulley displacements in pattern exotropia are mechanically consistent with the incomitance of the strabismus, so abnormal rectus muscle paths may be the major cause of pattern exotropia. This reasoning is consistent with absence of rectus pulley displacements in concomitant exotropia, where differences in horizontal rectus muscle volumes argue that muscle contractility is the cause.

Conclusion: Abnormalities of extraocular muscles and pulleys contribute differently in pattern vs. concomitant exotropia. Abnormally located rectus pulleys misalign muscle forces that contribute to pattern exotropia, while the smaller medial rectus reduces adducting force in concomitant exotropia.

Refractive Error and Anisometropia After Unilateral Intraocular Lens Implantation in Infants Under 7 months of Age - Results at 5 years of age from the Infant Aphakia Treatment Study (IATS)
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Introduction: To report refractive outcomes at age 5 years after unilateral IOL implantation during infancy.

Methods: 57 of 114 patients enrolled in the IATS were randomized to IOL implantation. IOL calculations targeted initial postoperative hypermetropia of +8D in patients <48 days of age and +6D in patients 48-210 days at surgery.1

Results: Fifty four of the 57 patients randomized to IOL implantation were analyzed (excluded patients were one that did not receive IOL, one with Stickler syndrome, and one lost to follow-up.) The median age at surgery of these 54 patients was 2.2 months (IQR, 1.2 – 3.5 months, range, 1.0 – 6.8 months). In three patients that underwent IOL exchange prior to the 5 year visit the last refraction prior to exchange was used for analysis. The age at the age 5 year follow-up visit was 5.0 ± 0.1 years (range 4.9 – 5.4 years) and the length of follow-up from surgery was 4.8 ± 0.2 years (range 4.5 – 5.3 years) in the 51 patients without IOL exchange. The median spherical equivalent refractive error at the age 5 year visit of the treated eyes (n=54) was -2.25 D (IQR, -6.50 to 0.00D; range, -19.00 to +5.00D) and of the fellow eyes (n=52) was +1.44 D (IQR, +0.88 to +2.25D; range, -1.13 to +7.25D). Resultant median anisometropia (n=52) was -4.00D (IQR, -8.44 to -1.25D; range, -19.63 to +2.75D).

Discussion: The majority of psuedophakic eyes were myopic at age 5 years and had significant anisometropia.

Conclusion: Variability in psuedophakic eye growth and myopic shift make predictable refractive outcomes challenging in unilateral IOL implantation in infants

Rate of Refractive Growth in Pseudophakic Eyes in the Infant Aphakia Treatment Study

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Introduction: To report the rate of refractive growth for pseudophakic eyes in the Infant Aphakia Treatment Study (IATS).

Methods: 55 infants (age, 1 to 6 months) in the IATS randomized to IOL implantation (targeted undercorrection: +8 D, surgery age 4-6 weeks; +6 D, surgery >6 weeks) had their rate of refractive growth calculated using the RRG3 formula. The change in refraction (1 month postop to age 5 years) was used to calculate the RRG3 except for 3 patients who underwent IOL exchange (RRG3 calculated using refraction prior to IOL exchange).

Results: Cataract surgery was performed at a mean age of 0.21 ± 0.13 years. The mean IOL power implanted was 29.45 ± 5.90 D and the mean refraction 1 month postop was +6.05 ± 2.48 D. The mean age at last refraction was 4.81 ± 0.83 years. The mean RRG3 was -20.7 ± 13.1 D (range, -4.7 to -93.9 D). The mean RRG3 for the 3 eyes that underwent IOL exchanges was -52.2 D. Their mean postop refraction was +2.0 D and their mean refraction at the time of IOL exchange was -12.5 D. Two of these eyes developed glaucoma.

Discussion: Rates of refractive growth vary widely in infants undergoing IOL implantation. Glaucoma is a risk factor for a high RRG3. A low initial undercorrection coupled with a high rate of refractive growth increases the likelihood of early IOL exchange.

Conclusion: Further research is needed to identify factors associated with differing rates of refractive growth after infantile IOL implantation.


Results of phase III clinical trial subretinal gene therapy for RPE65-mediated Leber Congenital Amaurosis (LCA)

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Introduction: Leber congenital amaurosis (LCA) is a leading cause of congenital blindness with at least 19 causative genes. A gene therapy (SPK-RPE65) for LCA caused by RPE65 gene mutations recently completed a Phase 3 trial.

Methods: 31 patients with CLIA laboratory-confirmed RPE65-mediated LCA were enrolled at two centers. 21 participants were randomized to the intervention group; 10 were randomized to 1 year of observation before crossover. Subretinal injection of SPK-RPE65 in a 300 uL volume was delivered to one eye, followed by the contralateral eye within 18 days. Efficacy measures included mobility testing (MT), full-field light sensitivity threshold (FST), and visual acuity (VA).

Results: The trial met its primary endpoint (p=0.001), demonstrating improvement of functional vision in the intervention group compared to the control group, as measured by bilateral MT change score between baseline and 1 year. FST improved significantly in the intervention group compared to the control group (p<0.001). MT change score for the assigned first eye was significantly better than controls (p=0.001). VA was not statistically different from controls (p=0.17). There were no serious adverse events (AEs) related to SPK-RPE65 or deleterious immune responses. Procedure-related AEs included transient elevated IOP (4), cataract (3), retinal tear (2), and inflammation (2).

Discussion: SPK-RPE65 resulted in statistically significant improvement in functional vision and visual function measured by MT and FST, respectively. AEs were typical for subretinal surgery and not related to vector or immune response.

Conclusion: Children with nystagmus and/or poor vision require genetic testing, since subretinal gene therapy improves visual function in RPE65-mediated disease.

Comprehensive genomic testing of over 200 paediatric cataract patients: an insight into the spectrum of genetic aetiology

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Manchester Centre for Genomic Medicine
The University of Manchester

Introduction: Childhood cataract (CC) is a major cause of lifelong visual loss. A large proportion of bilateral cases are genetic, resulting from mutations in one of more than 100 known causative genes. This heterogeneity complicates and delays clinical diagnosis.

Methods: We have designed an assay to screen 115 known cataract-causing genes in parallel, via next generation sequencing (NGS). 205 patients were tested from August 2013 to 2015, including isolated and syndromic forms of CC.

Results: Amongst a diverse cohort, NGS enabled clinical diagnosis in 55% (n=113) of patients. 73% of identified phenotypes were inherited as an autosomal dominant trait while 16% and 11% of cases were autosomal recessive and X-linked, respectively. Evaluation of 40 ‘sporadic’ cases revealed a mutation detection rate of 62% (n=25) with 50% attributable to de novo dominant mutations, and 12% compound heterozygous variants. 73% of diagnosed cases were caused by mutations in non-syndromic genes; syndromic disease accounted for 21% of cases; and metabolic disease a further 6%. A variety of mutation types were accurately detected: missense changes accounted for 61% (n=72) of variants, insertion/deletion 18% (n=22), nonsense 13% (n=16) and splice-altering 6% (n=7).

Discussion: Genomic approaches permit comprehensive, high-throughput screening enabling rapid, accurate diagnosis. For sporadic cases, this is key to providing a precise prognosis and individualised care in the genomic era.1, 2

Conclusion: This carefully validated diagnostic pipeline, allows reporting of results within 4-8 weeks, including discussion of likely variant pathogenicity within a multidisciplinary forum.


Visual outcomes following perinatal ischemic stroke

Erin C Kiskis BA Lori Billinghurst MD, MSc Rebecca Ichord MD Laura Jastrzab BS Gil Binenbaum MD, MSCE
The Children’s Hospital of Philadelphia, Philadelphia, PA

Introduction: There are limited data describing visual outcomes following perinatal stroke. We sought to describe the prevalence and type of visual deficits observed in children after perinatal arterial ischemic stroke (PAIS) and to evaluate clinical factors associated with abnormal visual outcome.

Methods: Single-center prospective consecutive cohort study of PAIS subjects enrolled 2006-2014 and followed by pediatric neurology and/or ophthalmology. Abnormal visual outcome was defined as any of poor central vision, suspected or confirmed visual field cut, or manifest strabismus. Clinical factors evaluated were early head turn (<1 year of age), infarct location, and infarct volume estimated by a validated scale (modASPECTS).

Results: Median follow-up of 98 children was 4.5 years (IQR 2.1-6.6). Infarct was unilateral in 85(87%) and within anterior, posterior, or both circulations in 85(86%), 4(4%), and 9(9%), respectively. Early head turn was detected in 33(33%), which later resolved in 31(33%)(94%). At latest follow-up, central vision was good in 96(98%), but 29(29%) had abnormal visual outcome (strabismus 18, field cut 15, poor central vision 2), which was associated with early head turn (p=0.01), basal ganglia involvement (p=0.01), and large stroke volume (p<0.0001).

Discussion: Central vision is usually preserved following PAIS. Field cut and strabismus occur in a minority of children. Risk factors for abnormal visual outcome include early head turn and larger stroke volume.

Conclusion: Parents can be counseled that visual outcomes following perinatal stroke are generally good and early head turn typically resolves. However, children remain at risk for visual deficits and should be screened by treating physicians.

Introduction: The prevalence of blindness in the US adult population is 0.8%. Data from worldwide health organization show that about 500,000 children become blind each year.

Methods: The Brainport system is a commercially available, bionic, non-invasive, vision-by-pass system that conveys environment images from a spectacle-frame-mounted video-camera to the brain via an electro-tactile tongue array. This is a prospective, IRB approved, interventionional cohort reporting data on the use of Brainport in 5 ‘early’ blind children. The paradigm consisted of a general training regimen protocol for BrainPort then testing of; visual acuity and ambulation on a 40-foot obstacle course. The primary outcome measures were ability to detect visual acuity in LogMar, and, obstacle course error number and time to completion. The error rate and time for completion based on complexity of the 40 feet obstacle course were statistically compared using analysis of variance (ANOVA).

Results: Subject ages 7-17 years, 3 female. After training all control and blind subjects were able identify a LogMar letter, walk the route on their own and identify the presence of obstacles. Orientation-and-mobility scores improved significantly in both blind and controls as indicated by increased preferred walking speeds and fewer collisions. Walking speeds and collisions did not significantly differ between the controls and the blind before or after training.

Discussion: We have demonstrated the potential of BrainportR to provide an innovative method for developing orientation and mobility skills in blind children.

Conclusion: Sensory substitution vision technology is a high impact area of vision research.

References:

Reimbursement Rates for Photoscreening by Insurance Provider

Cherie A Fathy  Sean P Donahue
Vanderbilt Eye Institute
Nashville, TN

Introduction: The US Preventative Services Task Force and the American Academy of Pediatrics both endorse the use of automated vision screening for the detection of amblyopia risk factors. A current impediment to widespread implementation is perceived inadequate reimbursement. We examined reimbursement rates for photoscreening (CPT code 99174) at a large community pediatric practice and assessed for potential differences across insurance payors.

Methods: We retrospectively queried claims data over one year for 1,889 patients receiving automated vision screening with their well-child examinations. We evaluated the insurance payment as a proportion of the standard charge ($40). We also examined payment differences by type of payor (commercial vs. Medicaid), which were evaluated using a t-test with unequal variance.

Results: 1,214 patients were privately insured. 685 were publicly insured. There were six commercial payors with a minimum of 15 claims. 3 paid relatively consistently (more than 60% of the time), while the other 3 payors paid fewer than 50% of the time. In contrast the three Medicaid providers paid claims 0%, 4.1%, and 100% of the time. The mean payment for commercial insurance payors, when they paid, was $22.60 ($0.05-$45.56), compared to $16.47 ($10.07-$19.27) for public providers (p<0.05).

Discussion: Majority of payors in this study reimburse for automated vision screening. Payment rates differ by type of provider. Commercial insurance paid a higher amount than Medicaid.

Conclusion: Many payors currently reimburse for automated vision screening in conjunction with USPSTF recommendations. The assumed lack of reimbursement is not supported by the evidence and should encourage more widespread use of vision screening.

References:
**Assessing Suppression in Amblyopia with a Dichoptic Eyechart**

Eileen E Birch PhD  
Sarah E Morale BS  
Reed M Jost MS  
Angie De La Cruz BS  
Krista R Kelly PhD  
Yi-Zhong Wang PhD  
Peter J Bex PhD  
Retina Foundation of the Southwest  
Dallas, TX

**Introduction:** Suppression can be overcome and binocular interaction revealed by balancing the contrast of images in the amblyopic and fellow eyes. Repeated experience with contrast-balanced images improves binocular vision and visual acuity. Here we describe a novel, eyechart-based method to assess the contrast balance needed to overcome suppression.

**Methods:** 91 children (6-12y; 59 amblyopic; 22 nonamblyopic; 10 controls). Three sizes of Sloan letters were presented on passive 3D display (5 letters per line). Children wore polarized glasses so that a different letter chart was presented to each eye. At each position, the letter and its contrast differed on each eye’s chart. Children completed 8 lines (40 letter/contrast combinations) for each letter size. We determined the contrast balance at which 50% of amblyopic eye letters and 50% of fellow eye letters were seen.

**Results:** For all 3 letter sizes, amblyopic children had significantly higher contrast balance (4.86, 4.63, and 4.96) than nonamblyopic children (2.14, 2.34, and 2.35; p<0.003) and controls (0.93, 0.95, and 0.90; p<0.0008). Amblyopic eye visual acuity was correlated with contrast balance (r=0.53, 0.55, and 0.58 for the 3 letter sizes). Changes in visual acuity with treatment or recurrence were correlated with changes in contrast balance for the two larger letter sizes (r=0.57 and 0.47).

**Discussion:** Severity of suppression can be assessed by measuring contrast balance with a dichoptic eyechart. Amblyopic children needed 5X more amblyopic eye contrast to overcome suppression.

**Conclusion:** It is feasible to assess severity of suppression as an outcome measure for amblyopia treatment.

**Decreased binocular summation in strabismic amblyopes and effect of strabismus surgery**

Melinda Y Chang  
Joseph L Demer  
Sherwin J Isenberg  
Federico G Velez  
Stacy L Pineles  
Stein Eye Institute, University of California, Los Angeles, Los Angeles, CA

**Introduction:** Binocular summation (BiS) is the improvement in visual function using binocular vision surpassing the better eye alone. Previous studies have demonstrated diminished BiS in non-amblyopic strabismic patients. We examined effects of strabismic amblyopia and strabismus surgery on BiS.

**Methods:** We prospectively enrolled 13 strabismic patients with amblyopia, 26 age-matched normal controls, and 26 strabismic patients without amblyopia. Strabismic patients were tested before and after realignment surgery. Visual acuity was tested binocularly and monocularly using high-contrast ETDRS charts and Sloan low-contrast charts at 2.5% and 1.25% contrast. BiS was calculated as the difference between the binocular and better eye scores.

**Results:** Patients with strabismic amblyopia had subnormal BiS at both 2.5% (1.7 letters in strabismic amblyopes vs. 6.2 letters in normal controls, p=0.001) and 1.25% contrast (-0.46 vs. 5.9 letters, p = 0.0075). There was no difference in BiS between strabismic amblyopes and non-amblyopic strabismic patients. After strabismus surgery, BiS improved in amblyopic patients who had measurable stereoaucity preoperatively, from -2.6 to 6.0 letters on 2.5% contrast charts (p = 0.03), but did not improve after surgery in patients without stereo. Among patients with different strabismus subtypes, there was no significant difference in postoperative improvement in BiS.

**Discussion:** Both strabismic amblyopes and non-amblyopic strabismic patients have decreased BiS, but amblyopia may not further degrade BiS in the setting of strabismus. BiS may improve after strabismus surgery in amblyopic patients with measurable stereoaucity.

**Conclusion:** Binocular summation is subnormal in strabismic amblyopia, but may improve after surgical realignment in some patients.

Randomized clinical trial of binocular iPad treatment for amblyopia versus patching
Reed M Jost MS; Krista R Kelly PhD; Lori Dao MD; Joel N Leffler MD; Cynthia L Beauchamp MD; Eileen E Birch PhD
Retina Foundation of the Southwest, Dallas, TX

Introduction: Binocular experience, revealed by decreasing fellow eye contrast to reduce interocular suppression, is effective in treating amblyopia with at-home binocular iPad games.1,2 However, 38% of children had poor compliance with our rudimentary iPad games. Here we evaluated a more engaging, action-oriented binocular iPad game app using the same contrast-balancing approach.

Methods: 21 amblyopic children (4-9y; 20/40-20/125) were randomly assigned 2 weeks of patching (2hrs/day, 7days/week) or binocular iPad gameplay (1hr/day, 5days/week). After 2 weeks, all children were assigned 2 weeks of binocular treatment. Binocular treatment was a dichoptic iPad action game with reduced fellow eye contrast. Best corrected visual acuity (BCVA) was measured at baseline, 2-week, and 4-week outcome visits.

Results: At baseline, mean amblyopic eye BCVA±SE was 0.48±0.03 logMAR. After 2 weeks of binocular treatment (11.1±0.7 hours), mean BCVA improved 0.15±0.02 logMAR (p<0.0001, n=10). With 2 weeks patching treatment (27.4±0.9 hours), mean BCVA improved 0.07±0.03 logMAR (p=0.02, n=10). For those who crossed over to 2 weeks of binocular treatment (9.7±1.1 hours), mean BCVA improved an additional 0.09±0.03 logMAR (p=0.02, n=9). With 4 weeks of binocular treatment (19.3±1.5 hours), mean BCVA improved a total of 0.18±0.03 logMAR (p=0.0001, n=11). Only 1/21 (5%) children had poor gameplay compliance.

Discussion: Binocular iPad treatment yielded significant improvement in amblyopic eye BCVA after 2 weeks, significantly better than 2 weeks patching (p=0.03). This more engaging dichoptic game resulted in better compliance.

Conclusion: Repeated binocular visual experience with reduced fellow eye contrast improved vision in the amblyopic eye. Highly compliant binocular treatment provides an additional therapy option for amblyopia.

References:
1. Li SL; Jost RM; Morale SE; Stager DR Sr; Dao L; Stager D Jr; Birch EE. ‘A Binocular iPad Treatment for Amblyopic Children.’ Eye. 28.10 (2014): 1246-5310.

Perceptual Learning Treatment of Amblyopia in Adults
Stacy L Pineles  Steven Thurman  Jenni Deveau  Joseph Demer  Federico Velez  Aaron Seitz
Jules Stein Eye Institute, University of California Los Angeles
Los Angeles CA

Introduction: Recently a perceptual learning-based video game (ULTIMEYES) has been developed for treatment of various low vision conditions. The game task involves the detection of low contrast sine gratings of varying spatial frequency, where contrast is controlled adaptively to maintain performance at threshold levels. This program has previously not been utilized for amblyopia.

Methods: This pilot study enrolled 9 adults (mean age 32 years; range 16-49) diagnosed with strabismic or anisometric amblyopia, who had previously undergone patching treatment, and whose visual acuity in the amblyopic eye ranged from 20/40 to 20/200. Subjects underwent pre- and post-treatment testing using high and low contrast visual acuity optotypes and sensory measures including Worth-4-dot and stereoacuity at distance and near. Prescribed treatment consisted of four sessions of 20 minutes each per week for 8 weeks. The therapy was performed binocularly with the use of a polarizing filter over the dominant eye to minimize contribution ability of that eye.

Results: Following treatment there was a statistically significant improvement in amblyopic eye ETDRS visual acuity averaging 5 letters (p<0.01). Suppression on the Worth-4-dot tests at distance was reduced from 6/9 subjects pre-treatment to 3/9 subjects post-treatment.

Discussion: ULTIMEYES is a perceptual-learning based therapy. Pilot data shows that 8 weeks of therapy in adults leads to significantly improved visual acuity and reduced suppression. Further study is needed in order to determine long-term effects, and compare to placebo and established amblyopia treatments.

Conclusion: ULTIMEYES shows promise as a perceptual-learning technique to improve visual acuity and binocularity in amblyopic adults.

References:
Amblyopia Treatment Outcomes Assessment Using AAO’s IRIS-7 Measure

Constance E. West, MD, Patricia I. Cobb, MS, Denise L. White, PhD
Cincinnati Children’s Hospital Medical Center
Cincinnati, Ohio

Introduction: The American Academy of Ophthalmology recently announced Center for Medicare and Medicaid Services’ inclusion of “IRIS-7: Amblyopia: Interocular visual acuity” as an outcome measure of effective clinical care. Treatment was defined as ‘successful’ if corrected interocular visual acuity difference (IOD) was <0.23 logMAR 12-18 months after first diagnosis. We report our amblyopia treatment outcomes using IRIS-7.

Methods: Records of all new amblyopia patients aged 3-7 years evaluated during 2013 were reviewed. Multiple logistic regression analysis was used to assess factors affecting successful treatment.

Results: Of the 477 new patients diagnosed with amblyopia, 199 met IRIS-7 inclusion criteria. Of these, 91 (46%) had IOD_{exit} <0.23 less than 18 months after initial diagnosis, including 65 with IOD_{exit} <0.23 at 12-18 months (IRIS-7-defined ‘Performance Met’). IOD_{entry}, number of attended visits, atropine prescription, and average days between visits correlated with successful outcome (backward elimination technique, ROC=0.83). Age, race, ethnicity, payor, and number of missed visits were not associated with outcome.

Discussion: In this first-reported application of IRIS-7, our outcomes leave room for improvement. Further subgroup analysis, comparison with results of other centers, and focused prospective studies may help to uncover factors that are amenable to intervention when managing this patient population.

Conclusion: Less than half of our patients were successfully treated for amblyopia using IRIS-7 criteria.

References: 1. AAO IRIS-7: www.aao.org/assets/d881fe07e-238e-4940-ad0a-0ce2edf1b57e/635676621632000000/iris-7-amblyopia-interocular-visual-acuity-pdf

Implantation of the Phakic Intraocular Collamer Lens (ICL) for Correction of Pediatric Myopia

Lawrence Tychsen Nicholas Faron James Hoekel
Washington University School of Medicine, St. Louis, MO

Introduction: A subset of children with high anisometropia or isoametropia and neurobehavioral disorders have chronic difficulties with spectacle or contact lens wear. We report the results of refractive surgery in a series of these children treated using bilateral or unilateral intraocular collamer lenses (ICLs) for moderate to high myopia.

Methods: Clinical course and outcome data were collated prospectively in a group of 23 children (mean age 11.4 yrs, range 1.8 - 18.0 yrs) with neurobehavioral disorders exacerbated by poor compliance with spectacles. Myopia in 40 eyes ranged from -3.0 to -15.0 D (mean – 9.1 D). Goal refraction was ~ 0.5 to +1.5 D. Correction was achieved by unilateral or sequential bilateral sulcus implantation of a Visian ICL under general anesthesia. Mean follow-up was 9 mos (range 4 mos - 2 yrs).

Results: Correction averaged 9.3 D (range 2.25 – 15.7 D). Uncorrected visual acuity improved substantially in all eyes (from a mean 20/1148 [logMAR 1.76] to a mean 20/40 [logMAR 0.30]). Mean axial length for all eyes was 25.73 mm (range 20.7 - 30.62 mm). Mean corneal diameter for all eyes was 11.48 mm (range 10.66 - 12.5 mm). Ocular co-morbidities (amblyopia in 63%, strabismus 56%, nystagmus 38%, ROP 13%, albinism 6%) as well as neurodevelopmental disabilities (cerebral palsy, Down Syndrome, developmental delay, seizure disorder) in 52% of the children accounted for residual post-operative, subnormal visual acuity. Two children (2 eyes) required unplanned return to the OR in the first post-operative week because of a non-patent iridotomy.

Discussion: Visian ICL implantation improves visual function in children who have ametropia and difficulties wearing glasses or contact lenses. Visuo-motor and neurodevelopmental co-morbidities did not preclude substantial gains in visual acuity.

Conclusion: Visian ICL implantation improves visual function in special needs children who have ametropia and difficulties wearing glasses or contact lenses.
Uncorrected Hyperopia and Preschool Early Literacy: Results of the Vision In Preschoolers - Hyperopia In Preschoolers (VIP-HIP) Study

Gui-shuang Ying PhD Graham E Quinn MD
Department of Ophthalmology, University of Pennsylvania
3535 Market Street, Suite 700, Philadelphia, PA 19104

Introduction: Controversy exists regarding the association between hyperopia and reading ability in children. This study compared early literacy in 4- and 5-year-old, uncorrected, hyperopic children with that of emmetropic children.

Methods: Hyperopia (>/>=3.0D to </=6.0D [most hyperopic meridian], astigmatism</=1.5D, anisometropia</=1.0D) or emmetropia (hyperopia </=1.0D; astigmatism, anisometropia, and myopia</=1.0D) was confirmed by cycloplegic refraction. Binocular near visual acuity (VA) and stereoacuity were measured. Masked examiners administered the Test of Preschool Early Literacy (TOPEL).

Results: 244 hyperopes and 248 emmetropes were enrolled from preschool or kindergarten (mean age 58 months; mean±SD of the most hyperopic meridian +3.78D±0.81 in hyperopes, +0.51D±0.48 in emmetropes). After adjustment for age, race/ethnicity, and parent/caregiver’s education, the mean difference in TOPEL score between hyperopes and emmetropes was -4.3 (p=0.01). Compared to emmetropic children, the TOPEL score deficits were greatest in hyperopic children with =4D (-6.8, p=0.01), or hyperopia =3D with near VA of 20/40 or worse (-8.5, p=0.002) or with stereoacuity of 240 sec arc or worse (-8.5, p<0.001). The greatest deficits in TOPEL component score were found for Print Knowledge (p</=0.007), while Phonological Awareness was not significantly different (p/>=0.39).

Discussion: Hyperopia with reduced visual function at near is associated with deficits in print knowledge.

Conclusion: Uncorrected hyperopia >/= 4D or hyperopia >/= 3D associated with reduced near VA (20/40 or worse) or stereoacuity (240 sec arc or worse) in 4- to 5-year-old children is associated with significantly worse performance on a test of early literacy.

Ocular Congenital Anomalies in Infants with Microcephaly and Presumable Zika Virus Infection

Virginia Vilar Sampaio; Sarah Rogeria Martins Moura; Luciana Portella Rabelo; Maria Cecilia Santos Cavalcante Melo; Carlos Teixeira Brandt

Introduction: Zika virus (ZIKV) is a mosquito-borne flavivirus that is been associated with a twenty-fold increase in prevalence of microcephaly in Brazil due to presumable maternal-fetal transmission.

Methods: A complete ophthalmological screening examination was performed in twenty infants delivered by women with presumable ZIKV infection. The investigation was done at a public hospital in Campina Grande - Paraiba, Brazil.

Results: Eight out of twenty infants presented with ophthalmological anomalies. The mothers had been clinically diagnosed with ZIKV infection and proved microcephaly. Six of them had symptoms such as fever, rash, headache in the first trimester of gestational age. One in the second and one in the third trimester. Eight infants (14 eyes) presented with ocular anomalies (6 binocular and 1 monocular). Ocular anomalies included: chorioretinal atrophy: three patients (5 eyes), retinal pigmentary abnormalities: three patients (6 eyes), optic disc abnormalities 4 patients (7 eyes). From these, six presented with binocularly enlarged cup-disc ratio. Additionally, in one infant was observed hypoplasia in one eye. Anterior segment abnormalities were not found. Serology was negative in all infants for Toxoplasmosis, Syphilis and human immunodeficiency viruses.

Conclusion: Ocular congenital anomalies were found in eight (40%) infants from mothers who presented with presumable ZIKV infection during early pregnancy. Further studies are required for proving cause-outcome of ZIKV infection in pregnancy and congenital ocular anomalies.
Notes
## Poster Schedule

1st Set of Hard Board Posters (1-27) displayed from Wednesday, April 6, 4:00 PM - Friday, April 8, 11:30 AM, Ballroom C

Interactive Poster Session - Author Presentation and Q/A - Thursday, April 7, 10:00 - 11:00 AM

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<td>Jennifer Vaughn, MD; Caroline Robson, MD; Sarah Whitecross, BSc, OC(C); Gena Heidary, MD, PhD</td>
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Erick D. Bothun, MD  
David Morrison, MD; Gui-Shuang Ying, PhD; Ebenezer Daniel, MBBS, MS, PhD;  
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Performance of the Spot Vision Screener in Children Younger than Three

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Introduction: To evaluate the use of the Spot Vision Screener (Welch Allyn, Skaneateles Falls, NY) for detection of amblyopia risk factors in children of age 6 to less than 36 months, as defined by the 2013 guidelines of the American Association for Pediatric Ophthalmology and Strabismus. The USPSTF indicates that data are insufficient to support vision screening in this age group.

Methods: In this ongoing prospective study, patients seen from February 2012 to October 2015 were tested with the Spot during a routine visit. Enrolled children underwent a comprehensive eye examination including cycloplegic refraction and sensorimotor testing within six months of the testing date by a pediatric ophthalmologist masked to the Spot results.

Results: A total of 118 children were included. The Spot successfully obtained readings in 113 patients (96%). Compared to the ophthalmologist’s examination, the Spot had a sensitivity of 90.2%, a specificity of 63.6%, and positive predictive value (PPV) of 56.9% for detection of 2013 AAPOS amblyopia risk factors. For children 6-23 months, sensitivity was 82.4%, specificity was 56.7%, and PPV was 51.9%. For children 24-35 months, values were 95.8%, 68.1%, and 60.5%, respectively.

Discussion: The Spot achieved a good sensitivity and specificity for detection of amblyopia risk factors in this young cohort, particularly in the older subgroup.

Conclusion: Our data offer support for automated vision screening in young children.


Time of maximum cycloplegia after instillation of cyclopentolate 1% in children with brown irises

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Introduction: To determine the time of maximum cycloplegia after instillation of cyclopentolate 1% in children with brown irises and the presence of a relationship between pupillary reaction and time of maximum cycloplegia.

Methods: This was a prospective analytical study involving children aged 5 to 14 years. Cyclopentolate 1% was instilled three times at 10-minute intervals. The spherical equivalent, pupillary reaction and pupillary diameter were recorded before the first drop and nine times after the last drop at 10-minute intervals. Time of maximum cycloplegia was determined from the time point at which the 95% confidence intervals of differences between mean spherical equivalent at each point and its final value was reached and remained within equivalence limit (±0.25 diopter).

Results: Sixty children were enrolled in this study. Mean age was 9.8 years (5–14). Time of maximum cycloplegia was reached at 30 minutes after the first instillation of cyclopentolate. Poor correlation was observed between pupillary reaction and time of maximum cycloplegia (r = -0.07). The mean pupillary diameter at 30 minutes was 3.7 ± 1.3 mm, and further dilation occurred thereafter.

Discussion: The maximum cycloplegia was reached at 30 minutes. Maximum cycloplegia and absence of pupillary reaction did not occur at the same time. It takes longer to reach maximum pupillary dilatation than to reach maximum cycloplegia.

Conclusion: In most children with brown irises, maximum cycloplegia was reached 30 minutes after the first instillation of cyclopentolate. The absence of a pupillary reaction should not be used as an indicator of maximum cycloplegia.
**Amblyopia disrupts the development of eye-hand coordination**

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**Introduction:** Decorrelated binocular experience during development can result in amblyopia and disrupt motor abilities that rely on vision for development. Reduced motor ability may negatively impact academic and social functioning. We assessed motor ability in amblyopic children to determine factors associated with any impairments.

**Methods:** 29 amblyopic children (mean age±SD=7.9±2.6 years), 22 non-amblyopic children treated for strabismus (7.3±2.3 years), and 22 normal control children (8.8±2.9 years) were evaluated on motor ability using the Movement Assessment Battery for Children, consisting of 8 tasks evaluating manual dexterity, aiming/catching, and balance. Binocular fixation stability was assessed using eye movement recordings (Eyelink 1000).

**Results:** 11(38%) amblyopic, 7(32%) non-amblyopic strabismic, and 3(14%) control children were at-risk or impaired on total motor ability (≤15th percentile). Amblyopic children had poorer manual dexterity (standard score±SD=6.8±2.1) compared with non-amblyopic children treated for strabismus (8.6±3.3; p=0.022) and controls (10.0±3.1; p<0.001). Non-amblyopic children treated for strabismus were not different than controls. No group differences were found for aiming/catching or balance; however, more precise aiming was related to better fixation stability of both non-preferred (r=-0.35; p=0.023) and preferred (r=-0.50; p=0.001) eyes. In this initial cohort of amblyopic children, no effects of amblyopia type or severity, or stereoacuity on task performance were found.

**Discussion:** Amblyopia from decorrelated binocular experience disrupts the development of eye-hand coordination.

**Conclusion:** More effective screening and interventions are needed to prevent or ameliorate eye-hand coordination deficits in amblyopic children, to improve academic success and social function.

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**Cortical Visual Impairment (CVI) in Children - An analysis of Risk Factors, Clinical Presentation and Treatment Outcome**

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**Introduction:** To gain more insight into causes of cortical visual impairment (CVI) in children and to analyze associated ophthalmic findings and treatment outcomes at a tertiary care referral facility.

**Methods:** The clinical data of 49 consecutive children less than 5 years of age diagnosed with CVI in our low vision department from Jan to Sep 2014 were analyzed for etiology, ocular variables, presenting vision and treatment outcome. All were advised vision training techniques.

**Results:** 29% of the study population was preterm and 76% were males. 50% had birth weight less than 2500 g, 49% of children had documented MRI findings of which 20% had hypoxic ischemic encephalopathy, 14% had periventricular leukomalacia, 4% had structural brain anomalies, 6% had neonatal infection, 3% had hydrocephalus and 2% had intraventricular hemorrhage. Associated ophthalmic findings included nystagmus (14%), strabismus (7%), disc pallor (53%) and severe sequelae of ROP (8%). Majority had mild hyperopia/astigmatism and only 4% were high myopic. All of them showed delay in developmental milestones. 55% of children showed an improvement in visual function on last follow up examination.

**Discussion:** Cortical visual impairment is emerging as the leading cause of bilateral visual impairment in Children. Prevention of diseases that lead to prematurity and hypoxia/ischemia at term would be the ultimate goal in preventing this condition.

**Conclusion:** In our study, the major risk factors for CVI were perinatal hypoxia and premature birth. Most patients had associated serious neurological and ophthalmic abnormalities.
Visual Field Outcomes in Children with Neurofibromatosis Type 1 Associated Optic Pathway Gliomas

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Introduction: The majority of studies of neurofibromatosis type 1 (NF-1) associated optic pathway gliomas (OPGs) have focused on visual acuity (VA) outcomes. In contrast, visual field (VF) outcomes data are limited even though VF loss may occur concurrently with VA loss. The purpose of this study is to examine the impact of OPGs on VFs in a large cohort of children with NF-1.

Methods: Eleven year retrospective chart review of all patients with a diagnosis of NF-1 (ICD-9 237.7) and optic nerve glioma (ICD-9 192.0) at a single, tertiary care center. Data regarding demographic characteristics, VF data, and radiographic data were collected.

Results: A total of 140 patients with NF-1 associated OPG were identified of whom 119 (52% female) performed either Goldmann or Humphrey perimetry. Median age of first VF test was 6 years (range 3-20 years). Mean follow up was 74 months. VF loss was noted in 51/119 (43%) of patients. Types of VF loss included generalized constriction (26%), temporal hemianopia (59%), homonymous hemianopia (13%) and nasal defect (2%). Treatment occurred in 41% of patients, and of those, 69% had visual field deficits present on most recent VF compared to 18% of patients who did not undergo treatment.

Discussion: VF loss occurs at a high frequency in children with NF-1 associated OPGs. We found that formal VF assessment is a feasible method to monitor disease progress in young children.

Conclusion: Evaluation of VF dysfunction in children with NF-1 OPGs is important as it is a significant source of morbidity in these patients.

Radiographic features in pediatric idiopathic intracranial hypertension

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Introduction: Adult patients with idiopathic intracranial hypertension (IIH) may harbor characteristic radiographic signs on magnetic resonance imaging (MRI). These signs have not been extensively evaluated in children. The purpose of this study is to examine the radiographic findings of pediatric IIH to characterize salient features and gain a deeper understanding of disease pathophysiology.

Methods: Retrospective, case-control study of pediatric patients with and without IIH from the ophthalmology department at single tertiary care center was performed. Clinical data including demographics, lumbar puncture results, and ophthalmic findings were obtained. Patient MRI/MRV was reviewed for presence of an enlarged perioptic subarachnoid space, posterior globe flattening, protrusion of the optic nerve head, empty sella turcica, prominent arachnoid granulations, skull base crowding, Chiari malformation, ventriculomegaly, and transverse sinus stenosis.

Results: Neuroimaging and clinical findings of 49 patients with IIH and 30 age- and sex-matched control patients were evaluated. Compared to controls, IIH patients had significantly larger perioptic subarachnoid space (p <0.001), and higher incidences of posterior globe flattening (p <0.001), protrusion of the optic nerve head (p <0.001), and empty sella turcica (p <0.001). The presence of prominent arachnoid granulations, skull base crowding, Chiari malformation, ventriculomegaly, and transverse sinus stenosis did not reach significance. Multivariate models were developed for predicting IIH in children.

Discussion: Several highly sensitive key radiographic findings in pediatric IIH were identified and models were developed for predicting pediatric IIH.

Conclusion: In the evaluation of pediatric patients, there are characteristic radiographic findings on MRI that should raise concern for IIH.
Time to resolution of papilledema in pediatric patients with intracranial hypertension

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Introduction: The characteristics of papilledema reported in pediatric intracranial hypertension (IH) are poorly understood. We evaluated the time to resolution of papilledema in a pediatric cohort with IH.

Methods: A retrospective chart review was performed on patients diagnosed with IH from June 2010 to June 2013 in a tertiary care center ophthalmology clinic. Time to resolution was documented as the time difference between first documented elevated lumbar puncture to first exam with Frisén grade 0 edema. Our study included patients with primary and secondary IH with no space-occupying lesion, known opening lumbar puncture pressure, and who were geographically within our hospital’s primary service area. Patients were excluded if they did not have follow-up ophthalmologic data.

Results: 65 patients were included, with a median age at diagnosis of 12.6 years (range=3.2-19.1). 52(80%) had papilledema at time of diagnosis. Of those presenting with edema, 41(79%) resolved and 7(13%) had chronic edema. Of those who resolved, resolution occurred between 1 and 32 months (median=5 months) after diagnosis. Resolution time was comparable between those with primary IH and secondary IH (7.75 ± 7.4 months and 7.35 ± 5.58 months respectively, p < 0.52). Resolution was slightly quicker in patients with surgical intervention (5.60 ± 2.88 months), but this was not statistically significant (p < 0.13).

Discussion: Resolution of papilledema occurred within 7 months in most cases irrespective of underlying cause or treatment.

Conclusion: Most papilledema in the pediatric population resolves with medical treatment of IH. Surgical intervention does not necessarily hasten time to resolution.

Decreased corneal biomechanical properties in children with osteogenesis imperfecta

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Introduction: Osteogenesis imperfecta (OI) is a genetic disease due to type I collagen defects. In adults, OI is associated with degenerative ocular pathologies, however, eye findings in children are not well-described.

Methods: A prospective, comparative, cross-sectional study of pediatric patients (2-19 years) diagnosed with OI. Thirteen patients with OI and four control patients underwent complete ophthalmic examinations. Additional tests included ocular response analyzer, pachymetry, axial length measurement, automated perimetry, and, retinal nerve fiber layer (RNFL) thickness. Statistically significant differences between OI and control groups were determined using independent-samples t test.

Results: We found significantly (p<0.05) decreased corneal hysteresis (8.2±1.4mmHg vs. 10.5±1.3), and central corneal thickness (CCT; 451.9 ± 29.1 m vs. 550.5±30.7 m) in OI patients compared to controls. There was no significant difference in corneal resistance factor (9.9±1.3 mmHg vs. 10.5 ±0.8 mmHg). None of these differences correlated with age, race, or gender. IOP corrected for corneal thickness and hysteresis was significantly higher in OI patients than controls (19.1 ± 3.0 mmHg vs. 13.7 ± 0.7 mmHg). There were no differences in keratometry, axial length and RNFL thickness in OI patients compared to controls.

Discussion: Strength, flexibility and organization of type-I-collagen are critical for corneal structure and function. In our study, we found that children with OI had decreased corneal hysteresis and CCT, which resulted in artificially low IOP readings. In adults, OI has been associated with primary open angle glaucoma and keratoconus.

Conclusion: Our findings suggest that in OI, alterations in corneal biomechanical properties are present at a young age and affected individuals should be routinely screened for glaucoma and corneal pathologies.
Genotype-Phenotype Correlation in Patients with Albinism

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Introduction: Oculocutaneous albinism causes vision loss, from legal blindness to mildly decreased vision. At least 5 genes are associated with non-syndromic albinism. Our study aims to determine mutation frequency and genotype-phenotype correlations.

Methods: IRB approved - retrospective chart review. All patients with albinism or nystagmus (183) in the pediatric genetic eye disease service from 1980-2015 were included.

Results: 48/183 had a clinical diagnosis of albinism. 31/48 had molecular genetic testing. Patients with genetic testing were more likely to have some pigment. Mutation(s) in an albinism gene were found in 22/31 (71%). 10 had mutations in OCA1, 9 in OCA2, 1 in OCA4 and 2 in OA1. 10 patients (32%) had the R402Q variant. 5 of these also had a single pathologic mutation in OCA1; one had homozygous pathologic mutations in OCA2. 4/10 had heterozygous R402Q without other mutations.

There was no statistically significant difference in vision between patients with OCA1 versus OCA2, or between patients with and without mutations. Patients with two mutations tended to have worse vision than those with one, but not statistically significantly.

Discussion: Genotype-phenotype correlation is not strong in albinism patients. In approximately 45% one mutation is found, and about 29% had no detectable mutations. R402Q was over represented in albinism patients (population carrier frequency 25%) and may be in linkage disequilibrium with an occult allele.

Conclusion: Most albinism patients had mutations in OCA1 and OCA2. Genetic testing may be helpful with diagnosis of patients with reduced, but not absent, pigment. Genetic subtype does not correlate strongly with visual acuity.


Structural changes following early childhood lensectomy and the risk for secondary glaucoma
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Introduction: The purpose of this study is to describe baseline characteristic changes of the anterior segment structures after childhood lensectomy. We hypothesize that structural variants may be predictors of aphakic or pseudophakic glaucoma.

Methods: For this prospective, nonrandomized study, 28 eyes in 23 children age 3 weeks to 5 years were enrolled. UBM images were collected on patients pre- and post-lensectomy. The fellow eye in most patients was used as controls and post-op aphakic and pseudophakics were grouped together. Children with congenital or early childhood cataracts were included. Exclusion criteria included pre-existing glaucoma, trauma, or any other anterior or posterior segment anomalies. UBM analyzed the cornea, anterior chamber, angle, iris, lens, and ciliary body structures. A total of 47 parameters were measured.

Results: Preliminary analysis on 5 of the 47 parameters in the pre-operative versus post-operative eyes demonstrate: anterior chamber depth (mm) 2.16 ± .79 vs 3.61 ± .36; trabeculo-Iris angle (degree) 35.88 ± 13.06 vs 52.68 ± 11.06; ciliary body area (mm2) 1.14 ± .26 vs 1.51 ± .36; maximum iris thickness (µm) 498.90 ± 111.04 vs 564.17 ± 88.32; and sulcus angle (degree) 26.65 ± 8.73 vs 27.47 ± 14.07. Based on this preliminary data, none of the structural anatomic changes measured thus far before and after lensectomy reached statistical significance.

Discussion: This is an ongoing study of structural predictors of aphakic and pseudophakic glaucoma. Completed data analysis of the remaining 42 parameters may demonstrate structural changes related to the development of secondary glaucoma.

Conclusion: Anterior segment anatomic changes can be demonstrated by UBM. Future studies will evaluate whether these changes can predict the risk for aphakic and pseudophakic glaucoma.

Cataract surgery in children with retinopathy of prematurity (ROP): surgical outcomes

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Introduction: Cataract development has been reported in association with ROP with and without treatment. The study aims to report outcomes of cataract surgery in children with ROP.

Methods: A retrospective review revealed 22 children who underwent cataract surgery of 2258 diagnosed with ROP, from January 2001 to December 2014, 22 (incidence 0.97%). Comprehensive data analysis was done.

Results: 28 eyes of 22 children were included, 14 boys and 8 girls. Mean age at cataract surgery was 15.76 months (range:2 months to 12 years). 15 eyes had cataract at presentation while 13 developed cataract after interventions. Most common grade of ROP was stage 4 (11 eyes). 19 eyes underwent retinal surgery, scleral buckle (1 eye), laser (3 eyes). 5 eyes showed spontaneous regression. Mean duration for development of cataract post-retinal surgery was 7.76 months (range 2-32 months). 9 eyes did not receive a primary intraocular lens (IOL). Intraoperative posterior capsular rupture occurred in 2 eyes. Postoperative complications included visual axis opacification (4), secondary glaucoma (2) and IOL capture (1). 7 eyes underwent resurgeries, which included membranectomy (4) and one each of secondary IOL implantation and retinal surgery. Postoperative visual acuity assessment was possible in 23 eyes, 11 had better than 20/200 vision.

Discussion: Results of IOL implantation in premature infants with or without ROP have been encouraging. We found promising results in children with ROP with complication rates similar to those reported in pediatric eyes without ROP.

Conclusion: Cataract surgery in eyes with ROP has favourable prognosis and primary IOL implantation has good surgical results.


Incidence and timing of ocular pathology in premature infants

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Introduction: We sought to determine the incidence and onset of ocular pathology in premature infants and define the duration of follow-up required before otherwise healthy children can be safely discharged from ophthalmologic care.

Methods: Retrospective consecutive cohort study of infants with gestational age (GA) <37 weeks and minimum 6 months follow-up. Outcomes were incidence and age at diagnosis of strabismus, nystagmus, and high (>4D) myopia or hyperopia.

Results: 1036 infants were studied (median GA 29 weeks (range 22-36), BW 1220g (380-3290), latest follow-up age 18 months (6-68)). 714 infants developed no ROP, 187 stage 1-2, 135 stage 3-5 or treatment. Pathology was seen in 22.5% (17% for ROP-0, 28% ROP-1-2, 44% ROP-3-Rx). 16.9% had strabismus, 6.4% nystagmus, 3.2% high myopia, 4.2% high hyperopia. Strabismus, nystagmus, and high myopia increased with ROP stage (p<0.001), reaching 30%,16%,17%, respectively, for ROP-3-Rx. Among infants with pathology, 41% were diagnosed <12 months age, 78% <24 months, 89% <36 months. Among 561 infants with visit between ages 6-12 months, these rates were 77%, 92%, 97%.

Discussion: While severe ROP requires lifelong surveillance for retinal sequela, even premature infants with no/mild ROP are at increased risk for eye disease. Limiting follow-up to 12 months of age, as recommended by many insurance carriers, results in underdiagnosis of visually-significant disease by 23% to 59%.

Conclusion: Eye examinations in premature infants should begin prior to 12 months of age and continue through 36 months of age to ensure timely diagnosis of visual pathology.
Time and Motion Study for Retinopathy of Prematurity Examinations
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Introduction: Retinopathy of prematurity (ROP) diagnosis and treatment is crucial for decreasing blindness. The examinations are resource intensive, but limited data are available on the professional time involved. We sought to determine the time effort required by healthcare personnel involved in ROP examinations.

Methods: Observational time and motion study of personnel involved in ROP diagnostic examinations at 4 NICUs, which had ophthalmologists practicing nearby, and 2 outpatient clinics over a 10-month period. Procedures were timed and standardized data collection forms used. Primary outcomes were overall and subtask times per infant examined.

Results: 303 inpatient and 37 outpatient examinations were timed. Mean(SD) inpatient ophthalmologist time was 14.0(7.7) minutes/infant, including 5.9(3.4) minutes exam time; 2.7(1.4) minutes documentation time, which was higher for electronic (3.3 min) versus paper records (1.2 min); 5.4(2.9) minutes travel, waiting, and counseling. Mean outpatient ophthalmologist time was 7.0(2.4) minutes/infant. Mean neonatal nursing time 15.2(7.9) minutes/infant. Mean outpatient technician time was 5.4(1.7) minutes/infant. Mean time spent by an ROP coordinator scheduling and ensuring compliance with inpatient and outpatient examinations was 21.9(8.0) minutes/examination.

Discussion: The personnel time required for ROP screening is significant, involving not only the actual physical examination, but also preparation (e.g., mydriatics, premedication, positioning, swaddling), waiting, documentation, and coordination (e.g., scheduling, interdepartmental communication, maintaining rounding lists, following missed examinations), by multiple staff members.

Conclusion: These personnel time data can guide resource allocation, including reimbursement, and enable more complete cost-effectiveness analysis of alternative ROP screening approaches, such as growth based predictive models and telemedicine.

Postnatal Serum Insulin-Like Growth Factor I and Retinopathy of Prematurity in Latin American Infants
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Introduction: In developed countries, low serum insulin-like-growth-factor 1 (IGF-1) and its surrogate, weight gain, are associated with retinopathy of prematurity (ROP). There are no IGF-1 studies from Latin America, where infants with severe ROP have higher gestational age (GA) and birthweight (BW). We sought to determine the relationship between IGF-1 and ROP in Mexico and Argentina.

Methods: Prospective cohort study in La Plata, Argentina, and Guadalajara, Mexico, of infants receiving ROP examinations. Filter paper IGF-1 measurements were performed weekly from birth until 40 weeks postmenstrual age (PMA) or hospital discharge.

Results: 112 infants (70 Guadalajara, 42 La Plata) were studied (median GA 33 weeks (range 25-37); median BW 1412g (range 620g-2390g)). 19 infants had severe ROP; 24 mild-moderate; 69 none. 588 IGF-1 levels were measured. For each individual PMA week from 29 to 39, there was no significant difference in IGF-1 between infants who did and did not develop ROP, nor among infants with no, mild-moderate, and severe ROP. Subgroup analysis for infants with GA <32 and >=32 weeks also did not show any significant associations.

Discussion: Low IGF-1 was not associated with ROP in Latin American infants. Excessive oxygen supplementation likely plays a more dominant role in ROP pathogenesis in these infants.

Conclusion: The lack of an association between IGF-1 and ROP in Latin America suggests growth-based predictive models would not be expected to work well in regions where more mature babies develop severe ROP. Such models require extensive testing before use in these settings.
Impact of Number and Quality of Retinal Images in a Telemedicine Screening Program for ROP: Results from the e-ROP Study

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Introduction: Telemedicine for the detection of retinopathy of prematurity (ROP) is becoming more common. However, obtaining multiple retinal images from an infant can be challenging. In this secondary analysis of data from the Telemedicine Approaches to Evaluating Acute-Phase Retinopathy of Prematurity (e-ROP) study, we evaluated the accuracy of detection of referral warranted ROP (RW-ROP) by trained readers when a full set of five retinal images could not be obtained.

Methods: 7905 image sets from 1257 infants in the e-ROP study were evaluated. Retinal location of images and image quality were recorded. Sensitivity and specificity of RW-ROP detection by trained readers were calculated by comparing findings in incomplete image sets to the findings on standard eye exam.

Results: The majority of image sets contained all 5 retinal images (92.8%). The disc center view was the image most likely to be present, and to be of acceptable image quality (96.8%). The nasal retina was the most difficult to obtain with acceptable image quality (83.4%). Sensitivity of detection of RW-ROP was 82.1% when 5 retinal images of acceptable quality were submitted for grading, 67.2% when 4 acceptable images were submitted, and 66.7% for 3 or fewer acceptable images (P=0.02), with corresponding specificity of 82.2%, 89.0% and 81.7% respectively (P<0.0001). Sensitivity was not increased with number of images when images of any quality were evaluated (P=0.74).

Discussion: The likelihood of detecting RW-ROP by telemedicine screening is decreased when a full set of retinal images is not obtained.

Conclusion: Acceptable image quality is needed to improve detection accuracy from retinal images.

References:

Spectral Domain Optical Coherence Tomography (SDOCT) Imaging of the Vascular-Avascular Junction in the Nursery in Infants with Retinopathy of Prematurity

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Introduction: Since the publication of Foos’s, there has been little additional microanatomic data on the vascular-avascular junction in retinopathy of prematurity (ROP) in infants. We hypothesize that one could view retinal development across the vascular-avascular (V-AV) junction in infants with ROP using portable bedside SDOCT imaging and novel image analysis.

Methods: Using a Bioptigen Envisu system, we examined inner retinal layer development in the temporal retina in infants with stage 1-4 ROP in Zone I or II. B-scans and custom three-dimensional reconstructions from SDOCT volumes were examined in: anterior avascular retina, retina and neovascularization at the V-AV junction and retina posterior to the junction.

Results: In 11 infant eyes, V-AV junction was imaged and it was readily determined from en face view using retinal vasculature projection. On B-scans, thin non-differentiated inner retinal layers were visible anterior to the junction with thickening typical of vanguard cells immediately anterior to V-AV junction. The inner retina differentiated posteriorly into nuclear and plexiform layers. Neovascularization was visible in custom 3D reconstructions. With larger neovascularization, feeding/draining retinal vasculature bulged into the vitreous reminiscent of plus disease on OCT (VASO). Inner retinal layers sometimes split, anterior to, beneath and posterior to neovascularization.

Discussion: It is possible to image and monitor at high resolution, the development of inner retinal layers at the vascular-avascular junction using non-contact bedside SDOCT imaging.

Conclusion: Imaging the vascular avascular junction with portable SDOCT at the bedside, provides a novel perspective on the earliest transitional changes in the developing retina and in ROP.

References:
Magnetic Resonance Imaging (MRI) Demonstrates That Extraocular Muscle (EOM) Volume Increases During Contraction
Robert A Clark  Joseph L Demer
Stein Eye Institute, University of California, Los Angeles, Los Angeles, CA

Introduction: It has been tacitly assumed that overall EOM volume is conserved during contraction and relaxation, yet this assumption is heretofore untested. We used high resolution MRI to determine if total EOM volume changes during relaxation and contraction.

Methods: Surface coil, quasi-coronal plane MRI was obtained in target-controlled extremes of secondary gaze in 30 orbits of 15 normal subjects at 0.312 mm resolution. Ductions were quantified by change in globe-optic nerve position. EOM cross-sections were manually outlined in contiguous image planes, then volumes were calculated by multiplying cross-sections by the 2-mm slice thickness. Three-dimensional reconstruction allowed measurement of the length of terminal, un-imaged EOM segments, providing estimates of terminal EOM partial volumes to be summed with measured partial volumes to obtain total EOM volumes.

Results: Duction range averaged 44.3±4.8° from relaxation to contraction. There was a significant increase in total volume in each rectus EOM from relaxation to contraction: superior rectus (SR) 92±36 mm³ (+18%, p<10⁻¹¹), inferior rectus (IR) 51±18 mm³ (+9%, p<10⁻¹¹), medial rectus (MR) 78±36 mm³ (+11%, p<10⁻⁴), and lateral rectus (LR) 47±45 mm³ (+7%, p=0.005).

Discussion: EOM volume increases during contraction, probably due to increased actin-myosin lattice spacing, so that density decreases. This effect is opposite that predicted from possible hemodynamic changes. Because volume change for SR and MR exceeds IR and LR, total rectus EOM volume increases in supraduction 41±42 mm³ (+3.7%) and in adduction 32±63 mm³ (+2.3%).

Conclusion: Total EOM volume is not conserved, increasing with contraction and decreasing with relaxation.


Magnetic Resonance Imaging (MRI) of Inferior Rectus (IR) Flap Tears
Tina G Damarjian MD Joseph L Demer MD, PhD
Jules Stein Eye Institute
200 Stein Plaza Driveway, Los Angeles, CA 90095

Introduction: Thus far, the only evidence for existence of flap tears in EOMs has been observations during surgical repair. This study employed MRI to investigate anatomy of flap tears of the IR.

Methods: Five adults (ages 25-68yr) who sustained trauma to the IR were studied prospectively using a 1.5 Tesla MRI scanner with surface coils and fixation targets. Sagittal and coronal T2 sequences were performed in upward, downward, and central gaze for each eye, permitting comparison with age matched controls.

Results: Patients exhibited infraduction limitation greatest in abduction, and incomitant ipsilateral hypertropia greatest in infraversion. All but one had associated orbital fractures. Three torn IRs exhibited a longitudinal fissure separating the orbital (OL) and global layers (GL), with avulsion of the GL from the sclera in one case, and avulsion of the OL from its pulley in two cases. Two involved IRs exhibited a longitudinal fissure separating medial portion of the GL that was attached to the sclera, from the avulsed lateral portion. All cases manifested extensive inferior orbital scarring. Surgical repair was possible in three cases.

Discussion: Blunt trauma may cause longitudinal tears in the IR having variable orientations: longitudinal separation of OL from GL, or disinsertion of only the lateral IR from sclera. Both diminish infraduction. Due to traumatic anatomic distortions and their posterior locations, these flap tears would be difficult to recognize surgically.

Conclusion: Longitudinal tears may selectively avulse one compartment of the IR, sparing the other, but both compromising infraducting function. Demonstration of this pathologic anatomy requires high resolution orbital imaging.

**Immunohistochemical analysis after bupivacaine injection in the rabbit extraocular muscle**

Luisa M Hopker MD Juliana Neves MS Daiane Nascimento MD Tomás S Mendonça MD Edmar Zanoteli MD, PhD Norma Allemann MD, PhD
Federal University of Sao Paulo, Brazil

**Introduction:** It has been demonstrated that Bupivacaine causes an increase in size and contractility when injected in extraocular muscles. This study aims to show the distribution of myosin subtypes after the effect of Bupivacaine on the extra ocular muscle of rabbits.

**Methods:** Forty rabbits were selected. Eight rabbits were controls. Thirty-two rabbits received 0.3 ml of Bupivacaine 1.5% in the superior rectus (SR) of right eye (OD) and were sacrificed at 7, 28, 60 and 92 days. SR of both eyes were excised and frozen. Immunohistochemistry was performed to analyze myosin types 1 (slow), 2 (fast) and embryonic. Cross sections of each muscle were analyzed for myosin count by manual tracing.

**Results:** When compared SR OD to SR OS there was no significant difference between type 1 and embryonic myosin proportion in none of the groups. Concerning type 2 myosin, there was an increase on the 7-day (0.64;0.48;p=0.01) and 60-day (0.66;0.36;p=0.01), but not on the 28-day (0.48;0.35;p=0.43) and 92-day (0.66;0.52;p=0.06). When compared injected SR OD to control SR OD for type 1, 2 and embryonic myosin there was no statistically significant difference in none of the groups except for 60-day group in which embryonic myosin (0.79;0.40;p=0.002) and type 1 myosin (0.56;0;p=0.001) were decreased.

**Discussion:** Bupivacaine, when injected in the SR of rabbit increases the proportion of type 2 myosin compared to the yoke muscle. It also decreases the embryonic and type 1 myosin at 60 days after injection.

**Conclusion:** The change in expression of myosin type 1, 2 and embryonic might play a role in the contractile properties of extra ocular muscles after Bupivacaine injection.

**References:**
Incidence and Pathophysiology of Inferior Oblique Overaction after Surgery for Unilateral Superior Oblique Palsy
Alaa S Bou Ghannam, MD; William P Madigan, MD; Mohannad Al-Sammarraie, MD; Helia Garcia, CO; Julie Conley, MD; Mohamad S Jaafar MD
Children’s National Medical Center
111 Michigan Avenue NW, Washington, DC, 20010

Introduction: Masked contralateral superior oblique paresis (MCSOP) occurs in a significant number of patients who had surgery for presumed unilateral superior oblique palsy (PUSOP). Clinical findings and possible etiologies have been identified to help diagnose MCSOP.

Methods: We retrospectively reviewed 102 patients with PUSOP, operated over 10 years, to further refine our clinical diagnosis and identify possible etiology of the acquired contralateral inferior oblique muscle overaction (ACIOOA).

Results: 72% of patients remained unilateral postoperatively and 28% developed ACIOOA. The median age of onset was 3.25 and 2 years respectively. Preoperatively, both groups showed the same percentage of anomalous head posture. However, among those who presented without anomalous head posture preoperatively, more patients developed ACIOOA (Straight Head: 21% vs AHP: 8% p=0.015). Median hypertropia in primary position was 10PD in unilateral cases vs 5PD in MCSOP (p=0.14). 14% of the ACIOOA showed bilateral excyclotorsion vs 3% in those who remained unilateral (p=0.003). There was no association between the type of muscle surgery (inferior oblique myectomy or recession) and the development of ACIOOA. The etiology of strabismus (congenital vs traumatic) did not vary between the 2 groups.

Discussion: The percentage of presumed MCSOP is higher in our series (median age at presentation 3 years) than previous studies (age > 30 years). Except for straight head posture and bilateral excyclotorsion, preoperatively, our study showed no real predictor of ACIOOA.

Conclusion: In spite of critical evaluation in young patients, a high percentage of PUSOP developed ACIOOA. The etiology was suspected to be mechanical in some.


Strabismus Due to Isolated Schwannoma Involving Extraocular Muscles
Fatma Yulek MD Joseph L Demer MD, PhD
Jules Stein Eye Institute and Department of Ophthalmology, UCLA
UCLA, Los Angeles, CA 90095-7002, USA

Introduction: Progressive acquired strabismus initially considered idiopathic may be caused by isolated cranial nerve schwannoma of motor nerves to the extraocular muscles detectable only by carefully directed imaging. Schwannomas have pathognomonic appearance on magnetic resonance imaging (MRI). We reviewed clinical experience of an imaging referral practice specializing in complex strabismus.

Methods: We reviewed 647 cases imaged for strabismus to identify presumed cranial nerve schwannomas, identified by gadodiamide-enhanced, high resolution surface coil orbital MRI, and thin section cranial MRI. Clinical features and management were correlated with MRI.

Results: Presumed schwannomas involving cranial nerves were identified as fusiform intraneural enlargements in 8 cases: One affecting superior oblique, two abducens and 5 oculomotor nerves. Involved muscles were atrophic. Both abducens, superior oblique but only one oculomotor schwannomas were subarachnoid; The others were intraorbital. Associated strabismus was progressive for 3-17 years. Abducens schwannoma caused esotropia. Intracranial oculomotor schwannoma caused mydriasis and exotropia. Intraorbital schwannomas caused exotropia with or without hypertropia. Since lesion diameters were 3-9 mm, 6 had been previously missed on routine MRI.

Discussion: Cranial nerve schwannomas underlie ~1% of strabismus cases. The oculomotor is more often involved than the abducens nerve. Most lesions are intraorbital, and typically missed by routine imaging, so that strabismus is typically regarded as idiopathic.

Conclusion: Progressive, acquired strabismus may be caused by isolated schwannomas of cranial nerves. Since most of these schwannomas are small and deep in the orbit, they should be suspected when extraocular muscles are atrophic and are identifiable only using high resolution MRI technique targeted to identify them.

**Comparison of postoperative vertical drift in patients with thyroid eye disease with hypotropia: Vertical rectus muscle recession vs. combined horizontal rectus muscle recession**

Bo Young Chun MD, PhD, Marcelle V Freire, Dean M Cestari MD
Massachusetts Eye and Ear Infirmary
Boston, USA

**Introduction:** To determine the postoperative vertical drift in thyroid eye disease (TED) patients with hypotropia who underwent vertical rectus recession alone and those with combined horizontal rectus recession.

**Methods:** A retrospective medical record review was done in 67 patients with TED who underwent strabismus surgery for hypotropia between 2006 and 2015. Group 1 had vertical rectus muscle recession only, while group 2 had vertical rectus muscle recession plus horizontal rectus muscle recession. Data collected included: age, preoperative and postoperative sensorimotor details in primary position, distance and near. The amount of postoperative vertical drift for each group was calculated and compared between group 1 and 2.

**Results:** Mean preoperative hypotropia were 24.2 ± 7.2 PD and 24.5 ± 6.6 PD for group 1 (n=9) and 2 (n=9), respectively (p>0.05). Mean vertical deviations on postoperative day 1 (POD 1) measurements were 0.3 ± 2.5 PD and -2.2 ± 6.2 PD and those of final measurements were -0.9 ± 4.5 PD and -8.0 ± 4.1 PD, respectively (p<0.05). Mean amount of postoperative vertical drift toward hypertropia were 1.2 PD and 6.8 PD, respectively (p<0.05).

**Discussion:** There was a statistically significant larger postoperative vertical drift in TED patients with hypotropia who had combined horizontal rectus recessions compared with those that had vertical rectus surgery alone.

**Conclusion:** We should be aware of this difference when planning surgery for hypotropia in patients with TED.

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**Strabismus measurements in adults before and after pupil dilation**

Sean Rivera  Kim Merrill  Anna Schweigert  Andrea Kramer  Jill Anderson  Mike Lee  Erick Bothun
University of Minnesota Department of Ophthalmology and Visual Neurosciences
Minneapolis, MN

**Introduction:** The goal of the study is to determine if pupil dilation affects strabismus measurements in adults, as this currently influences the exam sequence of standard clinical practice.

**Methods:** Adult patients with strabismus were enrolled in the study and had a standard strabismus exam (visual acuity, motility, stereopsis, ocular alignment with alternate prism cover test) by a certified orthoptist. Pupils were then dilated with phenylephrine 2.5% and tropicamide 1%. Next, ocular alignment was measured at distance in primary gaze, 1/3m and 1/3m with a +3.00 add by a different orthoptist, masked to the initial measurements. To determine if the change was significant, the measurements were compared to published values of test-retest variability(1,2).

**Results:** Fifty-six patients were enrolled, 12 with an exodeviation, 19 with an esodeviation, 19 with a hyperdeviation, 3 with a trochlear palsy, 4 with an abduscens palsy, and 11 with a mixed vertical/horizontal deviation. For horizontal measurements the mean change in prism diopters after dilation was 1.65 at distance (95% CI +/- 0.77, p=0.99), 4.33 at near (95% CI +/- 1.47, p=0.77), and 3.51 at near with +3.00 (95% CI +/- 1.17, p=0.95). For vertical measurements the change was less with 0.76 at distance (95% CI +/- 0.31, p=0.99), 1.33 at near (95% CI +/- 0.53, p=0.99), and 1.16 at near with +3.00 (95% CI +/- 0.67, p=0.99).

**Discussion:** Pupil dilation does not seem to affect strabismus measurements in adults and age and presbyopia likely play a role.

**Conclusion:** Pupil dilation does not need to influence the strabismus exam sequence in adults.

**References:**
Introduction: Although survivors of pediatric abusive head trauma (AHT) may endure a complicated recovery, the long-term visual sequelae are sparsely reported.

Methods: We queried billing records to identify all patients with AHT at Boston Children’s Hospital between 2005-2015. Data abstracted from the initial admission included retinal examination and systemic findings. Data abstracted from follow-up visits included visual acuity (VA), cycloplegic refractions, and incidence of ophthalmologic sequelae.

Results: For the entire cohort (N=101), mean age at injury was 6.2 months. The mean and median follow-up intervals were 2.5 and 3.9 (range 0-21.6) years, respectively. Findings on presentation included retinal hemorrhages in 84.8% and subdural hemorrhages in 94.4%. Ophthalmic sequelae included retinal detachment (5.9%), nystagmus (8.9%), strabismus (29.7%), and amblyopia (22.8%). For the cohort subset with greater than 5 years of follow-up (N=29), 65.5% had visual impairment in at least one eye defined as corrected Snellen acuity poorer than 20/40, 51.7% developed strabismus, 27.6% developed amblyopia, 20.7% developed nystagmus, 57.1% had greater than 1D of astigmatism, 42.9% had greater than 1D of myopia, and 50.0% had greater than 1D of hyperopia.

Discussion: AHT patients have ophthalmic sequelae that affect vision and binocularity long after the trauma is over. These findings are likely related to retinal injury, amblyopia, ametropia, and cortical impairment.

Conclusion: Long-term visual complications for AHT survivors require continual clinical monitoring and treatment; thus, even after hemorrhages have cleared, significant follow-up is critical to minimize further visual impairment and maximize function.

References:

The socioeconomic impact of patient no-shows and same day cancellations on a university based pediatric ophthalmology practice

Edward W Cheeseman MD Rupel H Trivedi MD Millicent M Peterseim MD Jeffrey Blice MD Kelly Unkrich MD
Medical University of South Carolina Charleston, SC

Introduction: Patient no-show and same day cancellation frequencies are an ongoing problem for many pediatric ophthalmology practices. This study places a dollar value on the economic losses that result from clinic vacancies in a university based practice due to a patient not presenting for a scheduled appointment, or cancelling the day of the appointment.

Methods: A retrospective review was completed of all patient scheduled appointments for the pediatric ophthalmology service at the Medical University of South Carolina between 1 July 2014 and 30 June 2015. Patient no-show or cancellations within 24 hours were calculated. Data was also collected on the patient insurance carrier. The numbers of lost work Relative Value Units (wRVU) were calculated. This total was then multiplied by the average collections per wRVU as determined from university revenue cycle data.

Results: 1026 cancellations within 24 hours and 1704 no show patients were tabulated over the one year period for a total of 2730 patients. Using an average of 1.8 wRVU’s per patient service and $71 per wRVU, as assigned by university revenue cycle operations, the total revenue loss for the period was $348,894. The largest no show and same day cancellation rates were found in the Medicaid population.

Discussion: No show and same day cancellations are a significant challenge in the pediatric ophthalmology population, particularly among Medicaid patients. Phone reminders, or reminder cards alone, do not seem to be adequate.

Conclusion: Patient no show and same day cancellations have a significant financial impact on a university based pediatric ophthalmology practice. Practical methods should be explored to dramatically lower these rates.
Computer simulation models for optimizing clinical workflow in pediatric ophthalmology

Leah G Reznick MD Michelle R Hribar PhD Sarah Read-Brown BA Thomas R Yackel MD
Michael F Chiang MD
Oregon Health & Science University - Casey Eye Institute, Portland, OR

Introduction: Pediatric ophthalmologists need to maximize clinical efficiency. This study demonstrates that timestamp data from EHRs may be applied to develop computer simulation models to identify scheduling templates which reduce patient wait times.

Methods: Clinical workflow was mapped for a single pediatric ophthalmologist (LGR). EHR databases and audit logs were used to identify timestamps that best correlated with clinical activities during one year (2558 patient visits, 496,301 timestamps). EHR timestamps were validated against manually-observed timings by trained observers during 89 patient visits. Data were used to develop computer simulation models (Arena; Rockwell, Wexford, PA) to evaluate different scheduling policies for minimizing wait time.

Results: EHR timestamp data were accurate within 3 minutes of manually-observed times in 95/146 (65%) clinical activities. Over one year, EHR timestamp data showed mean wait time was 35.9±26.0 minutes/patient. Computer simulation models optimized patient wait times by scheduling patients for the shortest visit times earlier and longer times later in a half day clinical session. This model reduced wait times from 35.9 to 15 minutes/patient. This optimized schedule was implemented (2 half-day clinic sessions, 23 patients), and decreased mean wait time to 25±17 minutes/patient (p=0.03).

Discussion: EHR timestamp data, coupled with computer simulation modeling, can produce tools for managing clinical workflow. Additionally, we have used simulations to determine optimal number of ancillary staff and exam rooms.

Conclusion: EHR timestamp data may be used to develop computer simulation models for testing alternative clinic configuration and scheduling policies, which have potential to improve efficiency of care delivery.

References:
### Poster Schedule

2nd Set of Hard Board Posters (28-55) Displayed from Friday, April 8, 4:15 PM - Sunday, April 10 10:35 AM

Ballroom C

Interactive Poster Session - Author Presentation and Q/A - Saturday, April 9, 10:00 - 11:00 AM

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**OPTIC NERVE**

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**GLAUCOMA**

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**OCULOPLASTICS**

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**NASOLACRIMAL DUCT**

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**STRABISMUS SURGERY**

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Incidence and risk factors of Cytomegalovirus (CMV) retinitis: Implications for screening

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Introduction: Cytomegalovirus (CMV) retinitis is a devastating ocular complication related to immunodeficient states. However, its incidence in the modern era is unknown. This study aims to evaluate the incidence and risk factors for developing CMV retinitis in order to develop a protocol for surveillance.

Methods: Charts of Boston Children’s Hospital patients who had a positive serum CMV PCR results were reviewed. Comorbidities, viral load, treatment regimens, eye exam findings, and morbidity were abstracted.

Results: One-hundred-and-twenty-five patients were identified to have had a positive serum CMV PCR during the past 5 years. Mean age at positive CMV PCR was 7.7 ± 6.6 years (6 days-19 years). Sixty-four were female, and 61 were male. Diagnoses included congenital CMV infection (N=15), congenital immunodeficiency (N=21) and hematologic malignancies (N=32); 58 had bone marrow transplants and 30 had solid organ transplants. Sixty-two had been examined by the ophthalmology team at Boston Children’s. Forty-three exams were without findings. Four patients had significant findings in the fundus in the setting of CMV viremia, and 14 patients had other findings unrelated to CMV. Eighteen patients died, and of those, 11 within 1 year of their first CMV PCR.

Discussion: This study provides pivotal information in identifying children at risk for developing ocular involvement in pediatric patients with CMV viremia.

Conclusion: As more children survive through severely immunodeficient states, visual complications that occur during these times can lead to long-term morbidity. An evidence-based screening protocol will standardize the evaluation of patients with CMV infections to optimize early identification and treatment of ocular involvement and ultimately limiting associated morbidity.

Bilateral multilayered retinal haemorrhages after a short distance accidental fall in an infant.

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Manchester, UK

Introduction: A witnessed accidental short distance fall in a 3 month old infant resulting in bilateral multi-layered retinal hemorrhages.

Methods: Case note review and RetCam images.

Results: A 3 month old infant accidentally fell from his mother’s arms in a nursery group, which was witnessed by several other adults. CT and MR scan showed subdural hemorrhage and parietal bone fracture. Fundal examination and Retcam imaging showed multiple bilateral intra-retinal and pre-retinal hemorrhages involving the posterior pole and mid-periphery. Skeletal survey and coagulation profile was normal.

Discussion: It is reported that retinal hemorrhages are virtually never seen in short distance falls (1); those that do occur are usually unilateral, located in the posterior pole and within a single retinal layer (2,3).

Conclusion: This case adds to a small series of witnessed short distance falls associated with subdural and retinal hemorrhages (2,3). It highlights the diagnostic dilemma between accidental and non-accidental head injury in infants and that multiple multilayered retinal hemorrhages can occur even in accidental short distance falls.

D-EYE: a portable and inexpensive option for fundus photography and videography in the pediatric population with telemedicine potential
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Introduction: Fundus photography is a frequently used and necessary modality for documenting and tracking retinal pathology. Conventional fundus cameras along with contact and non-contact wide-field digital imaging systems have drawbacks including cost, accessibility, and portability. Due to exam limitations, these options may not be feasible for many pediatric patients. The D-EYE smartphone attachment was studied as a potential alternative for fundus imaging in the pediatric population.

Methods: We used the D-EYE with an iPhone 6 to image pediatric patients in both outpatient and inpatient settings.

Results: A diverse range of fundus pathology was imaged with the D-EYE (examples include neuroretinitis, optic nerve edema/pallor/cupping/hypoplasia, retinal coloboma). The D-EYE smartphone app facilitated storage and printing of the photos as well as collaboration with other specialists. The D-EYE was easy to use with acceptable photos, although a somewhat limited field of view.

Discussion: The D-EYE was useful for efficiently capturing quality photos of the posterior pole in situations where standard fundus photography was impractical. The captured images were helpful for documentation, follow-up, education and discussion of complex cases with colleagues.

Conclusion: The D-EYE cannot compete with conventional fundus cameras and wide-field digital imaging systems in terms of image clarity or field of view. However, it may have a niche in situations when and where conventional fundus photography or wide field imaging are not an option. Additionally, smartphone imaging systems like the D-EYE may be clinically useful for non-ophthalmologists (general practitioners, pediatricians, emergency physicians, neurologists, etc) as well due to the significant potential for telemedicine consultation.

References:

Portable Non-Sedated Electroretinogram Evaluation of Children with Nystagmus in the Pediatric Ophthalmology Clinic
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Introduction: Childhood nystagmus is a condition frequently evaluated by pediatric ophthalmologists. In young children with nystagmus and anatomically normal eyes, an electroretinogram (ERG) under general anesthesia may be performed to determine if a hereditary retinal disease is present. Sedated ERG in young children is costly, time-consuming, unavailable to many clinicians, and carries the risk of general anesthesia. We evaluated a novel, FDA-approved form of a non-sedated, handheld ERG exam (RetEval™) as a screening tool for retinal dysfunction.

Methods: The cone flicker function of the RetEval™ was used to evaluate patients with nystagmus that presented to the Bascom Palmer Eye Institute pediatric ophthalmology clinic.

Results: Exams were performed on 30 patients with nystagmus, age range 6 months to 18 years (mean = 5 years). Exam time was less than one minute per eye. RetEval™ results were consistent with prior formal ERGs in patients with retinal disorders. Normal implicit times and amplitudes were observed in suspected congenital motor nystagmus, optic nerve hypoplasia, oculocutaneous albinism and functional vision loss.

Discussion: The RetEval™ cone flicker exam is easily and safely performed in the clinic setting on pediatric patients and our results indicate that it may be a good screening exam for children with nystagmus to determine if cone dysfunction is present.

Conclusion: Our findings suggest that the use of the RetEval™ in young children with nystagmus may decrease the frequency of pediatric sedated ERGs or delay them until sedation is no longer required. Further study is needed to develop a normative database for the device.
The Effect of Enucleation on Orbital Growth in Patients with Retinoblastoma

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Introduction: Retinoblastoma is the most common intraocular tumor in childhood. Treatment advances have included intra-arterial chemotherapy, though enucleation is still standard of care for advanced disease. Enucleation has known implications on orbital growth, though the temporal associations between age of enucleation, orbital growth, and other confounders such as radiation are not well understood. The aim of this study was to measure orbital volume over time using serial Magnetic resonance imaging (MRI) scans to determine the effect of baseline patient factors on orbital growth.

Methods: Retrospective chart review of all patients who underwent unilateral enucleation for retinoblastoma at a large academic center since 2004 and had at least 2 MRIs. Orbital asymmetry was calculated using MRI measurements. Co-variates for analysis included use of adjuvant radiation and patient’s age at enucleation.

Results: Of the 41 children that underwent enucleation with an orbital implant, 27 met inclusion criteria. 55% were males. Mean age at time of enucleation was 2 years (range 2.5 months – 5 years). Mean number of MRI scans per patient was 9 (range 2 – 25), with 4.3 years between first and last scans (range 0.5 – 8.5 years). Average orbital asymmetry prior to enucleation was 0.80±5% and after was 16.10±7% (p=0.00).

Discussion: Enucleation, even in the presence of an implant, leads to a significant difference in orbital asymmetry over time.

Conclusion: Orbital volume is abnormally affected in children following unilateral enucleation for the treatment of retinoblastoma and MRI can precisely quantify the asymmetry that develops on serial scans.

Detection of Optic Disc Drusen in Children Using B scan through the lens and avoiding the lens

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Introduction: To assess if the detection rate of optic disc drusen in swollen optic discs in children varies if the B scan is performed through the lens or avoiding the lens. 

Methods: Retrospective review of the US machine database for all the patients who underwent Ultrasound for swollen discs in the Dept. of Pediatric Ophthalmology, Children’s Hospital of Pittsburgh. Only the patients who had fundus pictures and B scan performed through and avoiding the lens were included in the study.

Results: A total of 31 patients (62 eyes ) were included in the study. B scan detected optic disc drusen in 43.5% of the eyes . In 81.5% of these eyes, the drusen were not detected initially when the scanning was done through the lens but were detected on avoiding the lens. 10 out 16(62.5%) patients with no drusen on Ultrasound ,had an identifiable cause for disc elevation.

Discussion: B scan is a sensitive diagnostic tool for detecting a drusen .The rate of detection of the drusen is increased when the B scan is done avoiding the lens especially in a pediatric age group where the drusen are usually buried and not as calcified as those found in adults .Under such circumstances the reduced echogencity is absorbed by the more ultrasound absorbent pediatric lens ,thus limiting the detection rates when scanning through the lens.

Conclusion: Although various studies have reported that B scan being not as sensitive as OCT especially in buried drusen 50 ,however B Scan is an indispensable and could be the only tools in pediatric age group where the cooperation for other tests is limited. Thus, it is crucial to maximize the information obtained in a shorter time frame available for testing. The technique of avoiding the lens can increase the rate of drusen detection.
**Characterization of Optic Nerve Structure and Function in Pediatric Glaucoma and Non-Glaucomatous Optic Atrophy**

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**Introduction:** We aim to correlate optic nerve ganglion cell structure (via peripapillary retinal nerve fiber layer (pRNFL)) with function (via vision and visual fields) in children with glaucoma and non-glaucomatous optic atrophy (NGOA).

**Methods:** This retrospective study included children age<18 years with either glaucoma or NGOA, with Spectralis Spectral-Domain Optical Coherence Tomography (SD-OCT, Heidelberg, Germany) and reliable Humphrey visual fields (HVF, 24-2 SITA fast Carl Zeiss-Meditec Inc., Dublin, CA). Vision, HVF-mean deviation (MD), and pRNFL were studied. Excluded were eyes with retinal changes.

**Results:** Included were 74 eyes (74 children), 34 with NGOA and 40 with glaucoma. Despite equivalent mean LogMar Vision (NGOA=0.23±0.32 vs. Glaucoma=0.18±0.3, p=0.5) and HVF-MD (NGOA=-9.9±6.5 vs. Glaucoma=-8.4±7.6, p=0.37) between the two groups, eyes with NGOA had thinner average, nasal, and temporal pRNFL compared to glaucoma (average=67.3±26.6 vs. 79.2±21.0µm, p=0.036; nasal=49.7±25.6 vs. 64.9±18.9µm, p=0.026; temporal=42.3±17.7 vs. 66.8±16.8µm, p<0.0001 respectively). In NGOA, there was a possible trend for correlation between pRNFL and vision (R²=0.11, p=0.065) but not with HVF-MD (R²=0.76). In glaucoma, there was no correlation between pRNFL and vision (R²=0.02, p=0.36) but there was a correlation with pRNFL and HVF-MD (R²=0.27, p=0.006).

**Discussion:** Despite a significantly thinner pRNFL, the NGOA group performed equally to the glaucoma group in terms of HVF and vision.

**Conclusion:** HVF-MD correlates well with pRNFL in eyes with pediatric glaucoma but not in pediatric NGOA. Studies investigating the mechanism of injury to ganglion cells in each respective disease may help elucidate the cause for this difference.

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**The Use of Ocular Coherence Tomography (OCT) for Evaluating Glaucoma Suspect Patients**

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Children’s Hospital, Los Angeles, California; Children’s Eye Institute, Upland, California

**Introduction:** The diagnosis of glaucoma can be problematic in children with prominent optic nerve cupping. The evaluation of the Retinal Nerve Fiber Layer (NFL) has become part of the standard of care to diagnose and document glaucoma and its progression. The use of the Ocular Coherence Tomography (OCT), is invaluable in children.

**Methods:** we did a retrospective chart review of all pediatric patients having undergone an OCT with the Heidelberg Spectralis OCT in the preceding 6 months. Those evaluated for glaucoma suspect (Large cupping, assymetric cupping and ocular hypertension) are reported herein.

**Results:** A total of 79 patients were evaluated for glaucoma suspect. 70 presented for large or assymetric cupping, two for large cupping and ocular hypertension, and seven for ocular hypertension alone. For the 70 patients with cupping alone 31 were for the initial nerve fiber layer study, and 39 were for follow up (range 1-5 years, average 2.1 yrs). Of the 70 with cupping, 65 had normal NFL’s, and/or no nerve fiber progression. Five of the cupping patients had suspicious thinning of the NFL, one was on plaquenile for lupus, one was found to have a microadenoma. The other three suspicious exams had borderline thinning of the NFL on initial exam, of which two have had no change on repeat exam at 1 year. All will need to be followed for progression. Of the two patients with ocular HTN and cupping, both had normal NFL’s without change over 2.5 years. There were seven patients in the ocular HTN group alone. Two patients had borderline NFL thinning on initial exam despite no significant cupping. One of these has had a repeat exam which showed no change at 1 year. The remaining five exams were normal. Two were initial exams. The other three all had a 1 yr follow up without NFL change. All patients will need to be followed closely for progression.

**Discussion:** The inability to diagnosis physiologic optic nerve cupping from glaucoma can result in NFL loss, or prolong use of unneeded glaucoma medicines. This study shows that the majority of children with optic nerve cupping or ocular hypertension do not have abnormal nerve fiber layers or current evidence of glaucoma.

**Conclusion:** The OCT can be very helpful, documenting NFL status, especially in those who may have equivocal intraocular pressures or unable to do visual fields.

Long-term home monitoring of intraocular pressure in pediatric glaucoma: insights into diurnal fluctuation and the effect of improved aqueous outflow
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Introduction: Diurnal intraocular pressure (IOP) fluctuation, implicated in glaucoma progression, can inform disease management. Diurnal IOP variation has been reported in pediatric glaucoma from office and short-term home-monitoring, made feasible using Icare rebound tonometry. Reports of long-term diurnal IOP patterns and response to treatment are nonetheless lacking. Purpose: study of long-term patterns of IOP fluctuation and changes resulting from outflow-enhancing intervention in pediatric glaucoma.

Methods: Ongoing prospective study of parent-measured home-based Icare rebound tonometry (Icare,Finland Oy) in pediatric glaucoma cases with suspected IOP fluctuation. IOP was home-monitored for >1 month, with requested ≥3x/day measurements. Data are mean±SD unless stated.

Results: Enrolled to date: 7 children(14 eyes), mean age 8.2±2.1yrs, with IOP data now available in 8 eyes, measured over mean 98.5 days(range 30-227). Mean IOP readings ranged from 12.3-32.8mmHg; median daily IOP fluctuation ranged from 2-17mmHg. Three eyes underwent outflow improvement (trabeculotomy[1], initiated prostaglandin[2]) during home monitoring: mean IOP decreased 11.5mmHg, with range of decrease in median daily fluctuation from 4.5-15 mmHg. An IOP reading ≥20% greater than mean for an individual eye(“spike”) occurred in 18% of all measurements: probability of finding a “spike” over a 3-, 7-, and 14-day IOP monitoring period was 64.3%, 84.8%, and 95.1%, respectively, with median #2(1-6) IOP measurements per day.

Discussion: Home monitoring in pediatric glaucoma demonstrated large IOP fluctuations. Spikes usually occurred within a 7-day home-monitoring period. Mean IOP and IOP fluctuations improved with outflow-enhancing intervention.

Conclusion: Long-term home IOP monitoring is feasible, and even with few daily measurements, likely to identify an IOP spike over 7 days.


Primary congenital glaucoma vs. glaucoma following congenital cataract surgery: comparative clinical features and long-term outcomes
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Introduction: Primary congenital glaucoma (PCG) and secondarly glaucoma following congenital cataract surgery (GFCS) constitute the two most common types of pediatric glaucoma. This study reports and compares visual and glaucoma outcomes in PCG vs. GFCS.

Methods: Retrospective review of 130 pediatric glaucoma patients (age 0-18 yrs) treated at XXX by one clinician with >/=2-year follow-up. Glaucoma was defined by the Infant Aphakia Treatment Study criteria. Primary study outcome was Snellen-equivalent logmar visual acuity (VA), with secondary outcome as status of glaucoma control in worst-affected eyes. Asymptotic Wilcoxon Mann-Whitney rank sum tests were employed to compare glaucoma subgroups.

Results: Included were 74 PCG and 56 GFCS cases, with mean follow-up time 7.4 and 8.0 years, respectively. PCG showed better median VA at last follow-up: 20/60 (PCG) vs 20/400 (GFCS, p<0.0001). The following variables characterized the PCG and GFCS group’s glaucoma status, respectively: mean age at diagnosis: 0.70±1.3 vs. 3.3±3.5yrs, p<0.0001); mean IOP and #glaucoma medications at last follow-up: 16.0 vs. 19.3 mmHg (p=0.037); 1.5 vs. 2.5 medications (p<0.0001); mean #glaucoma surgeries: 1.49 vs. 1.48 (p=0.87); #LP/NLP: 7 vs. 10 eyes.

Discussion: In their worst-affected eye, children with PCG (vs. those with GFCS) presented earlier, had better vision, required fewer medications and glaucoma surgeries to control disease, and had lower IOP at last follow-up; blindness rates were similar.

Conclusion: In this long-term study of children with PCG and GFCS treated at one tertiary-care center, worst-affected eyes with PCG had overall better visual outcomes and better glaucoma control than those with GFCS.

Illuminated Microcatheter-assisted 360-degree Trabeculotomy for Medically-refractory Glaucoma Following Cataract Surgery and Juvenile Open Angle Glaucoma: Intermediate Follow-up
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Introduction: While angle surgeries, including illuminated microcatheter-assisted 360-trabeculotomy (360-trabeculotomy), show good success in primary congenital glaucoma, reported success in glaucoma following cataract surgery (GFCS) and juvenile open angle glaucoma (JOAG) is variable and with relatively short follow-up. Purpose: to evaluate longer-term outcomes of 360-trabeculotomy for medically-refractory GFCS and JOAG.

Methods: Retrospective review of consecutive patients with GFCS and JOAG who underwent 360-trabeculotomy from 2/2008-6/2015 using the iTrack catheter (Iscience Interventional, Menlo Park, CA) in a single-surgeon pediatric glaucoma practice. Success definition: IOP<22mmHg and 20% reduction without additional glaucoma surgery or devastating complication. Baseline characteristics, f/u time (to failure or last visit), surgical details, final intraocular pressure (IOP), and complications were recorded.

Results: Thirty-six eyes (36 participants) were included: 26 GFCS and 10 JOAG (mean age at diagnosis 3.4 vs. 14.2 years, respectively, p<0.001). Eight eyes (22%) had incomplete cannulation of Schlemm canal (<270 degrees), requiring completion with goniotomy or trabeculotomy. Success for GFCS versus JOAG was 17/26 (65%) and 6/10 (60%) eyes at mean f/u 2.5±2.2 versus 2.2±1.6 years, respectively. IOP (pre- vs. post- 360-trabeculotomy) was significantly reduced for both GFCS and JOAG (31.3±7.3 vs. 19.8±8.1 mmHg, p<0.001; and 29.5±10.3 vs. 15.8±6.6, p=0.003, respectively). Fewer glaucoma medications were needed after surgery (p=0.01).

Complications (all but two spontaneously resolving) included: choroidal effusion (1 GFCS), vitreous hemorrhage (3 GFCS, 2 required surgical intervention), and hyphema (1 GFCS, 2 JOAG). Kaplan-Meier success (GFCS+JOAG) at 1-, 3-, and 5-years was 76.9%, 65.8% and 54.8%.

Discussion/Conclusion: Illuminated micro-catheter assisted 360-trabeculotomy is a useful, low-risk initial surgical treatment for both medically-refractory GFCS and JOAG.

References:

Long-term efficacy of endoscopic cyclophotocoagulation in the management of aphakic and pseudophakic glaucoma in children
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Introduction: Endoscopic cyclophotocoagulation (ECP) has been effective in the management of a variety of difficult pediatric and adult glaucomas. This study reports long-term efficacy and safety of ECP in pediatric aphakic and pseudophakic glaucoma.

Methods: ECP was performed on 40 eyes of 28 patients under 16 years of age with aphakic or pseudophakic glaucoma. Patients were followed for a minimum of 12 months. Treatment failure was defined as postoperative intraocular pressure (IOP) of >24 mm Hg, IOP lowering of less than 15%, or occurrence of visually significant complications.

Results: Success rate was 50.0% (20/40), with 62% receiving one treatment only. Pre-treatment IOP averaged 34.4 ± 8.2 mmHg. Average total arc of treatment was 284°. Final IOP after mean follow-up period of 6.6 years was 19.3 ± 8.6 (p <0.001). Patients with single ECP demonstrated significant improvement in visual acuity from baseline to most recent follow up.

Discussion: ECP is successful in the majority of patients who receive a single procedure. Risk factors for treatment failure include elevated IOP at first measurement following cataract extraction, at time of diagnosis of glaucoma, and baseline prior to ECP; increased patient age at time of ECP; and increased time between cataract extraction and ECP. Hypotony was not encountered.

Conclusion: Analysis of longitudinal IOP and visual acuity data demonstrates that ECP remains a successful tool in the treatment of aphakic and pseudophakic glaucoma, with a low rate of visually significant complications. Unlike previous studies, failure was not increased in pseudophakic patients relative to aphakic patients.
Corneal Endothelial Cell Density in Early Childhood

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Introduction: The aim of our study was to measure corneal endothelial cell density (ECD) in the normal eyes of children under 5 years of age.

Methods: Specular microscopy was performed using a validated protocol either during examination under anesthesia or a clinic visit. Endothelial cell density was calculated using the center technique. Corneal diameter was recorded in children under 2 years old. A quadratic linear fit model was used to describe the relationship between ECD and age. Pearson correlation served to assess the correlation between age and ECD and between changes in corneal diameter and ECD.

Results: One hundred and eighteen eyes of 118 patients under 5 years of age were included in the study. Mean patient age was 2.6±1.4 years (range 0.1–5 years) and mean ECD was 3746±370 cells/mm2 (range 3145–5013 cells/mm2). Mean corneal diameter was 11.85±0.57 mm (range 10.50–12.75 mm) in 41 patients. Up to 2 years of age, ECD was inversely correlated with corneal diameter (r= -0.61; p<0.0001) more than with age (r= -0.38, p = 0.01). In contrast, after the age of 2, ECD was inversely correlated with age (r=-0.24, p=0.04) more than with corneal diameter (r=-0.24, p=0.2). The mean ECD decrease from birth to 5 years of age was 2.4% a year.

Discussion: The initial rapid decline in ECD in the first 2 years of life is most likely related to corneal growth and not cell loss.

Conclusion: This finding will be important for gauging the effect of cataract surgery on the corneal endothelium in children.

Predictors of poor visual outcome in children with open globe injury

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Introduction: Visual prognostic factors after open globe injury have been studied in adults, however relatively little is known about these factors in children. This study aims to identify risk factors for poor visual outcome in children after open globe injury.

Methods: Charts of all patients (59 eyes of 58 patients) who presented to Children’s Medical Center of Dallas for open globe injury between June 1, 2009 and June 30, 2013 were reviewed. Only patients with greater than 30 days follow-up were included in the study. Data collection included patient demographics, mechanism of injury, presenting visual acuity, ophthalmological exam details, management details, post-operative outcomes, and length of follow-up.

Results: Out of 59 cases of open globe injury, 6 were excluded due to insufficient chart data, and 2 were excluded due to inadequate follow-up time. Variables found to be predictive of poor visual outcome (<20/200) were poor presenting visual acuity (P=0.034), ocular trauma classification of 2 or 3 (P=0.002), injury with a blunt object (P=0.006), presence of an afferent pupillary defect (P=0.008), hyphema (P=0.0002), vitreous hemorrhage (P=0.0001), retinal detachment (P=0.043), and need for multiple surgeries (P=0.0001). Patient age, laterality of injury, and eyelid laceration were not found to be associated with visual outcome.

Discussion: Risk factors for poor visual acuity in children with open globe injury are poor presenting visual acuity, high ocular trauma classification score, blunt injury, afferent pupillary defect, intraocular hemorrhage, retinal detachment, and need for multiple surgeries.

Conclusion: Knowledge of these visual prognosticators can be used in counseling patients and determining appropriate management.
Outcomes of amniotic membrane transplantation for treatment of Stevens-Johnson syndrome in the pediatric population: A retrospective review

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Introduction: Early amniotic membrane transplant (AMT) during acute Stevens-Johnson syndrome (SJS) is an effective treatment for prevention of devastating chronic ocular sequelae. We characterized the outcomes of pediatric patients with acute SJS treated with AMT.

Methods: A retrospective study was conducted on 25 patients <18 years old (50 eyes) with acute SJS and moderate to severe ocular involvement treated with AMT. Time from the symptom onset to surgery, number of AMT surgeries, type of AMT surgery, and adverse outcomes were recorded. Data were analyzed using univariate analysis.

Results: 68% of eyes had no ocular sequelae following AMT for acute SJS. In the 16 (32%) eyes with an adverse outcome, median time between symptom onset to surgery was 6 days (range 3-10). In those eyes with an adverse outcome, 9% had decreased visual acuity (<20/30), 8% had symblepharon, 6% had lid malposition, 4% had moderate conjunctival scarring, 4% had moderate dry eye, 8% had photophobia and 8% had distichiasis or trichiasis. There was a trend between increased incidence of adverse outcomes and number of surgeries (OR = 9.6, p=0.07).

Discussion: In the pediatric population, the incidence of adverse outcomes is similar to those previously reported in adults. The majority of eyes had no adverse outcomes following AMT for acute SJS.

Conclusion: AMT continues to be a promising ocular treatment for acute SJS in children. Further research of this population may be able to define an optimal timeframe for AMT to prevent chronic ocular sequelae.


Visual Evoked Potential (VEP) Testing and Craniofacial Synostosis (CS): Results in 67 Patients

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Introduction: Craniosynostosis (CS) can be associated with afferent visual pathway damage from the retina to the visual cortex. We therefore have incorporated VEP testing as part of our routine evaluation of CS patients since 2013.

Methods: IRB approved prospective database collection of comprehensive craniofacial team evaluation (clinical, radiological) and LKC Technologies ETAS®, ISCEV standard, VEP testing under monocular conditions.

Results: Between November 2013 and August 2015, 67 children (66% male), age range 0.08-15.4 yrs (mean: 3.00 yrs) have been recruited. 17 (25%) patients had clinical, radiological or electrophysiological evidence of afferent pathway abnormalities (abnormal VEP, clinical vision loss or retinal, optic nerve or neuroimaging abnormalities of their visual pathway). Qualitative analysis of VEP data showed that 9 (13%) of patients had abnormal responses. Of the 54 patients who had neuroimaging, 6 (11%) demonstrated abnormalities of the afferent visual system.

Discussion: There was a poor correlation between those patients with clinical and/or neuroimaging abnormalities and qualitatively abnormal VEP’s. VEP quantitative (absolute latency, amplitude and breadth of N1, P1, N2, P2 waveforms) may be a more useful diagnostic tool for early detection of visual compromises in these patients.

Conclusion: These results suggest that qualitatively abnormal VEP patterns do not always reflect clinical abnormalities and may not be helpful in interventional decision making in patients with craniosynostosis. We are currently performing more quantitative analysis of the VEP response in patients with craniosynostosis with the hypothesis that those data may be more clinically useful.
Conservative Management of Lower Lid Epiblepharon in Children

Kathryn H Williams  John W Simon  Jitka L Zobal-Ratner  Gerard P Barry
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Introduction: Although much literature has focused on various techniques to repair epiblepharon, no study has addressed how frequently surgical intervention is required.

Methods: We tabulated data from all patients seen with epiblepharon over the past 15 years.

Results: Eighty-nine patients were included, 61 (69%) with tearing, discharge, conjunctival injection, or eye rubbing. Trichiasis was present in 15 cases (17%), 6 (7%) with corneal staining.

In all cases, our initial treatment was conservative, with antibiotic ointment or tear substitutes in 73 cases with trichiasis, symptoms of irritation, or corneal changes and observation in the remaining 16. Three children (3%) were referred for eyelid surgery because of persistent symptoms. No patient had corneal scarring or long-term complications.

Discussion: Although vision-threatening complications can result, a trial of topical antibiotic ointment and/or ocular lubricants was effective in nearly all our patients. Most resolved with minimal symptoms. The few eventually requiring eyelid surgery suffered no long-term complications.

Conclusion: We recommend a trial of conservative treatment before eyelid surgery is undertaken.

Risk of complications and ptosis recurrence by suture material in pediatric frontalis sling surgery

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Introduction: Ptosis in the pediatric population is a preventable cause of visual impairment. In patients with poor levator function, ptosis may be corrected with frontalis sling. Several synthetic suture materials are used, including nylon monofilament (Supramid) and polytetrafluoroethylene (PTFE). We hypothesized that the risk of recurrence and complications will vary based upon suture material used.

Methods: A retrospective chart review identified 65 eyes undergoing frontalis sling by a single surgeon (L.R.) using a single surgical technique. Patients had congenital myogenic ptosis and at least 6 months follow-up. Any patient with previous lid surgery or ptosis of any other etiology was excluded.

Results: Comparison of suture materials for both early and late sling failure showed no statistical difference. However late failures (>6 months) demonstrated a trend towards increased failure with nylon suture. There was a trend towards increased complications in the PTFE group (p<0.10). This might be age dependent, as patients in the PTFE group who developed early failure were significantly younger at the time of operation than those who did not (p = 0.03).

Discussion: Nylon monofilament for frontalis sling has a relatively high rate of ptosis recurrence whereas PTFE has better longevity but increased risk of inflammatory and infectious complications. The early complications of PTFE, however, appear to be age dependent.

Conclusion: There is a trend towards increased late recurrence for nylon monofilament slings as compared to PTFE. The PTFE suture may have a higher rate of early infectious and inflammatory complications, but this difference may be also a result of younger age.
Simultaneous versus sequential ptosis and strabismus surgery in children
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Introduction: Coincident strabismus and ptosis are often addressed with separate surgeries, which increases anesthesia exposures. Advantages of a staged approach have not been clearly established. We sought to compare clinical outcomes of simultaneous versus sequential ptosis surgery and strabismus surgery in children.

Methods: Retrospective cohort study of children requiring ptosis and strabismus surgery on same eye. Outcomes were ptosis success (MRD1 \(\geq 2\) mm, good lid contour, good lid crease); strabismus success (alignment \(<10\) PD of orthophoria for comitant strabismus, improvement in head position or alignment for incomitant strabismus); surgical complications; reoperations.

Results: Of 56 children studied (mean age 64 months (range 1-260), mean follow-up 27 months (3-112)), 38 had simultaneous surgery, 18 sequential. Strabismus surgery was performed first in all simultaneous and 6/18 sequential cases. 75% had congenital ptosis; 64% comitant strabismus. Ptosis surgery was 59% frontalis sling, 30% fasaneilla servat. There were no significant differences between simultaneous and sequential groups for surgical success, complications, or reoperations: lid height-84%/89%; lid contour-84%/94%; lid crease-90%/100%; strabismus-87%/78%; ptosis complications-8%/17%; strabismus complications-8%/0%; ptosis reoperation-18%/17%; strabismus reoperation-16%/6% (\(p>0.28\) for all outcomes, Fisher exact).

Discussion: This is the first comparative study of simultaneous versus sequential ptosis and strabismus surgery in children. There was no clinical advantage for sequential surgery. Despite a theoretical risk of increased complications, particularly with internal ptosis repair and strabismus procedures involving a superior muscle, no increased risk was seen.

Conclusion: Performing ptosis and strabismus surgery together appears to be clinically effective, safe and reduces anesthesia exposure during childhood.

The Presentation, Clinical Features, Complications and Treatment of Congenital Dacryocystocele
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Introduction: Congenital dacryocystocele is a rare presentation in neonates. Epidemiological data on the incidence, complications and treatment of congenital dacryocystoceles in the UK is currently incomplete. It may be complicated by dacryocystitis and respiratory compromise. The treatment is controversial. Uncomplicated dacryocystoceles may resolve spontaneously however the reported proportion that resolve or become inflamed varies. This study aims to determine the number of incident cases of congenital dacryocystoceles, their presentation, complications, treatment and outcome of cases presenting in the UK.

Methods: This is a 12 month prospective observational study of incident cases of congenital dacryocystocele and its complications. Incident cases are ascertained in the UK reported through the British ophthalmological surveillance unit reporting system. An initial questionnaire is sent to the reporting ophthalmologist with a follow up questionnaire at 6 months.

Results: There were 43 cases reported with a response rate of 79% to the initial questionnaire. This gives an incidence of 1:18,000. The mean age of diagnosis was 17.4 days. They were predominantly unilateral and 50% were male; 40% are complicated with dacryocystitis and 100% have intra-nasal cysts when endoscopy was performed. There were 20% who showed signs of respiratory compromise. A total of 85% of cases were treated with either conservative or medical management alone. The mean time to resolution was 20.3 days.

Discussion: The majority of cases were treated conservatively. Significant proportions are complicated with dacryocystitis and all cases where endoscopy was performed had evidence of intranasal extension.

Conclusion: This study provides important epidemiological data on congenital dacryocystoceles and its complications.

**A Population-Based Study of Congenital Nasolacrimal Duct Obstruction**

Saraniya Sathiamoorthi  Brian Mohney Dr. Ryan D. Frank  
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**Introduction:** The purpose of this study was to describe the incidence, clinical characteristics and natural history of congenital nasolacrimal duct obstruction (CNLDO) in a population-based cohort of children.

**Methods:** The medical records of all pediatric patients (<5 years) residing in a defined population who were diagnosed with CNLDO from January 1, 1995, through December 31, 2000, were retrospectively reviewed.

**Results:** A total of 1015 children were diagnosed with CNLDO during the 6-year period, yielding a birth prevalence of 9.8% or 1 in 11 births. The mean age at diagnosis was 15.3 weeks (range, birth to 60 months) and 520 (51.2%) were male. Eight hundred sixty-seven (85.4%) spontaneously resolved by a mean age of 5.0 months (range, 1 week to 65 months), and 8 were lost to follow-up. Among the remaining 140 (13.8%) patients who were examined by an ophthalmologist, the cycloplegic refractive error was measured in 107 (76.4%), of which 8 (7.5%) had anisometropia of 1.00 or more diopters.

**Discussion:** The incidence of CNLDO in this cohort was less than most prior reports, none of which were population-based. However, the rates of spontaneous resolution and anisometropia are similar to recent published findings.

**Conclusion:** In this population-based cohort of children, CNLDO occurred in 1 in 11 live births with no gender predilection. Approximately 4 of 5 patients experienced a resolution of their symptoms by one year of age. Anisometropia was observed in 7.5% of those that underwent a cycloplegic refraction.

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**Evaluating The Effectiveness Of Peri-operative Use Of Intravenous Dexamethasone In The Success Of Management Of Congenital Nasolacrimal Duct Obstruction With Balloon Dacryoplasty**

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Houston, Texas

**Introduction:** We evaluated the effect of peri-operative use of intravenous dexamethasone, presumed to reduce postoperative nasolacrimal duct mucosal edema, in the success of management of congenital nasolacrimal duct obstruction (NLDO) with balloon dacryoplasty.

**Methods:** Seventy four patients treated for NLDO with balloon dacryoplasty were included in this study. Infants that had less than 3 month of follow up, genetic diseases, prior NLDO surgeries, or anomalous NLD system were excluded. In 71 eyes of 61 patients IV dexamethasone was used, peri-operatively, at a dose of 0.50 mg/kg. In 18 eyes of 13 patients dexamethasone was not used, peri-operatively, and they were used as a control. Surgery was considered successful if there was no tearing or mucus discharge one month after surgery.

**Results:** The mean age at treatment was 23.3± 15.6 months for the steroid treated group and was 22.5± 14.9 for the control group, with no difference between the two groups (P= 0.84). In the steroid treated group, 6 of the 71 eyes (8.5 %) had residual symptoms after surgery, while 5 of the 18 control eyes (27.8%) had residual symptoms. There was a statistically significant higher success rate in the steroid treated group compared to the control group [P= 0.045, RR= 0.31 (95% CI= 0.11 to 0.9)]

**Discussion:** The use of peri-operative dexamethasone appeared to significantly improve the outcome in patients with congenital NLDO treated with balloon dacryoplasty.

**Conclusion:** The use of peri-operative dexamethasone may reduce the failure rate in children treated for NLDO with balloon dacryoplasty.
**Rectus muscle plication for the treatment of anomalous head position and nystagmus**

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Los Angeles, CA USA

**Introduction:** Patients with nystagmus and head turn are traditionally treated by resection and resection of the rectus muscles as described by Kestenbaum and Anderson. Rectus muscle plication is a less invasive surgical option that minimizes the risk of anterior segment ischemia.

**Methods:** A retrospective chart review of all patients with nystagmus and anomalous head position (AHP) who underwent plication of two horizontal rectus muscles as a treatment for AHP.

**Results:** Six patients met inclusion criteria and none were excluded. Age at the time of surgery ranged from 2 to 23 years and four were male and two female. Plication amounts ranged from 3-8.5mm on the medial rectus and 4.5-12mm on the lateral rectus. Average pre-operative horizontal AHP was 23.3 degrees and post-operative 5.0 degrees (p = 0.007). Visual acuity improved from pre-operative mean logMar 0.58 (approximately 20/80) to postoperative 0.45 (20/60). One patient required an additional surgery for a residual exotropia despite full correction of the anomalous head posture.

**Discussion:** We report six cases in which multiple rectus muscle plications were used for the treatment of AHP associated with nystagmus. To our knowledge this is the first report detailing the use of variable amounts of plication and plication-only surgery in the treatment of AHP and nystagmus. Plication is a safer alternative to resection particularly in patients with previously operated rectus muscles at risk for anterior segment ischemia.

**Conclusion:** AHP can be effectively treated with plication alone or in combination with recession and transposition.

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**Classifying Medial Rectus Muscle Attachment in Consecutive Exotropia**

Jae Ho Jung David A Leske Jonathan M Holmes
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Rochester, Minnesota

**Introduction:** To evaluate inter-examiner agreement when classifying medial rectus muscle attachment in patients with consecutive exotropia.

**Methods:** We retrospectively studied series of intraoperative photographs of twenty-six eyes in 25 patients who underwent surgery for consecutive exotropia. Two examiners independently classified the medial rectus attachment as either: normal, or stretched scar, or slipped muscle, or lost muscle. Agreement between examiners was evaluated using the weighted kappa (k) statistic, and causes of disagreement were assessed.

**Results:** Agreement was found in 15 (58%) of 26 eyes which would be considered ‘moderate’ agreement (k=0.41). Approximately two thirds of the disagreements, seven (64%) of 11 eyes, were between stretched scar and slipped muscle, with characteristics of each entity being present in the same attachment.

**Discussion:** The intraoperative distinction between stretched scar and slipped muscle appears to be obscure in patients with consecutive exotropia.

**Conclusion:** Since it is often very difficult to distinguish between stretched scar and slipped muscle during surgery, we propose that stretched scar and slipped muscle should be considered a single entity, which might be referred to as an “abnormal muscle attachment.” Further clinical outcome studies are warranted to support or refute this suggestion.
Treatment of convergence insufficiency exotropia in adults using a selective muscle fiber surgery treatment algorithm
Melinda C Fry MD, MPH Stacy Pineles MD Federico Velez MD
UCLA Jules Stein Eye Institute, Los Angeles, CA

Introduction: Treatment of adults with convergence insufficiency (CI) exotropia is challenging as surgery frequently results in distance and lateral gaze esotropia. Recent evidence demonstrates differential compartmental function of extraocular muscle fiber groups. Selective surgery of muscle fiber groups may diminish distance-near disparities (NDD) while maintaining alignment at distance.

Methods: Seven adults with a NDD>=8PD were included in this study. Patients with a NDD<15PD and a distance deviation of <10PD were treated with lateral rectus (LR) inferior marginal tenotomy, those with NDD>15PD and distance deviation of >10PD were treated with LR slanted recessions, and those with limitation in adduction with negative forced duction testing were treated with medial rectus (MR) inferior fiber plication. Success was defined <8PD of XT at distance and near without overcorrection, and a NDD<=8PD.

Results: Postoperatively the mean distance deviation was reduced from 8.29±7.60PD to an overcorrection of 5.65±7.32PD, and the near deviation from 21.00±10.55PD to an overcorrection of 12.71±3.35 to 3.29±5.62PD. Six of the 7 (85.71%) patients met criteria for success. One subject was overcorrected at near and distance requiring reoperation.

Discussion: CI exotropia remains a surgical challenge. Treatment may be optimized when using an individualized approach favoring selective LR and MR procedures when possible.

Conclusion: Preliminary data reveal that selective techniques eliminate diplopia while collapsing NDD in patients with CI exotropia. A focused algorithm will help surgeons select the procedure most likely to benefit each individual patient.


True muscle transplantation for very large angle esotropia: long term results
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Vadodara, India

Introduction: A very large angle esotropia could not be corrected by a single eye surgery. We present a series of 16 patients with large angle esotropia treated with muscle transplantation.

Methods: All the patients included had large angle esotropia (> 80 prism diopters). All patients underwent thorough preoperative orthoptic checkup and refraction. All the patients underwent muscle transplantation, where the stump of lateral rectus was transplanted to the medial rectus using 6-0 prolene which was recessed by a standard recession technique. The patients were followed up on day 1, day 30, at 6 months and at 1 year. The angle was measured postoperatively and ocular movements were also recorded.

Results: The mean age was 34.44 +/- 3.1 years. The mean preoperative angle was 96.3 +/- 18.5 prism diopters and at 1 year postoperative followup was 13.3 +/- 9.9 prism diopters.

Discussion: Supramaximal resections and resections for large angle would lead to restriction of ocular motility. Muscle transplantation has been known to augment the surgical results. It is a profound weakening of the medial rectus but keeping the insertion anterior to the physiological equator.

Conclusion: The true muscle transplantation is a safe alternate option for large angle esotropia when uniconcular surgery is desired. The surgical results are stable in long term.

A New Approach to Inferior Oblique Over Action (IOOA) without Cyclotorsion
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Osman B Ocak MD Asli Inal MD
Beyoglu Education and Training Eye Hospital, Istanbul, TURKEY

Introduction: There are some operational techniques for superior oblique muscle over or under-action, according to presence or absence of cyclotorsion, applied only on either posterior or anterior fibers. We introduce new operational technique to the patients who had hyperopia with IOOA but without cyclotorsion.

Methods: We have 11 patients in this study. Their mean ages were 13.6 and mean follow-up time was 36.4 months. Through a conjunctival incision the IO muscle is found and approximately 6-7/8 of posterior fibers are released from insertion, and cleared from adjacent tissues and anterior part. A locking 6/0 vicryl suture is placed on posterior parts of the muscle and attached 1 mm lateral and 4-5 mm distance from insertion to the inferior rectus. Or following desinsertion and cleared from adjacent tissues of whole inferior oblique muscle, when posterior part was recessed to lateral of inferior rectus muscle, anterior edge was sutured its original insertion. Patients’ preoperative and postoperative inferior oblique over actions (IOOA), vertical deviations fundus photographs has been evaluated.

Results: Preoperatively all patients had (+4) IOOA and the mean deviation was 18.4 PD hyperopia in primary position. Postop patients’ IOOA decreased between (0) and (+1) and vertical deviation decreased mean 1.43 PD in primary position. (p<.005). There were no changes in fundus images.

Discussion: IOOA is not always with excyclotorsion and studies showed us inferior oblique weakening procedures had intorsional effects. With our new technique, undesirable in-cyclotorsion was prevented.

Conclusion: The only posterior fibers anterior transposition of inferior oblique muscle was found an effective procedure for patients, who have obvious hypertropia with significant IOOA but without excyclotorsion. The anterior transposition of only posterior fibers of inferior oblique muscle was found an effective procedure for patients with hypertropia with significant IOOA but without excyclotorsion.


Use of smartphones to record and view stereoscopic video of strabismus surgery
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London, UK

Introduction: Viewing surgical procedures in 3D allows a better appreciation of the ocular anatomy and of the movements of the surgeon’s hand and instruments in space in relation to the eye. 3D video recording is possible but requires specialist equipment and knowledge and can be prohibitively expensive.

Methods: We have used smartphones with inexpensive microscope adaptors to take high quality videos of surgery through the left and right microscope eyepieces. These videos are synchronized and displayed side-by-side on a mobile device. The device is mounted in an inexpensive ‘Virtual Reality’ headset and the surgery viewed in stereoscopic 3D.

Results: We recorded videos of micro-incision and fornix-based incision strabismus surgery. The image quality is excellent with a good stereoscopic effect allows a good appreciate of the bimanual manipulation needed for these techniques. The videos were viewed by ophthalmic trainees who were able to follow all stages of the surgery in much the same way is when looking through the microscope side arm.

Discussion: This recording technique involves simple, inexpensive equipment and very little specialist knowledge. It allows a much more immersive and instructional view of surgery than is available with 2 dimensional surgical videos.

Conclusion: This method can be used to aid learning new surgical techniques. An online library of stereoscopic videos will allow trainees to watch many operations and see new techniques or procedures as though they were observing in theatre.
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A Randomized Trial of Amblyz Liquid Crystal Occlusion Glasses vs Traditional Patching for Treatment of Moderate Unilateral Amblyopia in Children: 6-Month Outcome

Griffin J Jardine  Charline S Boente  Jingyun Wang  Daniel E Neely  Jay G Galli  Heather A Smith  Kathryn M Haider  Gavin J Roberts  Derek T Sprunger  David A Plager

Glick Eye Institute, Department of Ophthalmology, Indiana University School of Medicine, 705 Riley Hospital Dr, Indianapolis, IN 46201

Introduction: We have previously reported the promising 3-month outcome data on our clinical trial comparing Amblyz intermittent occlusion glasses with traditional adhesive patching for the treatment of moderate unilateral amblyopia. We now report our 6-month outcomes.

Methods: Children from 3 to 8 years of age with previously untreated, moderate, unilateral amblyopia were enrolled. All subjects had worn optimal refractive correction (if needed) for at least 12 weeks. Their amblyopia was associated with either strabismus, anisometropia or both. Subjects were randomized into two treatment groups: 4-hour daily Amblyz™ occlusion glasses with the liquid crystal shutter at 30-second opaque/transparent intervals (Amblyz Group), or 2-hour adhesive patching (Patching Group). For each patient, visual acuity was measured with ATS-HOTV methods for enrollment and at 3 and 6 month follow-up exams.

Results: Eighteen children were available for 6-month follow-up visits (Amblyz Group N=9; Patching Group N=9). Both groups were significantly improved compared with the baseline at enrollment. Visual acuity in the amblyopic eye improved an average of 0.11±0.13 logMAR in the Amblyz Group and 0.20±0.18 logMAR in the Patching Group. Although slightly lower in the Amblyz Group, this difference between two groups was not statistically significant (P=0.24).

Discussion: Compared to traditional patching, treatment with Amblyz™ glasses was not significantly different in the treatment of moderate amblyopia. Both groups showed the most amount of improvement during the first 3 months of treatment.

Conclusion: Amblyz liquid crystal occlusion glasses are a promising alternative treatment to traditional adhesive patching for moderate amblyopia in children 3 to 8 years of age.

Feasibility to Monitor Objective Compliance with Liquid Crystal Glasses Intermittent Occlusion Therapy

Jingyun Wang PhD  Daniel E Neely MD  Kai Januschowski MD  Charlotte Schramm MD  David A Plager MD

Salus University, Elkins Park, PA

Introduction: Amblyz™ liquid crystal glasses utilize an intermittent occlusion technique (at 30-second opaque/transparent intervals) and avoid adhesive to treat amblyopia, potentially improving compliance. Several pilot studies support the effectiveness of this new device making it an interesting option/alternative for amblyopia treatment.(1, 2,3) However, there are no objective compliance data for these glasses, limiting understanding of the dose-response for this treatment. This study reports the feasibility of a sensor to monitor objective compliance with Amblyz™ glasses.

Methods: Two children (6-7 yr) with unilateral severe amblyopia associated with strabismus and anisometropia were enrolled. Prior to enrollment, both wore glasses for 12 weeks. At enrollment, both were prescribed 12 hours of intermittent occlusion therapy with Amblyz™ glasses. An inexpensive, commercially available sensor was attached to the temple arm to monitor compliance for 3 weeks. Compliance was defined as the percentage of hours of actual glasses wearing compared to the prescribed hours. Daily and general compliance were calculated.

Results: Patient A had general compliance of 89%, but daily compliance declined to from 110% to 60% over three weeks; Patient B had approximately 52% general compliance, with poor daily compliance on weekends. Neither of the patients’ parents reported that the child had discomfort or social concerns related to the attached sensor.

Discussion: Objective compliance with Amblyz glasses can be monitored by a simple sensor. These preliminary results are limited by short-term follow-up.

Conclusion: This finding will guide quantitatively investigate intermittent occlusion therapy in treating amblyopia.

**The red reflex test: can it detect anisometropia?**

Kara C LaMattina  Leonard B Nelson  Barry N Wasserman  Kammi B Gunton  Caroline N DeBenedictis  Alex V Levin  Bruce Schnall  
Wills Eye Hospital  
840 Walnut Street, Philadelphia, PA 19107

**Introduction:** The red reflex test has been theorized to be useful in the detection of anisometropia. To date, however, no study has looked at its specificity or sensitivity in screening for this important amblyogenic risk factor. Our study sought to define these, as well as the threshold of anisometropia needed to reliably detect asymmetry in the red reflex.

**Methods:** This study was conducted in a single-masked, prospective manner with internal review board approval in the Pediatric Ophthalmology and Ocular Genetics Clinic at the Wills Eye Hospital. One hundred patients will be screened by a masked observer for asymmetry of the red reflex with their cycloplegic refraction documented by a senior physician.

**Results:** To date, 26 patients with a median age of 7.5 years have been enrolled. Using univariate logistic regression on the absolute difference in spherical power, ROC analysis showed that the red reflex test has a sensitivity of 83.3% and a specificity of 80% in the detection of anisometropia equal to or greater than 0.5 diopters.

**Discussion:** In the absence of concurrent strabismus, anisometropic amblyopia can be difficult to test in preverbal or developmentally delayed children who cannot participate in visual acuity testing. Technological advancements in refractive screening tools make for an appealing solution to this problem, but may not be readily available or financially reasonable for all practitioners.

**Conclusion:** The red reflex test may be useful in detection of anisometropia, but further enrollment will increase the strength of our study.

**Clinical Features in Children with Posterior Polymorphous Corneal Dystrophy**

Young Chun Lee  Hae Ri Yum  Shin Hae Park

**Introduction:** To describe clinical features in children detected with vesicle- or band-like endothelial lesions characteristic of posterior polymorphous corneal dystrophy (PPCD) in their first or second decade of life.

**Methods:** Seven unrelated Korean pediatric patients who were diagnosed by the presence of characteristic vesicular or band lesions at the level of Descemet’s membrane were included. Thorough ocular examinations were performed, including best-corrected visual acuity, intraocular pressure, and refractive measurements, slit-lamp biomicroscopy, and specular microscopy.

**Results:** Slit-lamp examinations revealed vesicular lesions in one patient and horizontally parallel band-like endothelial lesions in 6 patients. Four patients displayed unilateral corneal involvement, yielding 10 eyes with characteristic deep corneal lesions. Other corneal, iris, or fundus pathologic findings were not detected in all cases. Two children with amblyopia had improved visual acuity through appropriate refractive correction and occlusion therapy. A final visual acuity of more than 20/32 was achieved with appropriate refractive correction in all PPCD-affected eyes. Specular microscopic examinations revealed a reduced endothelial cell density composed of enlarged cell with no significant changes in the hexagonality and coefficient of variation in the PPCD-affected eyes. The endothelial assessments at 3 years did not demonstrate any statistically significant differences in ECD, HA, and CV compared with those at initial diagnosis.

**Discussion:** The final visual acuity of more than 20/32 was achieved with appropriate refractive correction in all PPCD-affected eyes.

**Conclusion:** Children with early-onset PPCD can gain good visual function by early appropriate refractive correction with occlusion therapy. Long-term monitoring of corneal endothelium should be required in pediatric patients with early-onset PPCD.

**References:**  
Etiology of bilateral pediatric cataracts in children older than 2 years in a tertiary care center

Deborah K VanderVeen, MD Bharti Nihalani-Gangwani, MD
Boston Children’s Hospital, Boston, MA

Introduction: To determine the etiology of bilateral pediatric cataract in children older than 2 years at the time of cataract surgery in a tertiary care center

Methods: Retrospective chart review of children older than 2 years undergoing bilateral pediatric cataract surgery in a tertiary care center over a period of 15 years. We excluded patients with traumatic cataract and unilateral cataracts. The results were analyzed depending on the etiology and the age at the time of surgery.

Results: 368 eyes of 184 patients were analyzed in the study. Mean age at surgery was 8.7 ± 4.7 years. The most common etiology of bilateral pediatric cataract were idiopathic (31%), radiation/steroid therapy for cancer treatment (20%), hereditary (14%), and subluxated lenses (7.6%). The other less common causes included uveitis (3.3%), Diabetes (3.3%), steroids for other systemic diseases (3.3%), Down syndrome (2.7%), associated with posterior segment anomalies (3.3%) and anterior segment anomalies (1.6%). The hereditary and idiopathic causes were common in the younger age group while radiation/steroid, systemic causes and subluxated lenses were common in the older children.

Discussion: The study gives us an understanding of etiology of bilateral pediatric cataracts in children older than 2 years at the time of surgery in a tertiary care center.

Conclusion: Pediatric cataracts have a diverse etiology, with the majority being idiopathic. Detailed assessment of ocular and general health of the child is helpful to determine associated conditions that can cause pediatric cataract.

Validation of Enyedi's rule for undercorrection of intraocular lens (IOL) power in children

Virender Sachdeva Sushma Katukuri Ramesh Kekunnaya
L V Prasad Eye Institute, GMRV Campus and LV Prasad Eye Institute, KAR Campus India

Introduction: Initial under-correction during primary cataract surgery in children is preferred practice done using either Dahan’s formula, or ‘Enyedi’s rule of seven’. The long term refractive status of these children are largely unknown. The purpose of this study is to analyze the long-term refractive status of the children who have been under-corrected according to Enyedi’s rule.

Methods: Retrospective analysis of records of children (< 7 yrs) who underwent cataract surgery with primary IOL implantation was performed. Main outcome measure was mean post-operative refraction at age of 7 years.

Results: 84 eyes of 51 children met the study criteria (18 unilateral and 33 bilateral cases). Mean age at surgery was 3.97± 1.57 years. At the age of seven years, mean refractive error and absolute refractive error for the whole cohort was 0.23 ± 2.0 D and 1.49 ± 1.35 D respectively. 7/84 (8.3%) children achieved emmetropia while an equal proportion were myopic (45%) or hypermetropic (46%). The median refraction at seven years of age was 0 D (inter-quartile range IQR, -1 D to +1.5 D). There was no significant difference between the three groups in the refraction at seven years (p = 0.10), ages 0-2: median of +2 D (IQR, -0.5 D to +2 D), ages 2-4: median of +0.375 D (IQR, -1 D to +1.5 D), ages 4-6: median of -0.25 D (IQR, -1 D to +1.25 D).

Discussion: Our study is the first to validate the outcomes of the refractive error at age of seven-year in children initially under-corrected by Enyedi’s Rule. Enyedi’s rule tends to more accurate in children > 2 years of age.

Conclusion: This study suggests Enyedi’s rule may be reliably used to select pediatric IOL power in children; however more studies are needed to validate various methods of undercorrection.

**Role of Aphakic Rate of Refractive Growth in Predicting Long-term Postoperative Refraction after Secondary IOL Implantation**

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**Introduction:** The purpose of this study is to evaluate the role of aphakic rate of refractive growth (RRG3) in predicting long-term postoperative refraction after secondary IOL implantation in children.

**Methods:** We reviewed the charts of children who underwent cataract surgery before 18 months and secondary IOL implantation at our institute. Data were collected for refraction at the spectacle plane at multiple intervals (first aphakic AR1, last aphakic AR2, first pseudophakic PR1 and last pseudophakic PR2). Patients were included if duration between two aphakic refractions and two pseudophakic refractions was at least 2 years. We calculated the predicted error (PE) based on the observed individual RRG3 value and compared that to the PE using the mean RRG3.

**Results:** Eighty-eight eyes were identified, of those, 31 eyes met inclusion criteria. We anticipate follow-up data for an additional 10 patients to be included in the final report. The mean age at cataract removal, secondary IOL implantation and final refraction was 2.4 months, 4.7 years and 9.6 years respectively. The median PE using observed individual and mean population RRG3 was 0.61D and 2.09D respectively (Wilcoxon signed rank test P<0.001). Similar values for absolute PE was 2.45D and 2.28D respectively (P=0.4).

**Discussion:** It appears that using individual RRG3 values calculated based on early aphakic refractions might help predicting the postoperative refraction after secondary IOL implantation and help selecting IOL power.

**Conclusion:** Using individually measured values of RRG3 from the early years of aphakia showed promising results in predicting the long-term postoperative refraction after secondary IOL implantation in children.

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**Pediatric cataract surgery with hydrophilic acrylic intraocular lens implantation in Nepalese Children**

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**Introduction:** Pediatric cataract is one of the leading causes of childhood blindness in Nepal. The purpose of this study is to assess the outcome of cataract surgery with hydrophilic acrylic intraocular lens implantation in children with congenital and developmental cataracts.

**Methods:** It was a retrospective review of medical records of children with congenital or developmental cataracts who underwent cataract surgery with hydrophilic intraocular lens implantation, from January 2011 to December 2014 in a tertiary eye hospital.

**Results:** A total of 178 eyes of 120 children underwent cataract surgery with primary intraocular lens implantation. Mean age at the time of surgery was 6.9 years (3 months to 15 years). Average follow up time was 13.7 (±5.9) months. Post operative complications were noted in 33 eyes (18.13%). Post operative fibrinous reactions (10%) and Posterior Capsular Opacity (3.38%) were the most common early and late postoperative complications respectively. Second intervention was needed in 12 (6.5%) eyes. Preoperative vision of less than 20/200 was present in 105 eyes (57.69%). Final best corrected visual acuity of 20/40 or better was achieved in 81 (44.5%) eyes.

**Discussion:** Our study shows that hydrophilic intraocular lens is suitable for use in children undergoing cataract surgery. Low cost hydrophilic intraocular lenses are locally produced in the institute. The results of this study is comparable with other studies on pediatric cataract surgeries using hydrophobic and hydrophilic acrylic intraocular lenses.

**Conclusion:** Hydrophilic lens is one of the cost effective approach to managing pediatric cataract surgery in developing countries like Nepal.
Outcome of cataract surgery in children with Down syndrome

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Introduction: To report the outcomes and complications in children with Down syndrome who have undergone cataract surgery

Methods: Retrospective chart review

Results: A total of 14 patients with Down syndrome who underwent cataract surgery between July 2002 and March 2015 were identified out of 454 patients who had undergone cataract surgery (3.1%) over this time period. Average age at presentation was 19.0 ± 51.5 months (range 0.1 to 179); average follow up period was 73.2 ± 54.6 months (range 8 to 150). 6/14 patients of presented with bilateral congenital cataracts and had bilateral cataract surgery, 3/14 presented with bilateral cataracts but required surgery in only 1 eye, and 5/14 had unilateral cataracts. There were no surgical complications. 10/14 of the patients had congenital cataracts, 3/14 had developmental cataracts, and 1/14 had a traumatic cataract. 1/6 of the bilateral patients and 4/8 of the unilateral patients developed strabismus. One bilateral patient developed a visual axis opacification in the left eye 57 months after initial surgery. Aphakic glaucoma developed in two of the bilateral patients. A total of eight patients had nystagmus (3/6 of the bilateral patients and 4/8 of the unilateral patients). Only 2/14 patients were able to perform an objective visual acuity at last follow up.

Discussion: Follow up of children with cataracts and Down syndrome is frequently limited by ability to measure visual acuity due to the patients' developmental status. Nystagmus is present in a high number of these patients, regardless of etiology of the cataract.

Conclusion: Cataract surgery in patients with Down syndrome is effective and does not appear to have a higher complication rate than cataract surgery in patients without Down syndrome.


The use of depo-medrone in the management of postoperative inflammation in congenital cataract surgery

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Introduction: There is very little published on the management of postoperative inflammation following congenital cataract surgery. We aim to share the results of a case series of infants treated with orbital floor depo-medrone (Pharmacia aqueous suspension of methylprednisolone acetate 40mg/ml) at the time of cataract surgery over a 2 year period (April 2013 to April 2015).

Methods: A case note review was undertaken of patients less than 2 years of age, identified from the theatre operating system as having been given orbital floor depo-medrone during congenital cataract surgery over a 2 year period. The dose varied between 10 mg and 20mg. The postoperative drop regime was maxitrol one drop 6 times a day, maxitrol ointment at night and cyclopentolate either 0.5% or 1% based on the infant’s age. These drops were then changed to preservative free drops if the infants were fitted with contact lenses.

Results: Nineteen eyes and 13 patients have been identified who received the orbital floor depomedrone. The average age at the time of cataract surgery was 343 days (range 27- 651 days). Six of the infants were male. Eight of the patients had bilateral cataracts. No intra procedure complications were recorded associated with the use of depo-medrone. Two eyes developed glaucoma. No post-op inflammation was recorded. Three eyes required anterior segment revision.

Discussion: Our case series shows that the use of depo-medrone is safe and helps to control the postoperative inflammation especially in infants in whom parents may find it difficult to instil regular postoperative drops.

Conclusion: The use of orbital floor depo-medrone is safe in infants and can be used to as part of a strategy to reduce postoperative inflammation following congenital cataract surgery. More data is required to determine the risk of steroid-induced glaucoma.

Effect of posterior optic buttonholing of intraocular lens in pediatric traumatic cataracts

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**Introduction:** Effect of posterior optic buttonholing (POBH) of intraocular lens in pediatric traumatic cataracts

**Methods:** Prospective case series of 47 eyes of 47 patients (4-18 yrs) underwent primary/secondary IOL implantation with or without primary posterior capsulotomy (PPC) & anterior vitrectomy (AV).

**Results:**
- Gp.A-22 eyes with POBH. Gp.B -22 eyes without POBH. Postoperative visual acuity, visual axis opacification (VAO) & complications were analysed at 1st postoperative day, 1 week, 1 month & 3 months. Data analysed using SPSS.

**Discussion:** We found that performing PPC with POBH in pediatric traumatic cataract reduced the opacification of the posterior capsule and helped in maintaining clear visual axis with good IOL centration. This has special relevance to a developing country like India, where patients are likely to be lost to follow-up because of socioeconomic factors and the lack of adequate ophthalmic infrastructure.

**Conclusion:** POBH of IOL in pediatric traumatic cataracts may reduce pupillary capture along with maintenance of clear visual axis.

**References:**

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Second intraocular surgery after successful primary pediatric cataract surgery: Indications and outcomes during long term follow-up

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**Introduction:** Due to the inherent nature of the developing eye and surgery, additional surgical interventions are not uncommon after pediatric cataract surgery. The purpose of this study was to analyze the incidence of complications following paediatric cataract surgery which required an intraocular intervention.

**Methods:** The records of children (< 7 yrs) who underwent cataract surgery with or without primary intraocular lens (IOL) between January 2004 to December 2014 were retrospectively analyzed. Complications that required second intraocular surgery was analyzed.

**Results:** Records of 814 eyes of 500 children (570 pseudophakic and 244 aphakic), were reviewed. Mean age at first surgery was 1.6± 1.99 years (0.08 - 6). Mean follow up duration was 4.83 ± 2.31yrs. Overall incidence of the second surgery was 5.53% (45 eyes). Most common indications were visual axis opacification (VAO) (2.9%), followed by glaucoma (0.73%). Other indications were IOL decentration/dislocation requiring IOL exchange (3 eyes), YAG capsulotomy (4), residual cortex (2), vitreous wick syndrome (1), endophthalmitis (2), IOL decentration and wound leak (1). Repeat interventions were slightly less in pseudophakics (4.91%) vs. aphakics (6.91%, p=0.31). VAO was less in pseudophakics (2.1%) vs aphakics (4.9%, p=0.05) and glaucoma in pseudophakia (0.4%) vs. in aphakia(1.6%)(p=0.12). Visual acuity improved from 1.16 to 0.8 LogMAR after intervention.

**Discussion:** The overall incidence of children needing re-surgery was lower in pseudophakic children. Most common intraocular reoperation was for VAO. In addition, incidence of VAO and glaucoma was found to be less as compared to previous reports.

**Conclusion:** Our study suggests that incidence of second intra-ocular surgery is quite low over 5 year’s follow-up. VAO and secondary glaucoma remain the most common indications.
Secondary intraocular lens implantation following infantile cataract surgery: Indications, lens placement, and long-term postoperative outcomes

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Aim: To report long-term postoperative outcomes after secondary intraocular lens (IOL) implantation following infantile cataract surgery.

Methods: Study population: Infants operated for congenital cataract before seven months of age. Exclusion criteria: Acquired cataract, congenital glaucoma, ROP and PFV stretching the ciliary process, <1 year follow-up after secondary IOL implantation (for postoperative outcome). We randomly selected one eye for statistical analysis in bilaterally implanted patients.

Results: n=49 (25 unilateral and 24 bilateral). Age at cataract surgery: 1.7±1.2 months; Age at IOL implantation: 4.6±1.8 years; Age at final follow up: 9.1±2.4 years; Follow-up after secondary IOL: 4.8±2.8 years. 57.1% received secondary IOL because of increasing difficulties with contact lens wear. Capsular bag fixation of the secondary IOL was achieved in 69.4% of patients. No significant relationship was found between age and site of implantation of IOL (p=0.3). 37 eyes were analyzed for postoperative outcomes. After Secondary IOL, 2.7% were diagnosed with glaucoma suspect, 10.8% received medical treatment for glaucoma, 5.4% had glaucoma surgery, and 5.4% had surgery to clear the visual axis. 1 patient required IOL removal because of high myopia. Median VA at final follow-up was 20/55 for unilateral patients versus 20/40 for bilateral patients.

Discussion: We reported long-term outcomes for secondary IOL implantation for patients who had cataract surgery early in infancy. Implantation was most commonly within the capsular bag and done at age 4-5 years.

Conclusion: Secondary IOL in children is relatively safe procedure associated with low rates of postoperative complications.

Strabismus developing after unilateral and bilateral congenital cataract surgery in healthy children.

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Introduction: Strabismus is a prevalent complication of children who have been operated for congenital cataract (1). This study aim is to evaluate the prevalence of strabismus after unilateral or bilateral congenital cataract surgery, with or without intraocular lens implantation.

Methods: Medical records of pediatric patients were evaluated from 2000-2011. Healthy children undergoing surgery for unilateral or bilateral congenital cataract with at least one year of follow-up were included.

Results: Ninety patients were included, 40% had unilateral and 60% had bilateral cataracts. Follow-up was on average 50.71 months. Strabismus was found pre-operatively in 34.4% children, and in 43.3% children at last follow-up. Strabismus developed in 46.2% of children who were orthotropic pre-operatively. Strabismus occurred after unilateral or bilateral cataract surgery in 63.9% and 29.6% children, respectively. At last follow-up, strabismus was found in 46.7% of aphakic and 58.7% of pseudophakic children (p=0.283). Children who developed strabismus were generally operated at a younger age as compared to those without strabismus (mean of 25.9 vs. 52.7 months, p<0.001). Final visual acuity was inversely correlated with prevalence of strabismus.

Discussion: We found risk factors for strabismus after congenital cataract surgery to be unilateral cases and young age at surgery. Our result is in accordance with other major studies (2,3). No correlation was found between prevalence of strabismus and use of intraocular lens. Strabismus was more common in children with poor final visual acuity.

Conclusion: Pediatric ophthalmologist should carefully monitor for the possibility of strabismus development in children who undergo congenital cataract surgery, especially when with aforementioned risk factors.

Introduction: We report four girls in three families who presented with bilateral microphthalmos and congenital cataracts requiring early surgery. Three of the four developed aphakic glaucoma.

Methods: Clinical data of 3 patients were obtained from the health records in BC Children’s hospital, Ophthalmology department with informed consent, including consent to use photographs in this report. One patient clinical data was obtained from the health records in IWK Children’s Hospital, Halifax-Canada.

Results: We report four girls in three families who presented with bilateral microphthalmos and congenital cataracts requiring early surgery. Three of the four developed aphakic glaucoma. Dysmorphic facial features, syndactily as well as cardiac abnormalities requiring surgery were early features. Dental abnormalities only became evident later after dental eruption, with very striking radiculomegaly. Oculo-facio-cardio-dental (OFCD) syndrome is a rare X-linked dominantly-inherited disorder. It is lethal in males. Genetic studies of 3 of our patients confirmed heterozygous mutation in the BCOR gene, encoding the BCL6 co-repressor. Results are pending for the fourth.

Discussion: Approximately 20 patients have been reported with this disorder, largely in the dental and genetic literature. Dentists are commonly consulted by this group of patients due to their significant dental problems but there is little reference to OFCD in the ophthalmology literature.

Conclusion: These 4 patients illustrate the wide clinical spectrum of this disorder. We will discuss its genetic basis and stress the importance of early recognition, appropriate management and vigilance for the possibility of aphakic glaucoma.

Complex optic nerve and macular hypoplasia in two siblings with compound heterozygous mutations in the ATOH7 gene

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Introduction: The genetic basis of isolated optic nerve hypoplasia (ONH) is not solved yet. ATOH7 plays a major role in optic disc size regulation and retinal ganglion cell development and it’s causative role in ONH is under discussion. We present two siblings with ONH and identified ATOH7 mutations to discuss the clinical implications.

Methods: Two sisters of a non-consanguineous family with unexplained low vision and apparent normal eye examination were referred to our institution. A comprehensive eye examination was repeated. Cerebral MRI was done in the older sibling. Genetic testing was performed by whole exome sequencing (WES). Subsequently, the two mutations in ATOH7 were confirmed by Sanger sequencing.

Results: The two normally developed siblings ages 3 and 7 years showed almost identical bilateral optic nerve and macular hypoplasia with reduced vision (20/70 to 20/100). No cerebral abnormalities were detected. The parents and 2 other siblings did not show ocular abnormalities. Genetic testing revealed in the affected patients two compound heterozygous mutations in the ATOH7 gene, which are not reported before.

Discussion: ATOH7 gene mutations can be causative for nonsyndromic ONH without affecting the brain development.

Conclusion: Analysis of this gene should be encouraged in patients with ONH despite controversial reports.
Visual Rehabilitation of Patients with Oculocutaneous Albinism Type IA (OCA 1A):
Results In 85 Patents
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Introduction: We report a multimodal treatment approach in patients with OCA 1A
Methods: Prospective, interventional, series, reporting data after treatment in 85 patients
with OCA 1A. Therapy included a four step approach; spectacle correction for 3 months,
exaocular muscle surgery, contact lenses, lastly oral baclofen. Study measures includ-
ed; refractive error (RE), contrast sensitivity function (CSF), binocular best visual acuity
(BBVA), head/face position (AHP), strabismic deviation (SD), gaze dependent visual
acuity (GDVA) and eye movement recordings (EMR). Computerized parametric and non-
parametric statistical analysis of data were performed using standard software.
Results: Age 4-59 yrs (Ave 16), 56% female, follow > 1 year all, 20% had associ-
ated systemic diagnoses, 93% with RE, 100% had strabismus (76% ET, 22% XT, 14%
HT), 88% with eccentric gaze null (85% vertical, 15% horizontal), 36% had (a)periodic-
ity. Group mean CSF Log Units (LU) improved significantly (p<0.01) at all cycle/degree
(CPD) (3 CPD - 0.7 to 1.53, 6 CPD - 0.87 LU to 1.66 LU, 12 CPD - 0.62 LU to 0.96 LU,
18 CPD - 0.23 LU to 0.92 LU), group mean BBVA improved significantly from LogMAR
.83 to .58 (p<0.01), AHP improved to within 10 degrees in 95% of patients. SD was less
than 12 prism diopters horizontally in 95% and 8 prism diopters vertically in all. GDVA
showed a broadend null zone in 95%. EMR demonstrated improved nystagmus wave-
forms and (a)periodically.
Discussion: Other than recommending low vision and sun protection aids OCA1 pa-

tients have been minimally treated.
Conclusion: A combination medical-surgical-optical approach results in significant im-
provements in ocular motor and visual functions in patients with OCA1A.

Incidence and Types of Pediatric Nystagmus

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Introduction: The purpose of this study was to report the incidence, prevalent subtypes
and clinical characteristics of pediatric nystagmus diagnosed over a 30-year period.

Methods: The medical records of all children (< 19 years) diagnosed with any form of
nystagmus from January 1, 1976, through December 31, 2005, were retrospectively
reviewed.

Results: A total of 70 children were diagnosed during the 30-year period, yielding an an-
nual incidence of 6.98 per 100,000 younger than 19 years (95% confidence interval [CI],
5.34-8.61). The mean age at diagnosis was 6.7 months (range, 0 days to 18 years) and
41 (58.6%) were male. The main types of nystagmus, in declining order, were: idiopathic
or congenital motor nystagmus in 22 (31.4%), sensory motor nystagmus in 22 (31.4%),
manifest latent nystagmus or latent nystagmus in 17 (24.2%), and two (2.9%) each as-
sociated with Chiari malformation, medication use, and a tumor of the central nervous
system (CNS). There were no cases of spasmus nutans. Seventy-three percent had
20/40 (or equivalent) or better vision at presentation.

Discussion: Congenital motor and sensory motor nystagmus made up 3 of 5 patients in
this study while a CNS tumor occurred in only 2.9% (CI: 0.4-9.9) of all forms of childhood
nystagmus. There were no cases of spasmus nutans in this cohort.

Conclusion: This study provides the first population-based data on incidence and
clinical characteristics of childhood nystagmus in North America. Congenital motor and
sensory nystagmus were most common presentations with most patients having relatively
good vision and no intracranial malignancy.
Stability of Human Binocular Alignment: A Video-Oculographic Luminance Study

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Introduction: To evaluate the stability of human binocular alignment under conditions of altered fixation and luminance.

Methods: We measured horizontal binocular alignment in examined 8 healthy orthotropic subjects using infrared video-oculography (VOG) under conditions of binocular fixation and luminance change. Each testing condition was preceded by a binocular fixation period in room light (475 lux) to define the baseline binocular alignment. We then measured binocular alignment in darkness without fixation, in darkness with a distant fixational target, and in room light through a semi-translucent filter that precluded fixation. We determined whether these experimental conditions induced significant binocular alignment change from each baseline binocular alignment statistically using signed rank test.

Results: The mean horizontal binocular alignment in the dark was similar to baseline binocular alignment (0.2°±2.8°; p=0.4). The mean horizontal binocular alignment when fixing in a room light was similar to baseline binocular alignment (-1.4°±1.6°; p=0.08). The mean horizontal binocular alignment in the dark when a fixational target was provided showed an exo-drift compared to baseline alignment (2.3°±1.0°; p=0.0004).

Discussion: The human brain does not require visual input to maintain binocular alignment on a short-term basis. The resilience of binocular alignment reflects the presence a subcortical memory system or tonus mechanism which is probably calibrated by phoria adaptation, a sensorimotor process that resets the baseline phoria toward zero to eliminate binocular disparity. Ocular proprioception may play a secondary role.


Macular Segmentation via Optical Coherence Tomography in Pediatric Optic Nerve Head Drusen and Mild Papilledema

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Introduction: Optic nerve head drusen (ONHD) and papilledema in children can lead to partial optic atrophy, and frequently children with idiopathic intracranial hypertension may have both1,2. The purpose of this study is to use SD-OCT to identify possible subclinical atrophy of the inner macula in eyes of children with pseudopapilledema due to ONHD and mild papilledema.

Methods: Retrospective, IRB-approved study including eyes of children with pseudopapilledema, and those with acute mild papilledema (Frisén scale grade <2) who had clinically-indicated SD-OCT. Normal controls were recruited from another prospective study. Excluded were eyes with high refractive error (±5.00D) or retinal structural abnormalities seen on OCT. Automatic segmentation of the retinal layers was performed with Spectralis (Heidelberg, Germany) review software. The average volume of the nerve fiber layer (NFL), ganglion cell layer (GCL), inner plexiform layer (IPL), and inner nuclear layer (INL) in the macula (central 6 mm) were compared among diagnostic groups.

Results: Included were 104 eyes (104 children, mean age 11.5±3.30 years): 49 with pseudopapilledema, 12 with newly-diagnosed mild papilledema, and 43 controls. Mean GCL complex (NFL+GCL+IPL) average volumes (mm3) did not differ statistically among eyes with pseudopapilledema, papilledema, and controls: 3.10±0.27 vs. 3.08±0.30 vs. 3.03±0.22 (respectively, P=0.24, Bonferroni correction). The INL showed slight thickening in pseudopapilledema compared to controls (1.02±0.09 vs. 0.98±0.07, P=0.024)

Discussion: Conclusion: SD-OCT inner macular segmentation does not show significant differences between pseudopapilledema, mild papilledema, and controls. This suggests there is no significant ganglion cell atrophy that can be detected on OCT in pseudopapilledema or acute mild papilledema.

Optical Coherence Tomography Macular Segmentation as Predictor for Optic Atrophy in Children with Acute Papilledema

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Introduction: New Spectralis (Heidelberg, Germany) segmentation software allows automatic quantitation of the thickness of each macular layer. We evaluated the role of Spectralis spectral domain optical coherence tomography (SD-OCT) segmentation in children during acute papilledema to predict the subsequent development of optic atrophy.

Methods: This retrospective review included children <18 years of age with a diagnosis of idiopathic intracranial hypertension (IIH) who had fundus photographs, and retinal nerve fiber layer- (RNFL) and macular SD-OCT before initiation of treatment. The Frisén papilledema grade was determined from the fundus photographs by two masked neuroophthalmologists. Peripapillary RNFL (pRNFL) and automated segmented macular maps were obtained using Spectralis software. Atrophy was defined as optic nerve pallor on funduscopic examination and final vision <20/40 or visual field defect.

Results: 26 eyes of 26 children were analyzed. Frisén grade correlated with pRNFL (R²=0.34, p<0.002). There was no correlation between Frisén grade and the average thickness of any of the macular layers (p>0.12). The highest predictor for the subsequent development of optic atrophy was the Frisén grade (AUC=0.92, p<0.001) followed by pRNFL (AUC=0.84, p<0.001) and RNFL macular thickness (AUC=0.73, p=0.012). Segmentation of the other layers of the retina were not predictive (p>0.09). No eye with Frisén grade <3 developed optic atrophy.

Discussion: Clinical grading of papilledema is a better predictor of subsequent optic atrophy in children with acute papilledema than any OCT measurement.

Conclusion: A Frisén grade ≥3, synonymous with seeing vessel obscuration, is a predictor of vision loss and subsequent optic atrophy in children with IIH.

Cocaine test results in children with anisocoria

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Introduction: To establish a diagnosis of Horner syndrome in patients with anisocoria, pharmacological pupillary testing using cocaine eye drops is recommended. We aimed to identify the portion of positive cocaine test results in children and to describe the course of systemic work-up.

Methods: We retrospectively reviewed all medical records of pediatric patients (<18 years old) that underwent cocaine testing for evaluation of anisocoria in an 8-year period at our tertiary referral center.

Results: 38 pediatric patients with anisocoria were identified. Cocaine test was positive, inconclusive or negative in 11/38, 3/38 and 24/38, respectively. All children with a positive test result were referred for further medical work up, in which a mediastinal non-Hodgkin lymphoma was diagnosed in one patient. A history of birth trauma and thoracic surgery might be causative in two other patients.

Discussion: In most children with anisocoria and a positive cocaine test result, no underlying disease or explanation was found. Other diagnostic signs (ptosis, facial anhidrosis, iris heterochromia) were usually absent. Therefore, a certain rate of false-positive cocaine test results cannot be excluded. Cocaine testing is susceptible to different sources of error including pharmacological quality, dilution procedure and drop instillation.

Conclusion: Special diagnostic challenges are encountered in suspected Horner syndrome in children. Serious underlying disease was rare in our population. However, cocaine test results are sometimes equivocal especially in small children and ways to improve diagnostic accuracy are needed. This might include taking standardized photographs for pupil measurements and additional testing with direct-acting adrenergic agonists.
**Outcomes of nasolacrimal duct probing in older children**

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**Introduction:** There is limited literature regarding the success rate of surgery for older children with nasolacrimal duct (NLD) obstruction. The current study investigated the outcomes of primary NLD probing in patients four years of age or older with simple membranous NLD obstruction.

**Methods:** This was a retrospective chart review of children 4 years of age and older with uncomplicated NLD obstruction who underwent surgery from 1997 to 2015. All patients had simple membranous obstruction that resolved with passage of probes, and normal irrigation following probing. Patients with Trisomy-21, trauma and craniofacial anomalies were excluded. Outcome and need for additional surgeries were recorded.

**Results:** 35 patients with simple membranous NLD obstruction were treated. Surgery was successful in 30/35 (86%) of patients. Five patients had persistent symptoms that resolved following balloon catheter dilation or stent placement.

**Discussion:** Previous reports have suggested that outcomes of NLD probing may be decreased in older children. This study found that the success rate of probing in older patients with simple membranous NLD obstruction was comparable to that for younger patients.

**Conclusion:** NLD probing alone is a good treatment option for older children with simple membranous NLD obstruction.

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**Incidence and Clinical Characteristics of Pediatric Periocular Dermoid Cysts**

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**Introduction:** This population-based study was designed to report the incidence, clinical findings, and outcomes of periocular dermoid cysts diagnosed among children over a 20-year period.

**Methods:** The medical records of all patients 5 years of age or younger, who were diagnosed with a periocular dermoid cyst between January 1, 1986, and December 31, 2005, were retrospectively reviewed.

**Results:** A total of 54 children were diagnosed during the 20-year period, yielding a birth prevalence of 1 in 638 live births. The mean age at diagnosis was 12 months and 29 (53.7%) were female. Forty-four (81.5%) occurred at the supratemporal orbital rim, 6 (11.1%) at the supranasal orbital rim, 3 (5.6%) at other periocular areas, and one (1.9%) within the orbit. Thirty-four (63%) had an ophthalmic exam, all without amblyopia or other ocular morbidity. Forty-eight (88.9%) patients underwent surgical excision with 7 (14.6%) having documented rupture of the cyst, none of whom had post-operative complications. Two (4.2%) patients were noted to have lesion recurrence; one at 8 months and the second at 1 year following surgery.

**Discussion:** Pediatric periocular dermoid cysts are uncommon lesions that generally occur in the first year of life in the supratemporal orbital rim. Most patients undergo uncomplicated surgical excision with rare recurrences.

**Conclusion:** The incidence of periocular dermoid cysts in this population is 1 in 638 live births. Complete surgical excision is the treatment of choice, while ocular sequelae and postoperative recurrence are rare.
Clinical outcomes in children with orbital cellulitis and radiographic globe tenting

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**Introduction:** Radiographically, a configurational, conical change of the posterior globe, previously termed globe tenting, is occasionally seen in severe cases of orbital cellulitis, and can be a predictor of profound ophthalmic sequela in adults. Little is known, however, about the visual consequences of such a finding in children with orbital cellulitis.

**Methods:** A single site (Seattle Children’s Hospital), retrospective chart review of 46 children with orbital cellulitis and orbital imaging was performed. Initial and final visual acuities (VA) were available for 34/46 patients. Tenting angles were measured on axial CT or orbital MRI based on prior published methods, with globe tenting defined as a posterior globe angle of less than or equal to 130 degrees.

**Results:** Six eyes with globe tenting were identified. The mean posterior globe angle was 125.2 degrees, compared to 145.1 degrees in the affected eye of non-tented (40) patients. The mean difference in posterior globe angle (unaffected contralateral globe angle - affected globe angle) was 17.2 in tented vs. 1.4 in non-tented patients (p = 0.008). The final mean logMAR VA following a treatment course (parenteral antibiotics and surgery where appropriate) was 0 in tented vs 0.02 in non-tented patients (p = 0.7). Time to surgery was less in cases of globe tenting, although not statistically significant (mean 1.5 days compared to 4 days, p = 0.1).

**Discussion:** Children with orbital cellulitis and globe tenting did not have poor visual outcomes in this small subset of patients.

**Conclusion:** Rapid identification and intervention, including surgery when necessary, likely contributes to good outcomes.

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Use of Green Braided Polyester in Frontalis Suspension for severe or recurrent Ptosis

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**Introduction:** Frontalis suspension is a surgical procedure performed to address severe ptosis with poor levator function. Several different techniques and sling materials are commonly used. The purpose of this study is to demonstrate the benefits of using green braided polyester (Ethibond EXCEL- ETHICON) in the management of severe or recurrent ptosis in children and young adults.

**Methods:** Retrospective record review of 35 patients (48 eyelid procedures) affected by congenital or acquired ptosis, who underwent frontalis suspension with green braided polyester. Complications, functional and cosmetic results were evaluated pre- and post-operatively.

**Results:** Functional success was obtained in 46 eyes of 48 procedures. MRD1 increased an average of 2.57 mm and palpebral fissure increased an average of 3.92 mm after brow suspension. The mean follow-up duration was 18.4 months. Complications included untied suture (2), suture dehiscence (1), cellulitis (2) and granuloma (1).

**Discussion:** Frontalis suspension can be achieved using several different sling materials including fascia lata, silicone rods or gortex. None of them are completely satisfactory. We discuss the use of green braided polyester suture, a novel low cost material, for performing frontalis suspension.

**Conclusion:** Green braided polyester was found to be a safe, effective, easy-to-handle and very low- cost sling material for frontalis suspension. In many of our cases, Ethibond was both effective and long lasting after the failure of other conventional materials. It can be considered for clinical use, especially in developing countries where the cost and availability of other materials can represent a significant barrier to treatment.

Non vitreoretinal abusive ocular trauma in children: a systematic review

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Introduction: To identify the spectrum of non-retinal ocular injuries due to child abuse.
Methods: An all language search of MEDLINE, PsychINFO, EMBASE, AMED, Web of Science and CINAHL databases, 1950-2015, was conducted. Inclusion criteria: explicit confirmation of aetiology, age <18 years, examination details as conducted by an ophthalmologist. Exclusion: Post-mortem data, organic diseases of the eye, review articles. Standardised critical appraisal and narrative synthesis was conducted
Results: 1492 studies identified, 152 full texts were assessed, 49 underwent two independent reviews, resulting in five included studies: three case series and two case reports. The included cases (n=26) describe ocular, facial and skeletal injuries occurring as a consequence of child abuse. Ocular signs included periorbital oedema, chemosis, injection, abrasion, hyphaema and cataract. Of interest all children that had suffered physical abuse with ocular injury had subconjunctival haemorrhages. Children presenting with ocular injuries from abuse had a mean age of 13.9 months (range 1-68), whilst those who suffered violent corporal punishment were considerably older (mean 96 months). All cases underwent screening for occult fractures, but confirmed neuroimaging in only 2/5 eligible cases. Those who had suffered corporal punishment underwent no further investigations.
Discussion: The purpose of this systematic review was to identify the spectrum of non-retinal ocular abusive injuries and potentially highlight ‘red-flag’ injuries.
Conclusion: Although the face is the most common site of abusive injury, there is a paucity of high-quality data on non-retinal ocular abusive injury. Subconjunctival haemorrhages are a potential sentinel injury of abuse, and warrant further evaluation.

A systematic guideline for treatment of common ocular emergencies in the pediatric population

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Introduction: The creation of clinical treatment pathways enable evidence-based management steps to be employed systematically, and to highlight areas that need further study. Our goal was to create standardized, evidence-based guidelines for treatment of common ocular emergencies encountered in a pediatric setting.
Methods: Residents researched common pediatric ocular diagnoses (hyphema, ruptured globe, preseptal/orbital cellulitis, corneal abrasions, chemical injuries, eyelid lacerations). Treatment algorithms were created using evidence from the medical literature. Treatment steps not proven in the literature were discussed among residents and faculty during a resident led department meeting. Upon consensus among the ophthalmology faculty, the guidelines were then shared with other hospital teams, who would be co-managing patients, for agreement.
Results: Evidence-based guidelines of each ocular emergency were created as a tool for patient management in order to provide the most effective and efficient treatment in the emergency room setting.
Discussion: This project enabled residents to become familiar with common pediatric ocular emergencies before taking call. Residents gained experience researching medical literature, best-practice guidelines and leading discussions on unproven treatment aspects in order to agree on a departmental-wide algorithm.
Conclusion: Ultimately, the resident-derived protocols standardized the treatment of common pediatric ocular emergencies using evidence-based medicine at our hospital. This project also highlighted areas of treatment yet to be proven in the literature, and open for future resident research projects.
Physician Effort in Pediatric Eye Examination Under Anesthesia
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Introduction: The inability to tolerate a complete eye examination is an indication for an eye examination under anesthesia (EUA). This occurs in the pediatric population due to poor cooperation of the patient, or the need for detailed and lengthy examination techniques. The length of time spent in the operating room for EUAs were analyzed.

Methods: After IRB approval, the medical records of 127 patients age < 18 undergoing EUA from 9/1/2000 - 9/1/2015 were retrospectively reviewed. The length of time spent in the operating room, diagnoses and number of EUAs over the five year time period were recorded for each patient.

Results: The operative records of 143 EUAs were reviewed. 33 records of patients who were concurrently undergoing an operative procedure in addition to EUA were excluded. The average time spent in the operating room for EUA was 65.8 minutes.

Discussion: Eye examinations under anesthesia performed in the operating room require significant time and effort on behalf of the pediatric ophthalmologist. Our results demonstrate that only 4 EUAs could be performed in a half day, compared to 8-10 comprehensive examinations for established patients performed on average in a clinical half day. The amount billed for EUA (CPT 92018) is $425 compared to $320 billed for a comprehensive eye examination for an established patient (CPT 99214), despite the greater amount of time required for EUA in the OR.

Conclusion: While a significant amount of time and effort is spent on examination under anesthesia in the operating room, current billing and reimbursement does not reflect this.

Characterizing Pediatric Utilization of Ophthalmology-Specific Emergency Department Services
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Introduction: The Bascom Palmer Eye Institute (Miami, FL) maintains a 24-hour ophthalmology-specific emergency department (ED) with an approximately 20,000 new patient visits a year. The purpose of this study is to describe the nature and utilization trends of the pediatric patient population presenting for emergency care.

Methods: This is a retrospective study of all new pediatric patients (ages 0-17) over a 1 year period from June 1, 2014-May 31, 2015. Metrics including patient demographics, insurance status, time of presentation, and diagnosis were derived from electronic medical record (EMR) data.

Results: Of 19,503 total ER visits, 1,639 (8.4%) were pediatric, of which 54% were male and 46% were female. An average of 4.5 patients presented on a daily basis, with a mean age of 9.3 years. Most patients presented in the afternoon (67%) with only a minority (21%) presenting over a weekend. March witnessed the most pediatric ED visits, while November saw the least. The most common diagnoses were corneal abrasion and chalazion, followed by allergic and viral conjunctivitis. Most pediatric patients were privately insured (67%), the others having federal insurance (17%), regional insurance (1%), or self-paying (15%).

Discussion: To our knowledge, this represents the first study examining the utilization patterns of pediatric patients presenting to Ophthalmology specific ED.

Conclusion: This study is consistent with the literature that a sizeable proportion of ED visits are non-emergent. In the pediatric population, there was a significant degree of variation as to the demographic, indication, and urgency for pediatric visits to the ED.
Institutional review of ocular problems evaluated and managed by the ophthalmology consultation service of a university teaching hospital

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Introduction: To evaluate the utility of an ophthalmic consultation service at a tertiary pediatric medical center.

Methods: We conducted a retrospective review of charts of patients who presented to the consultation service between January 1 and December 31, 2014. Patients were categorized according to the presence (group A) or absence (group B) of an ocular complaint. The ophthalmic examination data were abstracted, and a positive exam was defined as any abnormal finding on clinical examination.

Results: One-thousand-forty-three total consultation requests were made in the 12 month period. This averaged to 4.5 patients per day. Group A (n= 620) constituted 54% of the total number, and the ophthalmic examination identified an abnormalities in 81% (524/620) of cases. Red eye was the most common complaint. Group B (n=523) was divided into different categories according to the departments referring them. Neurology/Neurosurgery referred the largest number of patients (n=93) with 30% of these having positive findings. Oncology/hematology referred a similar number (n=91) with 15% having positive findings on examination.

Discussion: An ophthalmic consultation service at a tertiary pediatric medical center can be very busy. Consultations based on patient complaints have the highest yield of positive findings. The vast majority of consultations called without patient complaints have very low yield.

Conclusion: With the increasing cost of healthcare delivery, these data imply that consultations for ophthalmic examinations should be well planned and specific. More specific consultations will yield positive results that may affect patient care without wasting valuable health-care dollars.

Presenting Characteristics of Children with HSV Keratitis

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Introduction: Herpes simplex (HSV) keratitis in children is a devastating condition leading to visual sequelae, including corneal scarring and amblyopia. The aim of our study is to describe the characteristics of children diagnosed with HSV keratitis presenting to a tertiary referral clinic.

Methods: IRB approval was obtained for the retrospective chart review of children with corneal opacities less than 17 years of age presenting to the Pediatric Cornea service. Children diagnosed with HSV keratitis between 1/1/2009 to 1/24/2014 were analyzed for age at presentation, time of initial symptoms, time to diagnosis, baseline vision, corneal findings, and other systemic comorbidities.

Results: A total of 45 patients were reviewed. 20 were female, 15.6% had bilateral disease at presentation. 31% had a history of atopic disease. Average age at first episode was 5.23 years (range 0-17 years), with the mean time from initial symptoms to diagnosis being 464 days. Mean BCVA in patients with bilateral disease was 20/30 (logMAR 0.19), with a 2-line difference between the eyes (logMAR 0.15, p=0.01). In those with unilateral disease, mean BCVA was 20/50 in the affected eye (logMAR 0.42) with a 3-line difference between the eyes (logMAR 0.33, p=0.16). 20% had an epithelial defect or dendrite, 46.7% had corneal scarring and 24.4% corneal neovascularization at presentation.

Discussion: We found a significant time delay between time of initial symptoms and diagnosis of HSV keratitis, with many presenting with corneal scarring and decreased vision.

Conclusion: Our study demonstrates the need for heightened awareness of HSV keratitis in children with suggestive symptoms in order to prevent permanent visual sequelae.
Survey of Childhood Glaucoma Suspects in a Tertiary Center

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Introduction: We investigated the baseline characteristics of childhood glaucoma suspects (age > 10 years) in order to identify high-risk features for conversion to childhood glaucoma.

Methods: We retrospectively identified the medical records of childhood glaucoma suspects based on claims data between 2002 and 2012. Records were included if the patient failed to meet glaucoma diagnosis criteria at the initial visit and follow up was greater than 6 months, and were excluded if either eye had undergone incisional surgery.

Results: Of the 108 charts reviewed, 44 patients had at least 1 episode of intraocular pressure (IOP) > 21 mmHg. Of these patients, 39 did not develop glaucoma, while 5 (11.4%) converted to childhood glaucoma based on the Childhood Glaucoma Research Network definition during the follow up period. Two of the total 108 patients (1.9%) had neither glaucoma nor elevated eye pressure, but had high-risk syndromes associated with childhood glaucoma (one Peters anomaly, one retinopathy of prematurity). 62 (57.4%) remained glaucoma suspects without high-risk syndromes nor history of elevated eye pressure. The follow-up durations were similar in the glaucoma, hypertensive, syndrome, and suspect groups (30-46 months, p = 0.774). The maximum (35 +/- 10 mmHg) and average (27 +/- 2.3 mmHg) IOP in the glaucoma group were higher than the rest (p < 0.0001 for both). No normotensive childhood glaucoma suspects converted to glaucoma.

Discussion: Elevated IOP in childhood glaucoma suspects is associated with conversion to glaucoma.

Conclusion: Childhood glaucoma suspects without elevated IOP are probably at low risk of converting to glaucoma.


Early Natural History of Moderate Refractive Errors in Infants

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Introduction: The purpose of this study was to investigate the early natural history of children diagnosed with refractive errors before one year of age.

Methods: The medical records of infants (< 1 year) diagnosed with moderate refractive errors (myopia -0.75 to -4.0; hyperopia >= +3.50; and astigmatism >= 2.00) from January 1, 1990 through December 31, 2010, and who were reexamined at approximately 2 years of age, were retrospectively reviewed. Improvement was defined as a decrease of >= 0.75 diopters (D), worsening as an increase of >= 0.75 D, and no change as an increase or decrease of < 0.75 D.

Results: Sixty-three infants were diagnosed with refractive errors at a mean age of 6.2 months (range, 0.4-11.9 months) and were followed for a mean of 14.0 months (0.3-85.0 months). Nine of the twenty-six (35%) myopes improved at a mean age of 10.5 months (6.0-20.8 months). Twenty-five of the thirty-four hyperopes (74%) improved at a mean age of 24.1 months (6.5-94.5 months). Six of ten infants (60%) with astigmatism improved by a mean age of 28.0 months (6.2-70.3) months.

Discussion: While some clinicians choose to correct moderate refractive errors of infancy, the findings from this small cohort suggest that correction of hyperopia or astigmatism is usually unnecessary for this age group.

Conclusion: Most children diagnosed with astigmatism or hyperopia in the first year of life showed a reduction of their refractive errors within one year of their initial refractions. Moderate infantile myopia occasionally resolved, although it persisted or worsened for most children.
Ocular biometry and determinants of refractive error in the Hutterites, a founder population of European ancestry

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Introduction: The prevalence of myopia is increasing. Several studies have associated myopia with increased education, near activities, and outdoor exposure. This study reports refractive error and biometry in a founder population of European ancestry, the Hutterites, and considers factors contributing to myopia.

Methods: Cross-sectional study conducted on site, including complete eye exams with retinoscopy and ultrasound biometry.

Results: As part of a larger study on the Hutterites, 939 subjects ages 6 to 89 were examined. Distribution of refractive error peaked at emmetropia with a leptokurtic distribution skewed towards myopia. Women were significantly more myopic than men (SE -0.85 ± 2.07 and -0.41 ± 1.53, in women and men respectively, p=0.0002). Men had significantly longer axial lengths and deeper anterior chamber depths (p<0.0001, p=0.0002). Women had steeper corneas (p<0.0001). There was no difference in lens thickness by gender (p=0.6056).

Discussion: Compared with other population-based studies, the Hutterites had more myopia and longer axial lengths. Women were more myopic than men, a finding which has only been reported in a few other populations. All Hutterite children complete compulsory education through the 8th grade, after which women and men assume gender-specific occupational tasks. While the association between near activities and myopia may be confounded by a preference for near work among myopes, the cultural imperative for occupational roles minimizes this effect in our population.

Conclusion: Development of myopia is multifactorial. The ratio of corneal curvature / axial length may be more strongly associated with myopia than axial length alone.


A lower urinary cotinine level was associated with a trend toward more myopic refractive errors in Korean adolescents.

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Introduction: To investigate the association between urinary cotinine level as an objective biological marker of passive smoking and refractive status in Korean adolescents.

Methods: This study was based on data from the Korea National Health and Nutrition Examination Survey, conducted between 2008 and 2011. A total of 1139 Korean adolescents aged 12-18 years were enrolled. Urinary cotinine concentrations and other potential risk factors were examined. Right-eye spherical equivalents (SE) were calculated as the spherical value plus half of the cylindrical value. Subjects were categorized into tertiles (T) of urinary cotinine level with age-specific cut-off values.

Results: The mean refractive errors were -3.1, -2.8, and -2.2 dioptre (D) in the low (T1), middle (T2), and high (T3) urinary cotinine level groups, respectively (P = 0.002). A lower urinary cotinine level was associated with a trend toward more myopic refractive errors (P for trend = 0.003). After adjusting for age, sex, parental income level, area of residence, and physical activity, subjects with low level of urinary cotinine (T1) had a significantly increased risk of myopia < -0.5 D, < -3.0 D, and < -6.0 D when compared with the subjects with high level of urinary cotinine (T3).

Discussion: The refractive error in the SE correlated significantly with urinary cotinine concentration. As the urinary cotinine level decreased, the risks of myopia < -0.5, < -3.0, and < -6.0 D increased significantly (r = 0.104, P = 0.011).

Conclusion: This population-based study of 12-18-year-old Korean adolescents added the epidemiologic evidence that subjects with lower urinary cotinine concentration were more likely to be myopic.

Anatomic indices following photorefractive keratectomy in children
5+ years after surgery

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Introduction: Photorefractive keratectomy (PRK) can reduce refractive error and improve visual acuity in children with refractive error associated with amblyopia. The purpose of this study was to evaluate long-term corneal indices in children treated with PRK.

Methods: This prospective interventional case series evaluated long-term anatomic outcomes in children with anisometropic or isoametropic amblyopia after PRK at a single hospital. Main outcome measures were 5+ years postoperative indices of corneal thickness, corneal curvature, presence of corneal haze, and presence of keratoplastic.

Results: Seven eyes in five subjects to date were included. Four subjects had high myopia and one had high hyperopic astigmatism. Mean age at surgery was 6.2 years (range 3 to 9 years). Mean follow-up was 6.2 years (range 5-8 years). Mean pre-operative spherical equivalent was -11.25 D (range -13.00 to -7.25 D) in the myopic group and +5.62 D (range +5.25 to +6.00 D) in the hyperopic group. At last exam, mean post-operative spherical equivalent was -3.20 D (range -6.75 to +1.25 D) in the myopic and +2.50 D in the hyperopic groups. Mean corneal thickness was 573um immediately before PRK, 441um immediately after PRK, and 525um (range 473-610um) at last exam. No subject had corneal haze or topographic evidence of keratoplastic.

Discussion: Nothing has been reported on the long-term effect of PRK on the cornea of children. We found that refractive error correction was persistent and corneal thickness and topography remained stable. No corneal haze or keratoplastic was found.

Conclusion: PRK does not appear to increase the risk of keratoplastic in appropriately selected children.

Screening for retinitis in children with proven systemic cytomegalovirus infection in South Africa.
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Introduction: The incidence of immune-compromised children with systemic cytomegalovirus infection is increasing in Southern Africa, and new treatment regimens for cytomegalovirus retinitis are now available. No protocol exists for screening children for cytomegalovirus retinitis in South Africa.

Objectives: To determine the prevalence of cytomegalovirus retinitis in children with laboratory proven systemic cytomegalovirus infection. To assess the value of clinical and laboratory data in identifying risk factors for cytomegalovirus retinitis in children.

Methods: A retrospective cross-sectional study design. All children, 12 years and younger, with laboratory proven systemic cytomegalovirus infection were identified over a 5 year period. Risk factors for the development of cytomegalovirus retinitis were identified and cases were evaluated by retinal screening.

Results: A total of 164 children were screened. Presumed cytomegalovirus retinitis was diagnosed in 8/164 cases. Causes of immune deficiency included human immunodeficiency virus (n=7) and chemotherapy (n=1). Human immunodeficiency virus infection showed no definite trend towards association with the development of cytomegalovirus retinitis in our study population, however due to small numbers, this association could not be confirmed (p=0.064). Cytomegalovirus retinitis was associated with a positive blood polymerase chain reaction. The CD4 ratio was an unreliable factor in identifying cases at risk for retinitis in our cohort.

Discussion: Southern Africa is experiencing an exponential increase in the number of paediatric cytomegalovirus requiring retinitis screenings. Cytomegalovirus retinitis is uncommon in children but can lead to devastating retinal disease.

The prevalence in our study was 4.9%.

Conclusion: Implementation of a national screening protocol for the effective screening for paediatric cytomegalovirus retinitis is recommended, especially in children with proven blood polymerase chain reaction systemic cytomegalovirus infection in combination with human immunodeficiency virus infection.

Screening for Retinopathy in Children and Adolescents with Diabetes Mellitus (DM)

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Introduction: Recent guidelines from the International Society for Pediatric and Adolescent Diabetes (ISPAD) recommend screening for diabetic retinopathy (DR) starting at age 10 years after 2+ years of disease duration. Given that intensification of care has slowed the progression of microvascular complications, current data is needed to reassess the prevalence of DR and to evaluate the validity of these guidelines.

Methods: Medical records were reviewed assessing the presence of DR determined by standardized mydriatic digital fundus photography in patients with type 1 and type 2 DM who comply with ISPAD criteria for screening in a large pediatric diabetes center between February and September, 2015.

Results: 144 subjects underwent digital fundus photography (mean age at DM onset 8.6 years, age at DR screening 15.3 years, DM duration 6.8 years, and HbA1c 8.9%). Ten subjects (6.9%) had evidence of DR and were older (18.5 vs 15.1 years) with longer disease duration (9.8 vs 6.5 years), and higher HbA1c (11.2 vs 8.7%) compared to those without. One subject (with type2 DM) had reached a stage of preproliferative DR disease.

Discussion: A significant number of youngsters had evidence of DR. The use of digital fundus photography allowed a quick evaluation of the retinae and the images were evaluated at a later time by an ophthalmologist.

Conclusion: These data suggest that while DR can be seen in 7% of patients screened, it occurs in older patients with longer duration of disease than the current screening guidelines suggest. A re-evaluation of these guidelines may be warranted.

Edema and Separation of Outer Retinal Layers Secondary to the MEK Inhibitor Selumetinib

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Introduction: New therapeutic agents targeting the MAP-Kinase pathway, including MEK inhibitors, are currently being evaluated in phase 1 and 2 clinical trials for pediatric brain tumors. Ophthalmologic side effects from MEK inhibitors have previously only been reported in adults and included retinal vein occlusion, central retinal artery occlusion and separation of the neurosensory retina.

Methods: Convenience sample of patients seen in a pediatric neuro-ophthalmology clinic being treated with MEK inhibitors for their brain tumor.

Results: Two patients with optic pathway gliomas (13 years old and 6 years old) developed outer-retinal edema visualized by optical coherence tomography 6 months after starting the MEK inhibitor selumetinib. The retinal edema was not visualized by indirect ophthalmoscopy. One patient complained of abnormal visual phenomenon while the other patient was non-verbal. After discontinuation of selumetinib, the retinal changes resolved without detectable visual sequelae. One patient was retreated with selumetinib and retinal edema recurred again six months later.

Discussion: Children taking MEK inhibitors are at risk for developing outer-retinal edema. It is unclear whether this edema increases the risk of retinal vein occlusion, central retinal artery occlusion or pathologic separation of the neurosensory retina.

Conclusion: Clinicians caring for children on MEK inhibitors, especially those with visual pathway tumors, should be aware of the potential retinal side effects and consider OCT imaging as part of their ophthalmologic evaluation, especially in pre-verbal or uncooperative children, or those complaining of unusual visual phenomenon.
OCT Findings in Children with Myelinated Retinal Nerve Fibers and Anisometropia

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Introduction: This study focused on peripapillary retinal nerve fiber layer (RNFL) and macular retinal imaging characteristics in children with MRNF. Furthermore, we investigated the correlation between MRNF abnormalities and refractive error and visual acuity.

Methods: Children with unilateral MRNF (N=12, 7-13 years old) were included. In 6 patients, fdOCT was used to image both the peripapillary RNFL and macular retinal structures. Using the instrument’s segmentation software, global RNFL thickness and central subfield thickness (CST) of the macula were analyzed. Planimetry was applied to quantify the MRNF area observed on fundus photography. Visual acuity and cycloplegic refractive error in spherical equivalent (SEQ) were recorded. Results from the MRNF-affected eye were compared with the fellow eye.

Results: The global RNFL thickness of the MRNF eyes (152 ±13.9µm) was significantly higher than the fellow eyes (114.3 ±15.2µm) (P =0.003). The global RNFL thickness of the fellow eye was in normal range, and no significant differences were detected in macular CST (P=0.403). The MRNF area was significantly correlated with SEQ of the MRNF eye (P=0.002). The intraocular difference of RNFL thickness was significantly correlated with anisometropia (P=0.03). No correlation was found between visual acuity of the MRNF eyes and Planimetry or peripapillary RNFL.

Discussion: Our findings may help clinicians differentiate retinal abnormalities associated with MNFL versus abnormalities due to other reasons.

Conclusion: Eyes with MRNF show a significantly thicker RNFL as compared to normal macular structure. The severity of MRNF is correlated with the development of myopia and anisometropia, but not with visual acuity.

Central Retinal Artery Occlusion in Pediatric Patients Secondary to Anomalous Retinal Vasculature

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Introduction: The incidence of central retinal artery occlusion (CRAO) in persons under the age of 30 has been estimated at less than 1 in 50,000. Retinal artery occlusions in children are exceedingly rare and usually seen in the setting of trauma, migraine, or cardiac emboli.

Methods: Case series of three patients.

Results: Three patients between 11 and 15 years of age presented with acute painless vision loss or amaurosis symptoms. Two were female and one male. Neuro-imaging was unremarkable. DFE revealed anomalous vasculature at the disc in which only branches of the central retinal artery were observed emerging from the lamina and not the main trunk. Diagnostic studies, including fundus photos, FA, HVF, and Doppler Ultrasound, confirmed the diagnosis of hemi-retinal branch occlusion in the setting of bifurcation of the CRA posterior to the lamina cribosa. Further evaluation showed no evidence of thrombophilia or cardiac abnormalities. One patient with threatened occlusion was treated with aspirin 75mg daily and dorzolamide-timolol BID with no recurrence. Another with more severe vision loss was placed on lovenox and transitioned to Xarelto.

Discussion: Congenital bifurcation of the CRA associated with branch occlusion is likely much more common than the literature represents. Characteristic retina vasculature can be seen on DFE and further studies including Doppler, FA, and HVF can confirm the diagnosis.

Conclusion: This is an exceedingly rare disease process and, to our knowledge, the largest series reported in the literature. The information described in this series will increase awareness, aid in diagnostic evaluation, and help to better understand treatment options.

Genetic Testing in Children with Retinal Dystrophies

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Introduction: While many retinal dystrophies present in adulthood, others have their onset in childhood, and some constitute diagnostic challenges. Molecular genetic testing can identify the precise etiology in such patients. The purpose of the present study is to determine the distribution of pediatric retinal dystrophies by clinical subtype at a referral center and to calculate the frequency of confirmatory genetic tests.

Methods: A retrospective chart review was conducted at a single academic medical center for patients less than 18 years of age with a diagnosis of retinal dystrophy examined by a retinal dystrophy specialist between June 2012 and June 2015.

Results: Sixty probands were included. 35 (58% of) probands were male. The most common diagnoses were Stargardt disease (17, 28%), Leber congenital amaurosis (15, 25%), and X-linked retinoschisis (8, 13%). 47 (78.3% of) probands underwent genetic testing that yielded a confirmatory result in 37 (79%). In four probands (7%), no mutations were identified in the genes tested. Three probands had mutations in genes that were not concordant with the clinical diagnosis. These included a misdiagnosis of Leber congenital amaurosis for Alstrom disease, X-linked retinitis pigmentosa for blue cone monochromacy, Usher syndrome for retinitis pigmentosa with coincidental non-syndromic hearing loss from a mutation in GJB2.

Discussion: There was a high rate of confirmatory genetic testing, although a few unexpected results led to a re-evaluation of clinical diagnoses.

Conclusion: Genetic testing is extremely valuable in the management of pediatric retinal dystrophies.

Clinical Characteristics of Isolated Foveal Hypoplasia: A Case Series

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Introduction: Foveal hypoplasia (FH) is a rare entity consisting of decreased visual acuity (VA), nystagmus, blunted foveal reflex and poorly defined fovea. It is often associated with aniridia, albinism or other ocular abnormalities. Case reports of isolated foveal hypoplasia (IFH) usually describe patients with nystagmus and poor visual acuity(1). In our tertiary pediatric ophthalmology practice, we describe a case series of nine patients who do not conform to the previously reported clinical characteristics of IFH.

Methods: A retrospective chart review was conducted at two tertiary pediatric ophthalmology centers from 1990 to present. Foveal hypoplasia diagnosis was made by ophthalmoscopy exam. When available, visual acuity was correlated with optical coherence tomography (OCT) findings and fundus photos.

Results: Nine patients were identified with isolated foveal hypoplasia. All patients were Caucasian. VA ranged from 20/25 to 20/70. Six patients had some stereopsis, and 4 patients did not exhibit any nystagmus. OCT revealed decreased foveal depression and fundus photos showed abnormal maculofoveal vessels.

Discussion: Contrary to previous reports of IFH with severely decreased visual function, this series describes a wide clinical spectrum of IFH, including excellent VA and stereopsis. As described by Thomas et. al, visual acuity can be correlated with findings on OCT(2). Our case series may represent a spectrum of isolated foveal hypoplasia or foveal plana(3).

Conclusion: Isolated foveal hypoplasia can present with good visual acuity and stereopsis. Nystagmus may not occur in some patients.

Prevalence of refractive errors in pediatric patients with retinoblastoma
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Introduction: The main purpose of this study is to investigate refractive errors in children with retinoblastoma (RB).

Methods: An institutional review board-approved retrospective cohort study was undertaken at an ocular oncology practice in Miami, FL, USA. Subjects underwent examination under general anesthesia as part of their RB follow-up, which included evaluation by a single pediatric ophthalmologist from 2014 to 2015. Cycloplegic retinoscopy was performed and keratometry data was assessed with a hand-held Retinomax K-plus 3 kerato-refractometer (Righton Ophthalmic Instruments).

Results: The study included 62 eyes of 37 subjects with 18 (51%) males and 19 (49%) females. Seventeen eyes (27%) had hyperopia with SE equal or greater than 3.00 diopter (D). Nineteen (51%) subjects had anisometropia equal or greater than 0.5 D. Eight (13%) subjects had anisometropia equal or greater than 2 D. Astigmatism equal or greater than 1 D was present in 54 % of the eyes and astigmatism equal or greater than 1.5 D was present in 29%. Mean steepest corneal axis was 91.9 ± 34.0 degrees. The mean difference between refractive cylinder and corneal cylinder was 1.1 D.

Discussion: Large studies have validated that strabismus and refractive errors are significant risk factors for unilateral amblyopia. [1-3] Mild astigmatism (1.0 D - 2.0 D) has been associated with amblyopia in preschool children. [1] However, refractive errors in children with RB have not been studied. In our study, a significant proportion of eyes had significant astigmatism and anisometropia.

Conclusion: This study reports the high proportion of amblyogenic risk factors in children with RB, both in RB affected eyes and contralateral normal eyes. Significant experience in pediatric refraction and visual rehabilitation may help these children achieve maximal visual potential.


Treatment of retinoblastoma tumors with iris diode laser
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Introduction: Chemotherapy combined with laser application may be used to treat patients with retinoblastoma if globe salvage is possible. We present the clinical findings and outcomes in a series of such patients.

Methods: Retrospective review of patients with retinoblastoma treated with diode laser and systemic chemotherapy.

Results: 20 tumors in 15 eyes (4 small, 6 medium, and 10 large tumors) were treated continuously with diode laser. The power was gradually increased until visible changes were seen. Typically, small tumors whitened within 1-2 minutes. Medium and large tumors became edematous and developed petechial hemorrhages over several minutes. The mean number of laser sessions for small, medium, and large tumors was 2.3, 4.8, and 5.3, respectively. All tumors regressed. Final visual acuity outcomes were better than 20/50 in 5 eyes, between 20/60 and 20/200 in 5 eyes, and 20/400 or less in 5 eyes.

Discussion: Direct treatment of tumor cells by continuous laser application over several sessions combined with chemotherapy can induce regression of retinoblastoma tumors. Little has been published regarding the specifics of this therapy. We describe the changes that occur in tumors during this treatment.

Conclusion: Repetitive continuous diode laser treatment combined with systemic chemotherapy can successfully induce regression of retinoblastoma tumors, with globe salvage and preservation of useful vision.
The Effects of the Retinopathy of Prematurity Exam in Premature Neonates

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Introduction: To determine the systemic effects of retinopathy of prematurity (ROP) exam in premature neonates, we measured oxygen saturation (SpO2), heart rate (HR), abdominal somatic tissue oxygen saturation (StO2) and urinary biomarkers of hypoxia and oxidative stress.

Methods: Data collection was started 12-24 hours before the exam and up to 24 hours after the exam. SpO2, and HR were recorded using a Masimo Radical-7. StO2 was recording using CASMED’s FORE-SIGHT Tissue Oximeter. Urine collection was done by placing cotton balls in the baby’s diaper and extracted with a syringe. Urinary concentration of purines (hypoxanthine, xanthine and uric acid) were measured using HPLC.

Results: We enrolled 9 subjects to this pilot trial. We found that HR and SpO2 were not significantly different before, during, and 12 hours after exam. We found that StO2 decreased during the exam, and was significantly lower than baseline at 150 seconds of the exam. We also found a trend for decreased SpO2, HR, and increased apnea episodes within the 24-hour period after the exam. In subjects with higher oxygen requirement, urinary purine concentration increased during the 6-hour period after the exam.

Discussion: Our pilot data showed a decrease in abdominal StO2 during the ROP exam, despite a stable HR and SpO2. The mechanism for this finding is unclear, although it could be a pain-related sympathetic vasocostriction to the gastrointestinal vasculature.

Conclusion: The ROP exam may alter abdominal StO2. More data is required to determine the mechanism as well as the systemic effects of this preliminary finding.

Characterization of Errors in Retinopathy of Prematurity (ROP) Diagnosis by Ophthalmology Residents

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Introduction: To describe errors in ROP diagnosis made by ophthalmology residents.

Methods: Thirty-two ophthalmology residents from the United States were each presented sixteen web-based cases consisting of wide-field retinal images of ROP. Residents were asked to diagnose plus disease, zone, stage, and category (none, mild, type-2 ROP or pre-plus, treatment-requiring ROP) for each eye. Responses were compared to expert-consensus reference standards. The frequency and types of errors (disagreement with the standard) were analyzed with descriptive statistics and t-tests.

Results: The error rate in detecting any ROP (mild, type 2, or treatment requiring) was 58%, and for treatment-requiring ROP, the error rate was 52%. Misdiagnosis of treatment-requiring ROP as type 2 ROP was most commonly associated with incorrectly identifying plus disease (plus disease error rate = 16% with correct category diagnosis vs. 81% when misdiagnosed, p<0.001). The error rate was highest for type 2 disease (66%), with a trend toward under-diagnosis (57% under-diagnosis vs. 43% over-diagnosis, p<0.012). PGY-2 residents performed significantly worse than PGY-3 or -4 residents in identification of category, plus disease, and stage. There was no significant difference in error rates for zone between the three years (range 54-59%).

Discussion: In this study, residents misdiagnosed ROP more than half of the time, with identification of plus disease and zone being the salient factors leading to incorrect diagnosis. This raises concerns for mismanagement by inexperienced examiners according to established guidelines.

Conclusion: General ophthalmologists may provide ROP care; therefore, it is important to improve competency in ROP diagnosis by ophthalmology residents.
Cost Analysis of Remote Telemedicine Screening for Retinopathy of Prematurity

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Introduction: To compare costs of two screening modalities for retinopathy of prematurity (ROP) from a rural area in Canada: remote interpretation of images obtained by non-ophthalmic personnel versus inter-hospital transfer for in-person indirect ophthalmoscopy (BIO).

Methods: We conducted cost analysis from the perspective of the Ministry of Health using retrospective data (2009-2014) from an existing telemedicine screening program. Patient level data was used for infants screened via telemedicine. We created a hypothetical control group that comprised of minimum number of in-person visits and inter-hospital transfers if the existing patients were screened by BIO. In total, costs consisted of cost of in-person exams, transfers, setting up and ongoing costs of telemedicine screening. Cost variables were compared using the Mann-Whitney U test.

Results: 102 infants were screened via telemedicine. Only 3% of infants needed at least one transfer in the telemedicine group and 90% in the control group. Average total cost per examination was $4,855±$515 (2014 Canadian dollars) for the telemedicine group and $19,834±13,814 for the control group (p<0.001). The main cost for the control group was inter-hospital transfer cost ($19,489±$13,605) compared to ($635±$3,968) for the telemedicine group.

Discussion: The telemedicine group reported significantly lower average total cost per visit compared to the hypothetical control group. Inter-hospital transfer was the main contributing cost.

Conclusion: Telemedicine screening for ROP appears to be cost saving for this remote neonatal unit when compared to inter-hospital transfers for BIO. This information will be useful for planning similar ROP services for remote areas.

Analysis of Discrepancy between Diagnostic Clinical Examination and Corresponding Evaluation of Digital Images in the e-ROP Study

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Introduction: Telemedicine in retinopathy of prematurity (ROP), including the ‘Telemedicine approaches to evaluating acute-phase ROP (e-ROP)’ Study,(1) use ophthalmologists’ examination findings as the standard for the accuracy of grading digital retinal images. This assumes an accurate diagnosis; studies suggest substantial ROP diagnosis variability among clinicians using indirect ophthalmoscopy. This report characterizes the false negative and false positive results in e-ROP image evaluation.

Methods: Secondary analysis of an observational cohort study data. Consensus review by four ROP experts of 188 image sets of discrepancies for stage 3 ROP, zone I ROP or plus disease between results of examination and remote image set grading by trained readers. If >100 cases, 40 were randomly selected.

Results: Among false negatives on image grading by trained readers, 56.3% of 32 reviews agreed with exam that ROP was present in zone I, 45.0% of 40 that stage 3 ROP was present, but only 5% of 20 for presence of plus disease. Among false positives, 90.0% of 40 agreed with trained readers that zone I ROP was present when not noted on exam, 57.5% of 40 with stage 3 ROP, and 25% of 16 for plus disease.

Discussion: Consensus review of discordant cases in e-ROP documented both agreement and disagreements between the clinical examination and image grading. Significant abnormalities were sometimes noted in one modality that were not noted on the other.

Conclusion: This report highlights limitations and advantages of both remote evaluation of fundus images and bedside clinical examination of infants at risk for ROP.

Infant Race/Ethnicity as a risk factor for Type 1 ROP in a Colorado Cohort

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Introduction: The objective of this study was to determine the understudied relationship of the infant’s race/ethnicity for Type 1 ROP in a racially and ethnically diverse Colorado Cohort.

Methods: We conducted a retrospective review on all infants examined for ROP from 2008- June 2014 (n=1303). We excluded infants with an unknown race/ethnicity (n=98), or infants with Type 2 (n=48) or low-grade (n=275) ROP. Ultimately, 77 infants with Type 1 and 805 infants with no ROP remained in the analytic dataset. We conducted univariate and multivariate logistic regression analyzes. Covariates included gender, birth weight, gestational age at birth, and birth order.

Results: As compared with Non-Hispanic White babies, African American babies were less likely to develop Type 1 ROP (RR = 0.26 95% Confidence Intervals (CI) 0.06-1.04). In contrast, Asian infants had an increased risk for Type 1 ROP (RR=2.33 95% CI=0.93-5.83), and we found a slight increase in risk for Hispanic babies (n = 31, RR = 1.05 95% CI = 0.67-1.65). Following adjustment for covariates, the adjusted odds ratios for African American, Asian and Non-Hispanic white were: 0.25 (95% CI= 0.04-1.42), 1.53 (95% CI= 0.28-10.39) and 0.86 (95% CI = 0.39-1.89), respectively.

Discussion: In this large Colorado cohort, African American babies were less likely and Asian babies were more likely to develop Type 1 ROP.

Conclusion: Our findings highlight the importance of race/ethnicity as an important risk factor in the development of severe ROP.

Validation of the Colorado Retinopathy of Prematurity model for detecting ROP in an expanded Colorado cohort

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Introduction: The purpose is to validate the performance of the Colorado Retinopathy of Prematurity model (CO-ROP) in an expanded cohort of Colorado preterm infants.

Methods: The CO-ROP model was applied to 1,225 preterm infants. Sensitivities and specificities for detection of high grade, low grade, and overall ROP with corresponding 95% confidence intervals were calculated using exact Clopper Pearson type test.

Results: Of the 1,225 infants included in the analysis, 75 (6.2%) developed Type 1 ROP, 50 (4.1%) developed Type 2 ROP, and 294 (24.0%) developed low grade ROP. The CO-ROP model identified 67.0% (845) of the infants in this cohort as being at risk for ROP and would have reduced screening of infants by 27.2% compared to current 2013 criteria. Application of the CO-ROP model to our expanded cohort had an overall sensitivity of 100% (95% CI 97.1-100%) for high grade ROP, 95.9% (95% CI 93.6-97.6%) for all grades of ROP, and a specificity of 39.2% (95% CI 35.8-42.7%) for no ROP. Using this model, 17 infants with low-grade ROP were missed when compared to 2013 guidelines.

Discussion: The CO-ROP model was highly sensitive in our large Colorado cohort of infants and did not miss any infants with high grade ROP. The model reduced more than a quarter of exams when compared to current screening guidelines.

Conclusion: The CO-ROP model has the potential to improve ROP screening efficiency, yet further validations with larger and more diverse patient populations are needed before acceptance and implementation of a new screening model.
Correlation between Serum Insulin-Like Growth Factor and Postnatal Weight in Premature Infants

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**Introduction:** Weights are used as surrogates for serum insulin-like-growth-factor-1 (IGF-1) in ROP prediction, despite limited published data demonstrating correlation in premature infants. We evaluated the association between postnatal serum IGF-1 and weight in a cohort of premature infants at risk for ROP.

**Methods:** Prospective cohort study of 74 infants with birth weight <1251g at 3 hospitals. Weekly IGF-1 assays and daily weights were collected. Correlation between IGF-1 and weights was assessed with Pearson’s coefficient (r>+0.7 very strong, +0.4 to +0.69 strong, <+0.4 weak or negative). Subgroup analysis was performed for presence or absence of ROP. Variability of IGF-1 and weights was calculated by standardizing measurements, fitting a linear model, and assessing variability not explained by trend over time.

**Results:** IGF-1 levels and weight were very strongly (n=32)/strongly (n=17) correlated in 66% of infants. However, the association was weak/negative in 34% of infants. NEC, hydrocephalus, sepsis, PDA, diuretics were unrelated to degree of correlation. Weak correlation was present in 46% of infants without ROP (median 7 IGF-1 measurements), and 14% of those with ROP (median 12.5 IGF-1 measurements). Variability among IGF-1 measurements was 0.69 and among weights 0.12.

**Discussion:** While most infants had strong correlation between IGF-1 and weight, a third of infants had poor correlation, which appeared to be due to a combination of higher measurement variability in IGF-1 assays and having fewer measurements. Medical conditions were not a factor.

**Conclusion:** Not all premature infants exhibit strong correlation between IGF-1 and weight. Weight measurements have less variability and may be a more reliable predictor of ROP.

Retinal haemorrhages in retinopathy of prematurity: a possible indicator of severity.

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**Introduction:** Retinal haemorrhages are common in severe retinopathy of prematurity; Retcam imaging permits easier delineation and documentation. Haemorrhages may be a marker of severe disease; the various types of retinal haemorrhages are documented in 6 infants with Type 1 ROP.

**Methods:** Prospective case series

**Results:** Six consecutive infants with severe ROP showed retinal haemorrhages documented with Retcam photography. The types of haemorrhages were: posterior and adjacent to the ridge, large blot, dot, splinter and preretinal. Two infants with severe ROP showed extensive small dot haemorrhages. All the haemorrhages except for the dot type were also apparent on indirect ophthalmoscopy. The dot haemorrhages were too small to be seen with indirect ophthalmoscopy.

**Discussion:** Multiple types of haemorrhages are present in ROP. The dot haemorrhages are a new observation and are similar to those seen in diabetic retinopathy. In adults with background diabetic retinopathy, dot haemorrhages are too small to be seen on indirect ophthalmoscopy. Possibly more infants with severe ROP have dot haemorrhages that are only visibly on Retcam photography under general anaesthesia. As in diabetic retinopathy they likely represent ischaemia.

**Conclusion:** While haemorrhages are not one of the major categories routinely documented in ROP examinations, their presence may be indicative of severe disease. Retinopathy of prematurity may be more akin to diabetic retinopathy than previously realized given our report of multiple dot haemorrhages. In general, haemorrhages maybe a useful sign that ischaemia is present.
A shift in retinopathy of prematurity diagnosis at treatment: A 10-year retrospective review

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Introduction: The severity of retinopathy of prematurity (ROP) for which treatment is recommended is well defined by the results of the Early Treatment of ROP trial (1). This study evaluates whether there has been a change over the past decade in the characteristics of ROP (stage, zone and plus disease) at the time of treatment.

Methods: Retrospective chart review of all ROP patients requiring treatment at Children’s Hospital of Philadelphia from January 2005 to December 2014. Two time periods were compared, 2005-9 and 2010-4 using t-test for means and chi-square test for proportions.

Results: Over the 10-year period, 189 patients were treated for ROP. 165 had complete data for the final analysis (98 in 2005-9, and 67 in 2010-4). The two groups are similar in mean birth weight (713 vs. 721g, p=0.83) and mean gestational age (25.3 vs. 25.1 weeks, p=0.48). The mean post-menstrual age at treatment was smaller in 2010-14 (36.5 vs. 37.5 weeks, p=0.04). Significantly more infants with zone 1 disease and less severe plus were treated in 2010-4 (Table 1).

Table 1: ROP Characteristics at the time of treatment

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
<th>Treated 2005 - 2009</th>
<th>Treated 2010 - 2014</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 2</td>
<td>5 (3%)</td>
<td>4 (4%)</td>
<td>1 (1%)</td>
<td>0.34</td>
</tr>
<tr>
<td>Stage 3</td>
<td>160 (97%)</td>
<td>94 (96%)</td>
<td>66 (99%)</td>
<td></td>
</tr>
<tr>
<td>Zone 1</td>
<td>44 (27%)</td>
<td>14 (14%)</td>
<td>30 (45%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Zone 2</td>
<td>121 (73%)</td>
<td>84 (86%)</td>
<td>37 (55%)</td>
<td></td>
</tr>
<tr>
<td>Plus None</td>
<td>7 (4%)</td>
<td>2 (2%)</td>
<td>5 (8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Plus PrePlus</td>
<td>18 (11%)</td>
<td>3 (3%)</td>
<td>15 (23%)</td>
<td></td>
</tr>
<tr>
<td>Plus Plus</td>
<td>139 (85%)</td>
<td>93 (95%)</td>
<td>46 (70%)</td>
<td></td>
</tr>
</tbody>
</table>

Discussion: Significantly more babies with zone 1 disease were treated in the 2010-4 period. Since stage 3 zone 1 ROP meets treatment criteria without the presence of plus disease, it follows that a lower rate of plus but increased pre-plus diagnoses were noted during the latter time period.

Conclusion: Our observed shift in ROP diagnoses in the latter time period may reflect variability in clinical diagnosis, and/or better availability of digital imaging for review of ROP.


Neonatal Intensive Care Unit (NICU) Management during Treatment for Type 1 Retinopathy of Prematurity and Eye Outcomes

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Introduction: There are no published guidelines for NICU management during Type 1 retinopathy of prematurity (ROP) treatment. This study assessed NICU care and eye outcomes.

Methods: We reviewed neonates with Type 1 ROP treated with laser January 2009-June 2015 at a Level IV NICU* to determine intubation requirements, treatment duration, median times to return to respiratory and feeding baselines, and eye outcomes at >/=6 months of follow-up.

Results: Forty-three of 49 infants were treated with laser (gestational age 24.1±1.6 weeks, birth weight 684.5±284.7g). Nine (21%) were intubated at baseline (base-ETI), 10 (23%) electively intubated before laser (elect-ETI), 3 (7%) required urgent intubation during treatment (urg-ETI), and 21 (49%) received no intubation (no-ETI). Treatment duration for no-ETI was shorter (0.8 hours) than all intubated groups (base-ET 1.0, pre-ETI 1.4, urg-ETI 2.0). Return to respiratory and feeding baselines were markedly prolonged for elect-ETI at median 90.0 hours and 75.0 hours, respectively, compared to base-ETI (16.8, 3.0), urg-ETI (51.7, 30.0), and no-ETI (11.0, 5.9). Eye outcomes included macular scar (14%), retinal detachment (8%), legal blindness (17%), and strabismus (28%) with elect-ETI having poorest outcomes (20%, 30%, 40%, 40%, respectively).

Discussion: Elective intubation for laser treatment may have association with longer return to respiratory and feeding baseline when treating extremely-low-birth-weight infants for Type 1 ROP.

Conclusion: These preliminary data indicate the need for further study of NICU management during laser treatment to ascertain whether differences persist when we account for differences in clinical severity.

Introduction: To compare retinal vascularization extent between treated and untreated eyes after unilateral monotherapy with intravitreal bevacizumab (IVB) for type 1 ROP in zone I or posterior zone II.

Methods: A retrospective chart review was performed for all infants treated with IVB in one eye from March 2012 - April 2014. The other eye came close to but did not meet treatment criteria1. Vascular markings on color fundus and FFA images pre and post treatment were reviewed. A linear measurement in disc diameter (DD) was taken from the center of the temporal edge of the optic disc extending through the fovea to the border of vascular-avascular retina using ImageJ software.

Results: Five infants were included. Vascularization extent between treated and untreated eyes was within 2DD on FFA performed at a mean of 10.2±2.9 months post treatment. All treated eyes vascularized to ora serrata nasally and none developed unfavorable structural outcomes1 at a mean follow up of 25.7±11.2 months. All but one untreated eye vascularized into zone III.

Discussion: In this cohort, we observed no difference in extent of vascular growth after a single injection of bevacizumab between treated and untreated eyes of the same patient using FFA. Vascularization of peripheral retina continued beyond original disease similarly in both eyes. All treated eyes had vascularized into zone III.

Conclusion: Vascular growth was comparable between treated and untreated eyes of the same infant following unilateral bevacizumab treatment. Systemic absorption does not appear to impede retinal vascularization in the contralateral untreated eye.

Animal model for retinopathy of prematurity laser surgery training

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Introduction: A previously published study reported that 46% of young pediatric ophthalmologists believe that they were not adequately trained in fellowship to perform ROP laser surgery and 74% believe that a wet lab simulation experience would be the preferred option to help fellows develop this skill.1 The goal of this study is to evaluate New Zealand white and Dutch belted pigmented rabbits as potential teaching models for ROP laser training.

Methods: Rabbits were placed under general anesthesia, dilated, examined and treated with a near-confluent pattern of photocoagulation using a laser indirect ophthalmoscope. Five faculty ophthalmologists performed the procedure on a rabbit and completed a brief survey.

Results: The nonpigmented fundus of the New Zealand white rabbit demonstrated very little photocoagulation tissue response whereas the Dutch belted rabbit demonstrated a very good tissue response. Costs were $150 per rabbit and $15 per hour for anesthesia service. All 5 ophthalmology faculty surveyed rated the Dutch belted rabbit eye as similar or very similar to a human infant eye for the purposes of a scleral depressed examination and laser photocoagulation.

Discussion: The adult rabbit globe is similar in size to that of a human infant and provides an examination and laser treatment experience similar to that of an infant with ROP as determined by faculty ophthalmologists.

Conclusion: The Dutch belted rabbit may be used to simulate the retinal examination and treatment of human infants with ROP. Future work will be to evaluate effectiveness of this simulation to enhance the training of fellows.


Eye Strain Associated with Childhood-Onset Strabismus

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Introduction: We describe the association of the symptom of eye strain with childhood-onset strabismus and its association with clinical characteristics.

Methods: 71 patients with childhood-onset strabismus (aged 13-82 years, median 39 years) prospectively rated frequency of eye strain on a Likert-type scale (never, rarely, sometimes, often, or always). Patients were required to have no previous surgery or surgery more than 10 years previously and not wearing prism. Patients were classified as having or not having, sensory fusion, motor fusion, microtropia (SPCT <10 pd at distance or near), and / or DVD. Strain ratings were converted to a score of 0 to 4 points (never to always) and mean scores were compared using t-tests for each characteristic using available data.

Results: 46 (65%) patients with childhood-onset strabismus rated strain as more than rarely. More frequent strain was experienced by patients with microtropia vs. larger deviations (2.5 ± 1.3 points vs. 1.8 ± 1.1 points, P=0.02). More frequent strain (albeit non-significant) was experienced by patients with vs. without motor fusion (2.4 ±1.2 points vs. 2.0 ±1.2 points, P=0.2). Similar frequency of strain was reported for patients with and without sensory fusion (2.2±1.3 points vs. 2.1±1.0 points, P=0.8) and with and without DVD (2.1 ±1.3 points vs. 2.2±1.1 points, P=0.8).

Discussion: The symptom of eye strain is commonly experienced by patients with childhood-onset strabismus.

Conclusion: In childhood-onset strabismus, eye strain appears to be associated with microtropia and motor fusion.
Medically Led Virtual Adult Strabismus Clinic
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Introduction: The purpose of creating the virtual service is to reduce waiting times in the Adult Strabismus Service and fulfill the local hospital target for new patient referrals using existing resources and to drive efficiency despite the constraint of limited contracted doctor’s time. The principle of the medically led virtual care pathway was to reduce face-time contact and maintain standard of care.

Methods: New referrals letter were vetted and appropriate cases were invited to attend for an assessment in the ‘Eye Movement Service’. An adult strabismus questionnaire (AS20) was completed prior to a standardized orthoptic assessment (including pupil and intracocular pressure check); followed by non-mydriatic wide-angle fundus photos and 9 positions of gaze. All case notes were reviewed by a strabismus specialist to decide on outcomes.

Results: 138 patient’s data from 146 cases in the prospective database (8-month-period, 8 failed to attend). The waiting time reduced from 10.4 to 4.9 weeks, correlation coefficient =-0.566, showing statistically significant reduction in waiting time with a strong negative linear correlation.

26.1% (36/138) were discharged after one assessment, 31.9% (44/138) were followed up by orthoptists; resulting in a reduction of demand to the doctor’s clinic by 58%. The AS20 scores are lowest in those needing surgery.

Discussion: Virtual clinics are popular in high volume areas e.g. Glaucoma and Medical retina. It is a viable option to apply this to an adult strabismus service to triage cases that do not need direct face-to-face medical input.

Conclusion: The virtual clinic can reduce waiting times effectively, maintain the standard of care and optimise the use of the doctor’s clinical time.

Ophthalmic prisms: Optical measurement errors and a simple device to minimize the errors
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Introduction: Our work is to demonstrate the detailed measurement errors of ophthalmic prisms and to report a new set of errors that are induced by rotating the prisms about their coronal axis. To avoid or to minimize the errors, a simple device - a prism frame are introduced.

Methods: To demonstrate the systematic errors, plastic and glass prisms were measured in both Prentice positions and minimum deviation positions. To show randomized errors the prisms were measured when they are rotated to a different angle about their vertical and coronal axes. Our prism frame allows rotations about vertical and coronal axes and can firmly hold the prisms in any secondary position.

Results: We showed that measurement errors of both glass and plastic prisms were significant when they were placed at incorrect positions including rotations about their vertical and coronal axes. Consistent positions can be obtained using the marks on the frame and randomized errors were avoided by using the prism frame.

Discussion: To minimize the errors, physicians should be aware of the errors and have a way to hold the prisms at a consistent position. Our measurements have indicated that ophthalmic prisms are not optimal devices for strabismus measurement and there is a need for better devices in strabismus management.

Conclusion: The measurement errors of ophthalmic prisms are significant, especially for glass prisms. So it is important to hold the prisms in a position to allow the line of sight to pass the prisms in the right direction vertically and horizontally.
**Role of a Standardized Prism Under Cover Test in Assessing Dissociated Vertical Deviation**

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**Introduction:** We compare a standardized 10-second prism under cover test (PUCT) with a prism and alternate cover test (PACT) in patients with dissociated vertical deviation (DVD).

**Methods:** 37 patients with a clinical diagnosis of DVD were measured, at distance fixation, with PACT fixing with the habitually fixing eye, and with PUCT, fixing both right and left eyes. The PUCT was standardized, using a 10-second cover for each prism magnitude, until the deviation was neutralized. We compared the magnitude of hyperdeviation by PACT and PUCT in the non-fixing eye using paired non-parametric tests. Agreement between PACT and PUCT was assessed by intraclass correlation coefficients and the frequency of discrepancies more than 4 pd was calculated.

**Results:** The magnitude of hyperdeviation was greater when measured with PUCT vs. PACT (median 10 pd vs. 4 pd, P<0.0001, range 0 to 30 pd vs 0 to 25 pd). Agreement was moderate, with an ICC of 0.73 (95% CI, 0.60 - 0.82). 59% of PUCT measurements were at least 4 pd greater than PACT and only 3% were smaller.

**Discussion:** A standardized 10-second PUCT may yield more representative values for quantifying DVD.

**Conclusion:** A standardized 10-second prism under cover test yields greater values than a prism and alternate cover test in the majority of cases, which may be important for surgical planning.

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**Fixational eye movements in Strabismus**

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**Introduction:** Microsaccades are miniature eye movements that constantly change the gaze during attempted visual fixation. Saccades and microsaccades represent an oculomotor continuum and are produced by common neural machinery1. Strabismic patients have impaired binocular horizontal saccades2. We examined the fixational eye movements (microsaccades and ocular drifts) in strabismic patients and correlated the severity of their disconjugacy with strabismus angle and binocular vision.

**Methods:** Eye movements were recorded with infrared video-oculography in 13 strabismic patients (stereopsis present=5;stereopsis absent=8) and 17 controls while they performed a visual fixation task.

**Results:** There was a decrease in the frequency of microsaccades in strabismics(mean frequency :strabismic=0.76±0.3Hz, controls=1.1±0.5Hz; Mann-whitney test p=0.03). The microsaccades in strabismic subjects were also disconjugate. Binocular disconjugacy was greater in patients with no binocular vision (strabismic stereopsis absent=0.53°±1.7°;strabismic stereopsis present=0.41°±1.2°;controls = 0.14°±0.19° one-way ANOVA p<0.0001) or when they had a larger angle strabismus (controls: 0.14±0.19°; small-angle(<15PD, n=4):0.20±0.29°;medium-angle(15-30PD, n=4):0.45±1.3°;large-angle (>30 PD, n=5):0.69±2.1,one-way ANOVA p<0.0001). The strabismics also had a subtle disconjugacy in the drift velocity (strabismic=1.05°/sec±1.8°/sec; controls=0.89°/sec ±1.0°/sec, ttest p = 0.004).

**Discussion:** Microsaccades are disconjugate in strabismics and exceed the capabilities of the sensory system to fuse the normal fixation disparity of 0.05-0.35°. The disconjugacy is more pronounced in patients with large angle strabismus and absent binocularity.

**Conclusion:** The increased disconjugacy of fixational eye movements in strabismus patients suggests that the fine-tuning of the motor and visual systems responsible for achieving binocular fusion is impaired with deficient oculomotor adaptive capabilities.

**References:**
Neuroimaging and surgical outcomes in acute comitant esotropia

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Introduction: The acute onset of comitant esotropia in older children is a relatively uncommon presentation of strabismus, which raises the concern for central nervous system abnormalities. We evaluated neuroimaging results and surgical outcomes in a group of patients with this disorder.

Methods: Children who presented with acute comitant esotropia after age 3 years underwent neuroimaging if they had diplopia, headaches, or no history of strabismus in first-degree relatives. We reviewed the medical records of these patients. Surgical outcomes were recorded for patients who had > 4 months of follow-up. Surgery was considered successful if the horizontal deviation was less than 10 prism diopters (PD).

Results: Twenty-five patients were included. None had a prior history of strabismus and none had hyperopia > 2 diopters. Age at presentation ranged from 3-11.5 years old (mean 5.9 years). The range of esotropia was 20-80 PD (mean 38 PD). All 25 patients had normal magnetic resonance imaging results. Surgery was successful in 17/20 patients (85%) who were followed more than four months. Follow-up ranged from 4 months to 11 years (mean 2.3 years).

Discussion: Although central nervous system tumors and Arnold-Chiari malformation have been reported in children with acute comitant esotropia, none of our patients had neuroimaging abnormalities. Surgical outcomes were good.

Conclusion: Neuroimaging appears to be of limited value in the evaluation of older children with acute comitant esotropia. The success rate of surgery is better than most other types of childhood strabismus.

Small Angle, Non-paralytic Hypertropia in Adults

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Introduction: The purpose of this study was to describe the clinical characteristics of non-paralytic, small angle hypertropia in a population-based cohort of adults.

Methods: The medical records of all adults (> 18 years of age) diagnosed with non-paralytic hypertropia from January 1, 1985, through December 31, 2004, were retrospectively reviewed.

Results: A total of 99 adults were diagnosed with an unspecified hypertropia during the 20-year period, constituting 14.3% of all forms of adult-onset strabismus observed in this population. The mean age at diagnosis was 71 years (range, 32.7 to 97.1 years) and 68 (57.6%) were female. There was a significant increase in incidence (p < 0.001) with increasing age. The mean initial hypertropia was 2.0 PD (range, 1 to 12) at distance and 1.7 PD (range, 1 to 10) at near. Approximately 75% were managed with prisms while less than 5% underwent surgical correction.

Discussion: Small angle, non-paralytic hypertropia is a poorly understood but common disorder among older adults who develop strabismus. The presenting angle of deviation is generally quite small and often overlooked or missed by the examining physician, resulting in a delayed diagnosis and frustration for the patient.

Conclusion: Acquired small angle, non-paralytic hypertropia is a common disorder among adults, comprising 1 in 7 of all forms of newly-diagnosed strabismus in this 20-year cohort. Although the deviation is often small, most patients are symptomatic and require prism or surgical intervention.
Acute Acquired Comitant Esotropia in Older Children and Adults

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Introduction: Acute acquired comitant esotropia is a rare condition that can occur at any age; however, evaluation and treatment success differ depending on age of onset. This study focuses on this condition in older children and adults. It identifies presenting characteristics, brain imaging results, surgical interventions, and surgical outcomes.

Methods: Retrospective review of eleven patients with acute onset of comitant esotropia. All patients underwent a complete ophthalmic examination and brain imaging.

Results: Average age at presentation was 22 years old and average follow-up was 9 months. All patients presented with acute onset of esotropia with diplopia and no other neurologic symptoms. All patients were able to demonstrate fusion. Brain imaging was negative in all patients. Strabismus surgery was undertaken in ten patients (91%). One patient opted to use prism glasses for relief of diplopia. At final follow-up, all patients had relief of diplopia and restoration of stereopsis. Alignment ranged from orthophoria to mild esophoria.

Discussion: Our series shows that older children and adults who present with acute esotropia, diplopia, fusional capacity, and no other neurologic symptoms do well following strabismus surgery without adjustable sutures. The brain imaging for all patients was negative, indicating that brain imaging in this condition may be unnecessary.

Conclusion: Acute comitant esotropia of older children and adults should be viewed as a defined condition. Patients do well following basic strabismus surgery and likely do not require brain imaging as part of their work-up.


Restrictive Fibrous Bands Originating From the Oculomotor Nerve (CN3) in Familial Duane Retraction Syndrome (DRS)

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Introduction: Fibrous bands cause restrictive strabismus, yet their pathogenesis is mysterious. We studied a familial case suggest neural origin of bands.

Methods: We employed high resolution, T2 weighted, surface coil orbital MRI to investigate the anatomy of incomitant strabismus in a father and son with DRS, correlating with clinical motility.

Results: The 2 year old son had right enophthalmos with markedly limited abduction, supraduction, and infraduction, and mildly limited adduction accompanied by palpebral fissure narrowing. Forced duction testing under anesthesia revealed diffuse restriction. The 30 year old father was orthotropic in central gaze but had limited right eye abduction and palpebral fissure narrowing in adduction.

In unilaterally affected right orbits of both patients, no abducens nerve was visible. The inferior division of CN3 both entered the inferior compartment of the lateral rectus muscle (LR), and was contiguous with dense bands running anteriorly to the inferolateral scleral entry of the short posterior ciliary nerves. In the son, another short band inserted on the posterior sclera inferior to the optic nerve.

Discussion: In these cases, the inferior division of CN3 was both the source of misinnervation and of fibrous bands targeting sites of normal ciliary nerve perforation of the sclera. Recognizing that familial Duane retraction syndrome is caused by mutation in nerve pathfinding molecules such as a2-chimaerin, we speculate that fibrous bands may represent abortive nerves mis-targeted to scleral emissary canals.

Conclusion: Occurrence of fibrous bands in familial DRS suggests that bands are caused by aberrant axons pathfinding by CN3.

Anatomical variations and clinical implications of extraocular muscles insertions following retinal detachment scleral buckle surgery

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Introduction: Strabismus following scleral buckle (SB) procedures may be associated with scarring, trauma, and malposition of disinserted extraocular muscles (EOM). SB procedures may result in increased axial length and myopization, but the effect of SB on EOM insertions and ocular alignment are unknown

Methods: This retrospective study reviewed consecutive patients who required horizontal strabismus surgery following a SB procedure, during which records indicated that the EOMs had not been disinserted. No patient had a history of strabismus before the SB procedure. Muscles insertions were measured in millimeters (mm) using calibrated calipers, from the limbus to the central portion of the muscle insertion

Results: Eleven patients were enrolled, eight (72%) of whom had posteriorly displaced muscles. Eight medial rectus (MR) and 6 lateral rectus (LR) muscles were operated on. MR insertions measured 7.8 +/- 2.1 mm posterior to the limbus (range 5.5-10.5 mm) and LR insertions measured 10 +/- 3.6 mm posterior to the limbus (range 6.5-15 mm). Five (62%) MR (9.3 +/- 1 mm posterior to the limbus, range 8-10.5 mm) and 4 (66%) LR (11.5 +/- 3.3 mm posterior to the limbus, range 8-15 mm) were found to be abnormally positioned. Horizontal deviations were larger in patients with posteriorly displaced muscles (24 +/- 9.3 PD vs. 14 +/- 5.2 PD, P=0.02). A relationship between posterior displacement and type of deviation was seen in 50% of the patients; no uniform relation was found between muscle insertion, intraoperative forced-duction-testing or time interval between surgeries

Discussion: Anatomical changes of the EOM insertion are common in patients with strabismus following SB procedures

Conclusion: Surgeons must be aware of potential anatomical changes when performing strabismus surgery following SB procedures


The anatomical basis of the alphabet

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Introduction: Primary V-pattern strabismus is frequently presumed to be due to bilateral superior oblique palsy. Such strabismus is often seen in the context of craniofacial disorders where excyclorotation of the orbital contents has been observed. We wished to assess the anatomical contribution to A- and V-pattern strabismus in patients without a recognised craniofacial disorder.

Methods: Patients with alphabet pattern strabismus (n=8) were prospectively identified in the ophthalmology clinic at BC Children’s Hospital, Vancouver. T2-weighted coronal section orbital MRI was performed. A normal pediatric control group (n=15) was selected from age-matched controls. The position of the extraocular muscles was analysed in a blinded fashion.

Results: In all subjects with V-pattern strabismus, the angle subtended to the midline by the horizontal recti (Mean 187.33 +/- 8.69 S.D) and the vertical recti (27.00 +/- 5.93) was found to exceed the mean from the control population (176.2 +/- 3.55 and 16.87 +/- 5.17) by a significant degree (p < 0.05).

Discussion: In this group of patients with V-pattern strabismus, the position of the rectus muscles appears to be excyclorotated within the globe. These patients do not display external features suggestive of this. Such patients may represent a forme fruste of a craniofacial disorder.

Conclusion: The anatomical configuration of the extraocular muscles may play a significant role in the etiology of alphabet pattern strabismus. This should be borne in mind when planning management.
Neck muscle asymmetry in ocular torticollis with positive head tilt test

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Introduction: Craniofacial asymmetry secondary to ocular torticollis has been well described. However, the asymmetry of neck muscle which is directly related to head tilt posture has not been evaluated appropriately in ocular torticollis. The purpose of this study was to evaluate the asymmetry of sternocleidomastoid (SCM) muscle in patients with ocular torticollis objectively.

Methods: A retrospective review identified ocular torticollis patients with positive head tilt test who had been evaluated the asymmetry of SCM muscle with neck ultrasound or magnetic resonance imaging. The presence and type of difference in the thickness between right and left SCM muscles were assessed and analyzed according to age, angle of head tilt, and angle of deviation. The SCM asymmetry was defined as a case with difference of 10% or more in the thickness between bilateral SCM muscles.

Results: Patients with ocular torticollis (63 with superior oblique palsy, and 1 with inferior oblique palsy) were evaluated at a mean age of 51.8 months. Twenty five patients (39.1%) had SCM asymmetry. Of the patients with neck asymmetry, 15 patients (60.0%) was less than 24 months of age (the youngest: 9 months) and 18 (72.0%) showed a thicker SCM in the site opposite to the head tilt. However, older patients with neck asymmetry tended to have a thicker SCM in the head tilt site. There was no difference in age, angle and direction of head tilt, or deviation between the patients with and without asymmetry.

Discussion: One third of ocular torticollis was associated with SCM muscle asymmetry, and more than half of cases were already determined in those younger than 24 months. A thicker SCM muscle was more frequently in the head tilt site in the older patients, suggesting the tightness, or contracture due to long-term abnormal head posture.

Conclusion: Our findings support the importance of early correction of torticollis in these patients.

Magnetic Resonance Imaging (MRI) in Dissociated Strabismus Complex (DSC) Demonstrated Generalized Hypertrophy of Extraocular Muscles (EOMs)

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Introduction: DSC is a poorly-understood cause of strabismus that includes dissociated vertical (DVD) and dissociated horizontal (DHD) deviations. We employed MRI to evaluate the EOMs in patients with DSC.

Methods: We prospectively studied five patients with DSC aged 12-42 (mean 25) yrs, and 15 age-matched, orthotropic control subjects. All patients had DVD, and three of these also had DHD. We employed high resolution, surface coil MRI with thin, 2-mm slices and central target fixation. The volumes of the rectus and superior oblique muscles in the region 12 mm posterior to 4 mm anterior to the globe-optic nerve junction were measured in quasi-coronal sections in central gaze.

Results: Patients with DSC exhibited statistically significant generalized volume increase of all rectus and superior oblique muscles ranging from 8.6% for lateral rectus to 22% for superior oblique (P <0.05). There were no structural or innervational abnormalities of EOMs in affected orbits.

Discussion: DSC is composed of various combinations of sursumduction, excycloduction, and abduction that do not conform to Hering’s law. Although consequent enlargement of the superior and lateral rectus muscles might have been anticipated in DSC, instead we found generalized enlargement of all rectus and the superior oblique EOMs. Generalized hypertrophy may be related to abnormal discharge patterns of motor neurons innervating the EOMs previously demonstrated in monkeys with DSC, and is consistent with similar changes in both agonist and antagonist EOMs in experimentally induced strabismus in monkeys.

Conclusion: DSC is associated with generalized EOM hypertrophy in the absence of other orbital abnormalities.

References:
Anomalous orbital structures resulting in vertical retraction syndrome

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Introduction: Vertical retraction syndrome is a rare, congenital eye vertical movement disorder characterized by the retraction of the globe and narrowing of the palpebral fissure during downward or upward gaze.

Methods: Ten patients with unilateral vertical retraction syndrome between 15 months and 20 years of age. The patients underwent MRI of the brain, brain stem, and orbits.

Results: All the patients exhibited anomalous orbital structures having MRI signal isointense to the extraocular muscles in the retrobulbar space of the affect orbits. Five children with hypertropia were characterized by limited depression, a light retraction of the globe during downward gaze and eyelid lag. MRI revealed anomalous orbital structures in the superonasal quadrant that between medial rectus and superior rectus or adjacent to the superior rectus. Two with intermittent exotropia, characterized by limited elevation, retraction of the globe and narrowing of the palpebral fissure during upward gaze. MRI showed anomalous orbital structures in the inferotemporal quadrant, one originates from the inferior rectus and another close to the lateral rectus. Three with hypotropia, MRI showed anomalous orbital structures situated between the optic nerve and the inferior rectus.

Discussion: Anomalous orbital structures are a main cause of vertical retraction syndrome. When eyelid lag was found since the early age, anomalous orbital structure was implied.

Conclusion: The anatomical difference of the orbital structures lead to atypical strabismus. The presence of unusual eye movement and MRI imaging may assist in diagnosis.


Dexmedetomidine oral sedation produces more oculocardiac reflex during strabismus surgery

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Introduction: The oculocardiac reflex (OCR) is a trigeminal afferent, vagal efferent reflex that variably impacts patients during strabismus surgery. Dexmedetomidine (Precedex®) is an alpha- adrenergic agonist that may be used as an alternative to oral midazolam for pre-operative sedation. The impact of Precedex on OCR is not known.

Methods: OCR elicited by 10-second, 200 gram tension on EOM during strabismus surgery was prospectively monitored. From 1/2013-8/2015, some younger (<20 years) cases received either Precedex (2 mcg/Kg nasal) or midazolam (0.5 mg/Kg po) before general anesthesia.

Results: 185 patients median age 7.5 years (0.3 to 82 years) with no anticholinergic had OCR with first EOM (93% inferior rectus) of -20.8 ± 3%. Compared to no pre-op sedation in young patients (n= 102, median -19.5%), dexmedetomidine produced more OCR (n=23, median -33.6%, Mann-Whitney p<0.01) whereas midazolam was not significantly different (n=11, median -28.9%, Mann-Whitney p=0.18). In younger patients who did not receive dexmedetomidine, OCR with fentanyl at induction -26.6±7% was greater than those who did not receive fentanyl (-18.6±4%, t-Test p=0.03). From 1992-2015, 2271 primary cases without anticholinergic had OCR during the first muscle (68% inferior rectus) of -20.2% ± 0.9%.

Discussion: Dexmedetomidine as pre-operative nasal sedation and induction fentanyl produced more OCR but were not associated with any adverse outcomes during strabismus surgery.

Conclusion: Awareness of muscle tension and heart rate during strabismus surgery is important with Precedex.

Introduction: There is currently no national standard for the pre and post-operative care of strabismus patients. Thus, we performed a national survey of pediatric ophthalmologists worldwide to assess the differences in management of strabismus patients and develop the most commonly used and effective regimen.

Methods: An anonymous survey was sent to pediatric ophthalmologists via the AAPOS database inquiring about preferences in pre and post-operative strabismus care. Results were recorded anonymously and analyzed using the Qualtrics software.

Results: 273 ophthalmologists completed the survey, with 75% having practiced for more than ten years and 77% currently practicing in the United States. Most pediatric ophthalmologists (82%) do not prescribe pre-operative medications, but 84% use betadine and 2.5% phenylephrine eye drops prior to surgery. Utilization of pre-operative workup is mixed, with only 44% who utilize a physical by a pediatrician prior to surgery. Intraoperatively, 95% of ophthalmologists surveyed do not soak sutures prior to use, and 88% do not use intraoperative antibiotics. Most (70%) do not feel the need of tegaderm for eyelash control is necessary. Post-operative, the majority (69%) use pain medication, with many (83%) prescribing a steroid/antibiotic combination. Most providers (54%) schedule follow up for 1 week, and perform a motility exam (97%) at that time.

Discussion: Survey results demonstrate that practicing pediatric ophthalmologists utilize varying yet similar care in strabismus patients. Pre-operative medication and work up is not done by most, and use of 5% betadine and 2.5% phenylephrine seems standardized practice. Intraoperative antibiotics is not viewed as crucial, but post-operative pain control, and inflammatory control via eye drops is used by most.

Conclusion: While no standardized protocol currently exists, from our results a comprehensive plan-of-care for operative care of strabismus patients can be drafted.


Sedated suture adjustments in children undergoing adjustable-suture strabismus surgery

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Introduction: While adjustable sutures may be used in children of any age,1 widespread adoption of this approach may have been limited in part by a lack of published studies on the methods and potential complications of sedated adjustment in the post-anesthesia care unit (PACU.)

Methods: Retrospective review of the post-operative experience of children ≤ 18 undergoing adjustable suture strabismus surgery over a 3-year period at our institution.

Results: Eighty-five patients met inclusion criteria. Of these, 26 (31%) required suture adjustment in the PACU, including 11 (ages 12-18 yr) adjusted while awake (1-2 muscles) and 15 (ages 1-8) adjusted under sedation (1-3 muscles.) Sedation was achieved using sequential boluses of propofol until adjustment was complete. Average initial bolus was 28.1 mg [range, 15-60 mg]; total dose was 257.9 mcg/kg/min [range, 62-506]. Mean sedation time was 15.9 min [range, 9-24]. There were no episodes of clinically significant bradycardia, oxygen desaturation, or nausea/vomiting during or after adjustment. Average PACU stay was 181 minutes (awake adjustment: 158 min; sedated: 198 min). Pain scores increased by > 2 units (to 4 or 5 of 10) after adjustment in 3 patients (2 awake (18%), 1 sedated (6.6%)).

Discussion: Sedated suture adjustment allows for fine-tuning of post-operative binocular alignment in the PACU. No complications were observed in our study group.

Conclusion: This work will enhance disclosure of risks and benefits of sedated adjustment while allowing for more accurate assessment of the cost and quality of adjustable sutures in children.

**Prism Adaptation and the Surgical Management of Acquired Esotropia**

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Mr Paul Mullaney

**Introduction:** Acquired esotropia is one of the most common causes of strabismus in childhood. Prism adaptation may be used to determine the angle to be corrected surgically(1).

**Methods:** Patients from two centers who underwent prism adaptation were retrospectively evaluated. Twenty-one patients completed follow-up at five months. These patients either showed a requirement for prisms which changed; prism-builders, or which remained stable during adaptation; prism-nonbuilders.

**Results:** The motor success rate, an esodeviation ≤10PD, for all patients was 66%. Prism-builders (n=10, 48%) had a higher rate of successful outcome versus prism-nonbuilders (n=11, 52%), 90% versus 54%, p=0.07. Larger initial angle of eso-deviation and involvement of the right eye were inversely associated with successful surgical outcome.

**Discussion:** Prism adaptation may be useful in highlighting patients who may benefit from a higher surgical dose by identifying prism-builders, who make up almost half of patients. Those whose esodeviation ‘built’ had particularly high success rates.

**Conclusion:** Prism adaptation is resource intensive but may have use in tailoring surgical management of paediatric esotropia. Interestingly it highlights a novel association for further investigation; children who respond to adaptation with a growth in angle of deviation tend to do well.


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**Intermittent exotropia in children:**

**Towards a more successful surgical outcome on long term follow up.**

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**Introduction:** The study aimed to identify different factors responsible for long term successful surgical outcome for intermittent exotropia in children.

**Methods:** A prospective non randomized comparative study that included 104 children with intermittent exotropia (ranging from -15 to -60 PD). They underwent three types of surgery. Group I (59 cases) had bilateral recession of the lateral rectus muscles. Group II (26 cases) had unilateral recession of the lateral rectus and resection of the medial rectus muscles. Group III (19 cases) had three muscles procedure. The outcome was evaluated at 1 month, 6 month, and 2 years after surgery.

**Results:** Orthotropia or minimal eso or exo (≤10PD) was considered success. 84 cases (80.8%) achieved success 12 cases (11.5%) had exotropia > 10 PD and 8 cases (7.7%) had esotropia > 10 PD immediately after surgery. Out of these 84 patients, 62 patients (73.8%) maintained success after 2 years, while the rest 22 cases (26.2%) showed recurrence of exotropia, making the success rate (59.6%) after 2 years. Cases with lower preoperative distant angles had better results (p < 0.001). Bilateral recession of the lateral rectus muscles ± unilateral medial rectus resection achieved better long term results than unilateral recession - resection (p < 0.001, 0.347 respectively).

**Discussion:** The success rate of intermittent exotropia surgery is disappointing and it declines with follow up. The effectiveness of surgical procedure used is controversial. In our study lower preoperative angles, good control and better fusion state and bilateral rectus muscle recessions gave better results.

**Conclusion:** Preoperative good control and better fusional state achieved more successful outcome after surgery. Aiming for immediate minimal postoperative overcorrection decreased the tendency for longterm recurrence. Bilateral recession of lateral rectus muscles ± unilateral medial rectus resection had better results than unilateral recession - resection procedure.
Bilateral versus Unilateral Lateral Rectus Recession for Small Angle Exotropia in Pediatric Patients

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Introduction: Small angle exotropia is commonly treated with either unilateral or bilateral lateral rectus recession. One potential disadvantage of unilateral recession is inconstant post-operative motility due to the large recession of one muscle. Our study aims to evaluate the success of unilateral versus bilateral lateral rectus recession in treatment of exotropia in the pediatric population.

Methods: This study is a retrospective chart review of 25 pediatric patients with exotropia less than 25 prism diopters who underwent unilateral or bilateral lateral rectus recession at Children’s Mercy Hospitals from January 1, 2013 to July 1, 2013.

Results: Of the 25 patients, 13 were treated with unilateral and 12 with bilateral lateral rectus recession. There was no significant difference in pre-operative alignment between the two groups. A total of 77% of the unilateral and 92% of the bilateral recessions had final post-operative alignment less than 8 prism diopters. One hundred percent of all patients had full motility at their final post-operative appointment.

Discussion: This data demonstrates that bilateral recessions have a slightly higher success rate than unilateral recessions, and post operative motility is not affected by unilateral surgery.

Conclusion: This study suggests that both bilateral and unilateral lateral rectus recession are successful techniques for treating small angle exotropia, and unilateral strabismus surgery does not significantly alter post-operative motility.


Lateral Rectus Extirpation and Denervation for Treatment of Paretic Exotropia

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Introduction: Paretic exotropia presents a management dilemma given the presence of unopposed contraction of the still innervated lateral rectus. Standard recess/resect procedures have limited efficacy as the paretic medial rectus cannot function against a nonparetic lateral rectus. Disinsertion of the lateral rectus with reattachment to the periosteum of the lateral orbital wall decreases unopposed abduction and preserves the muscle, but is complex and is still prone to deviation recurrence. We report a series of patient who underwent lateral rectus extirpation and denervation (LRED) for paretic exotropia caused by third nerve palsy or other disease.

Methods: Retrospective case series of patients undergoing LRED between June 1, 2013 and September 30, 2015 at Vanderbilt University.

Results: 12 eyes of 10 patients with paretic exotropia were operated upon (N = 12); 8 had cranial nerve III palsy (1 bilateral), 1 with sensory exotropia, 1 with epithelioid sarcoma overlying the medial rectus, 1 with Duane type 3, and 1 following iatrogenic medial rectus transection. One patient did not follow up and was excluded from results (N - 1). Abduction decreased from -0.6 to -2.4. Adduction improved from -4.0 to -2.8 Exotropic deviation in primary improved from 42 to 8.9 and 42 to 8.4 prism diopters at distance and near respectively. Head position was grossly unchanged.

Discussion: LRED offers an alternative treatment of paretic exotropia, eliminates the risk of LR reattachment, and is less technically challenging than periosteal fixation.

Conclusion: LRED improves distance and near exotropia and increases adduction.

Abduction remains surprisingly well-preserved.

Long-term follow-up after modified Kestenbaum procedure for abnormal vertical head posture

Priyanka Kumar  Scott R Lambert
Emory Eye Center, Atlanta, Georgia, USA

Introduction: The Kestenbaum procedure has been performed since the 1950s for the correction of nystagmus-related abnormal horizontal head position. Since its introduction, numerous modifications have been promoted to improve surgical outcomes. However, few studies have addressed the application of Kestenbaum's principles to correct abnormal vertical head position. We describe the long-term outcomes of a modified Kestenbaum procedure to correct abnormal vertical head posture in children with congenital nystagmus.

Methods: Retrospective case series of 7 patients evaluated at a single institution with abnormal vertical head position (chin-up or chin-down). All patients underwent bilateral surgery on one vertical rectus muscle and the opposing oblique muscle with the same surgeon.

Results: Seven children, ranging in age from 4 months to 5 years at presentation, underwent surgery to correct either a chin-down or chin-up head position. Two children had infantile nystagmus syndrome, four had albinism, and one had a cone-rod dystrophy. Six of the 7 patients had combined vertical recti and oblique muscle surgery. All but one demonstrated improvement in head position postoperatively. Specifically, 3 had complete resolution of abnormal head position, three had a reduction in head position, and one had no significant change. None of the children reported or had evidence of cyclotorsion postoperatively. Mean postoperative follow-up was 7.6 years (range 5 to 9.5 years).

Discussion: Combined vertical recti and oblique surgery to correct abnormal vertical head position is necessary to prevent cyclorotary disorders postoperatively, and provides long-term success.

Conclusion: A modified Kestenbaum procedure is effective in improving a chin-up or chin-down position on a long-term basis.


The Scott Procedure - A new era in the treatment of incomitance?

Adriana Kovacova Claire Voas-Clarke B.Sc(Hons) Vicki Wong B.Sc(Hons)
Jane Young B.Sc(Hons) Jon Durnian FRCOphth Ian B Marsh FRCOphth
St Paul's Eye Unit, Royal Liverpool University Hospital & Aintree University Hospital
Liverpool, UK

Introduction: The ‘Scott procedure’ - simultaneous recession and resection of the same muscle, is gaining popularity in the treatment of both horizontal and vertical incomitant strabismus. It is beginning to supersede the Faden retroequatorial suture technique. We sought to investigate its effectiveness.

Methods: A retrospective audit was performed of all patients that had undergone the Scott procedure at our units. The patients were identified from our departmental databases. All demographic, pre-operative, post-operative data was analyzed. Those patients with incomplete orthoptic data were excluded. The difference between the manifest angle in the primary position and the gaze direction of incomitance was calculated and compared. Both horizontal and vertical incomitant strabismus cases were included.

Results: 13 patients were identified with full pre and post-operative data. The mean age was 42 (6-73). 10 of the 13 cases were performed due to vertical incomitance. The mean pre-operative incomitance was 11.6PD and the mean post-operative incomitance, 6.1PD. The mean improvement was 5.6PD (0-19). The mean follow up was 87 days. All surgeries were technically successful and there were no operative complications.

Discussion: The Scott procedure leads to an improvement in incomitance (p=0.022). There is a wide range of improvements, ranging from no improvement to complete resolution. There is no difference in the success rates depending on whether the underlying condition is neurological or mechanical.

Conclusion: The Scott procedure is a successful alternative to Faden sutures. It can give good results but these are variable. Further work needs to be done to correlate the reasons why the results are variable.
The Effect of Surgical Intervention for Dissociated Vertical Deviation (DVD) Alone on Concurrent Horizontal Strabismus

Sunju Park MD Elias I Traboulsi MD
Cole Eye Institute, Cleveland Clinic
Cleveland, OH

Introduction: The purpose of this study is to determine whether DVD surgery in patients with concomitant horizontal strabismus can improve control of the latter, avoiding horizontal muscle surgery.

Methods: Retrospective chart review of patients with DVD and horizontal strabismus who underwent surgery by a single surgeon (EIT) between 1998 and 2015.

Results: 55 patients were included and divided into two groups: (1) 21 with concurrent surgery for DVD and horizontal strabismus; and (2) 34 with surgery for DVD only. Successful outcome for DVD was defined as improvement in severity of DVD, precluding additional surgery. Good outcome for horizontal deviations was defined as resolution of any deviation, good control of X(T), or constant horizontal deviation <10 PD. Failure was defined as constant horizontal deviation >10 PD, and/or subsequent horizontal muscle surgery. 18 of 21 patients (85.7%) in Group 1 and 29 of 34 patients (85.3%) in Group 2 had good outcome for DVD (p=1.00). 15 of 21 patients (71.4%) in Group 1 and 22 of 34 patients (64.7%) in Group 2 had good outcome of the horizontal deviation (p=0.77).

Discussion: There was no difference in the outcome of horizontal strabismus between patients who underwent concurrent surgery for DVD and horizontal deviation and those who underwent surgery for DVD only.

Conclusion: This preliminary study suggests that certain patients with both DVD and horizontal strabismus can have improvement in horizontal deviation following surgery for DVD only. Additional prospective randomized studies are necessary to explore the effect of DVD surgery on concomitant horizontal deviations.

Surgical Treatment of Inferior Oblique Overaction: Myectomy vs Anterior Transposition.

Jon Durnian FRCOphth Claire Voas-Clarke B.Sc(Hons) Jane Young B.Sc(Hons)
Vicki Wong B.Sc(Hons) Stephen B Kaye RCOphth
St Paul’s Eye Unit, Royal Liverpool University Hospital
Liverpool, UK

Introduction: There are many surgical strategies to combat inferior oblique overaction; two of the most popular are myectomy (IOM) and anterior transposition (IOAT). We performed a retrospective audit to compare these procedures.

Methods: A retrospective audit of all patients that underwent surgical correction of their IOOA from 2005-2012 was performed with any patient having less than complete data being excluded. The four-month post-operative data was compared to the pre-operative data using non-parametric testing.

Results: 35 patients had full data; 19 following IOM and 16 IOAT. Both groups showed significant reduction in vertical deviation in all gaze positions (p<0.01). IOAT had a greater effect when compared to IOM (p<0.01) especially in the primary position. For both procedures the magnitude of change in vertical angle depended on the pre-operative deviation (p<0.01). The percentage change in vertical deviation to the pre-operative angle was greater following IOAT (73%) then IOM (60%).

Discussion: Both procedures significantly reduced the manifest vertical deviation in all gaze positions. The magnitude of the effect of IOAT was significantly greater than IOM in all positions. IOAT appears to give a more consistent change than myectomy. Both IOM and IOAT led to a change in the horizontal deviation. IOAT led to a significant divergent effect of -1.87(2.90) in the primary position, whereas a myectomy is more likely to lead to a convergent effect 2.32(3.42).

Conclusion: It is clear from the results that both surgical procedures are effective in reducing inferior oblique overaction. The divergent effect following IOAT is of note and worthy of further study.
Refractive Changes Induced by Combined Recession of the Medial Rectus and the Inferior Oblique Muscles

Chaim Stolovitch MD\textsuperscript{1,2} Ari Leshno MD\textsuperscript{1} Daphna Mezad-Koursh MD\textsuperscript{1} Tomer Ziv-Baran PhD Tel Aviv Medical center\textsuperscript{1}, Assuta Medical center\textsuperscript{2}, Tel Aviv Israel

**Introduction:** The influences of strabismus surgeries on the refractive error have been investigated for many years. Most of the previous studies included single muscle surgery. There is no data on refractive changes after combined horizontal and oblique muscles surgery. We investigated refractive changes after combined recession of the medial rectus (MR) and inferior oblique (IO) muscles.

**Methods:** We reviewed cases of combined MR and IO recession. Individuals with both preoperative refraction measurement and postoperative measurement after one month were included. The preoperative refraction was mathematically subtracted from the postoperative refraction, and the induced refractive changes were averaged and statistically analyzed.

**Results:** Fifty-five eyes from 28 subjects met the criteria and were included in the final analysis. A significant surgically induced change was observed with a mean of -0.13D (±0.40, \(P = 0.028\)) in SE and +0.53 (±0.67, \(P<0.0001\)) in astigmatic power. A clinically significant change of ≈0.75D was observed in over 25% and 50% in sphere and cylinder power respectively.

**Discussion:** Although there have been several studies on refractive changes post strabismus surgery, this is the first attempt to evaluate refractive changes induced by combined recession of both a horizontal and oblique extra-ocular muscle in the same eye. Our results showed a surgically induced myopic shift of the sphere and increase in astigmatic power. These changes were both statistically and clinically significant.

**Conclusion:** Refractive changes are a significant side effect of combined recession of MR and IO, and patients should be informed regarding the possibility of such complication prior to the surgery.

Posterior Diversion Suture to Treat Symptomatic Vertical Diplopia Isolated to Lateral Gaze

David K Coats, MD; Charlene Crockett, MD; Evelyn A Paysse, MD
Texas Children’s Hospital, Baylor College of Medicine
Houston, Texas, USA

**Introduction:** Vertical strabismus that is present and symptomatic only in lateral gaze presents a challenging treatment problem. We developed a novel technique to treat symptomatic vertical diplopia that is isolated to lateral gaze positions.

**Methods:** Four patients with vertical diplopia that was present only in lateral gaze underwent a novel posterior diversion suture procedure to a single horizontal rectus muscle ipsilateral to the direction of symptomatic gaze. A 6.0 Vicryl suture was passed through the border of the horizontal rectus muscle 14-16 mm posterior to the limbus. The suture was then passed through the sclera 5-6 mm above or below the border of the muscle and tied to divert the path of the muscle in the direction opposite the vertical deviation.

**Results:** All four patients achieved relief of their vertical diplopia in lateral gaze postoperatively and no patient developed symptoms in the primary position. One patient developed new vertical diplopia at near, treated successfully with a spectacle slab off.

**Discussion:** Vertical diplopia isolated to lateral gaze presents complex treatment challenges, with significant risk of creating new and unwanted symptoms with standard strabismus surgery. Diversion of a horizontal rectus muscle path vertically away from the direction of the vertical deviation in lateral gaze resulted in excellent resolution of symptoms in four symptomatic patients with no complications.

**Conclusion:** A posterior diversion suture can be an effective means of treating vertical diplopia isolated to lateral gaze.
Modified Test Protocol Improves Sensitivity of the Stereo Fly Test

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Eileen E Birch PhD
Retina Foundation of the Southwest
9600 N Central Expressway Ste 200, Dallas, TX 75180

Introduction: Many pediatric vision disorders result in degraded stereoacuity. While random-dot stereograms, ranging in disparities up to 1200 sec of arc, are preferable for eliminating monocular cues, the Stereo Fly Test (Fly) is routinely used to establish the presence of coarse stereopsis (3000 sec of arc). Unfortunately, the Fly yields a high rate of false negatives due to monocular cues and learned response due to frequent testing. We present a modified administration of the Fly aimed at increasing sensitivity.

Methods: The Fly was administered following manufacturer instructions to children aged 3-12 years (n=380) wearing standard 3-D polarized glasses with opposite orientation of polarizers for each eye. Children conveying a ‘pass’ response by pinching above the plate (n=261) were retested wearing glasses fitted with polarized lenses of the same orientation for both eyes, eliminating disparity cues. Children who pinched above the plate with modified glasses were then considered a false pass. Randot® Preschool Stereoacuity Test was used as the gold standard.

Results: When presenting the Fly according to standard instructions, specificity was 100% (95%CI: 0.97-1.00) while sensitivity was 81% (95%CI: 0.75-0.86), with positive predictive value of 81% (95%CI: 0.75-0.86). Utilizing responses given with the modified glasses, sensitivity increased significantly to 96% (95%CI: 0.91-0.98), and positive predictive value increased to 91% (95%CI: 0.82-0.96).

Discussion: The modified Fly is quick and convenient to implement and decreases the false negative rate.

Conclusion: When random-dot stereocuity is not present, assessment of coarse stereopsis with the standard plus the modified Fly will provide an accurate assessment of binocularity.

Reduced VEP amplitudes in 12 year old children born moderately to late premature

Lina Raffa MD1,2 Josefin Nilsson MD,PhD3 Jovanna Dahlgren MD,PhD4
Marita Andersson Gronlund MD,PhD1
1Department of Ophthalmology, Institute of Neuroscience and Physiology, Sahlgrenska Academy at the University of Gothenburg, Gothenburg, Sweden; 2Department of Ophthalmology, King Abdulaziz University Hospital, Jeddah, Saudi Arabia; 3Department of Clinical Neurophysiology, Sahlgrenska Academy at the University of Gothenburg, Gothenburg, Sweden; 4Department of Pediatrics, Institute of Clinical Sciences, Sahlgrenska Academy at the University of Gothenburg, Gothenburg, Sweden

Introduction: The relation between visual evoked potentials (VEPs) and retinal nerve fiber layer (RNFL) thickness were studied in moderate-to-late preterm (MLP) children.

Methods: Visual acuity (VA), refraction expressed as spherical equivalent, birth anthropometric measurements, and VEPs (60 min arc checks) were obtained from 22 twelve-year-old MLP (11 male; 11 female) and 21 full-term controls. RNFL parameters were examined by spectral domain optical coherence tomography (SD-OCT).

Results: VEP amplitudes (P100) were smaller in the MLP group (Oz 18.7±8.2µV right eye (RE); 17.6±8µV left eye (LE)) compared with controls (30±14.8µV RE; 30.6±12.7µV LE); p=0.013 and 0.003, respectively. No differences in VEP latencies were found. There were no statistically significant differences between the MLP and controls in VA, refraction, or RNFL thickness. Gender differences were found in some RNFL measurements in both groups. VEP amplitudes did not correlate with birth anthropometric measurements, VA, refraction or RNFL thickness in neither the MLP nor the control group when adjusted for age and gender.

Discussion: We report decreased P100 VEP amplitudes in the MLP group. The physiological background for the differences found are not clear but since the RNFL thickness is similar it is probably not due to retinal morphological differences but may suggest differences in optic nerve or visual cortex properties.

Conclusion: Our study suggests that moderate premature birth may have a significant effect on visual evoked potential without clear retinal structural changes. Further studies are needed to better understand the association between this findings and visual functions in preterm children.
Prevalence of Eye Disease and Reading Difficulty in an Inner City Elementary School Population - Preliminary Results of the Baltimore Reading and Eye Disease Study (BREDS)

Megan E Collins MD Lucy Mudie MBBS, MPH Robert E Slavin PhD
Roisin P Corcoran PhD Josephine Owoeye OD Dolly Chang MD, PhD
David S Friedman MD, PhD, MPH Michael X Repka MD, MBA

Johns Hopkins University Wilmer Eye Institute and School of Education, Baltimore MD

Introduction: Reading is a fundamental skill taught during early elementary school education. Students who experience difficulty reading are at risk for long-term difficulty with academic achievement. Little is known about what vision problems affect an inner city grade school population with and without reading difficulty \[1,2\].

Methods: Second and third grade students at 12 Baltimore City public schools whose parents signed consent underwent baseline and follow up reading assessments and eye exams. The eye exam included cycloplegic refraction. Children with refractive error were given glasses (hyperopia \(\geq 1\)D, myopia \(\leq 0.5\)D, astigmatism \(\geq 1.5\)D) and children with convergence insufficiency were prescribed eye exercises. Reading assessments included Woodcock-Johnson III Tests, receptive vocabulary tests and Gray Oral reading assessment.

Results: A total of 317 children participated, including 192 second and 125 third graders (mean age = 7.9 y) with 84.5% identified as African American. 46.4% had a prior eye evaluation. Glasses were worn by 6.8%. The most common eye findings were refractive error (hyperopia, myopia and astigmatism) and convergence insufficiency (9.5%). Glasses were provided to 194 students (61%). Applying AAO preferred practice guidelines, 88 children (27.7%) would have been prescribed glasses \[3\].

Discussion: At baseline a strong negative relationship was found between distance (p<.001) and near vision (p<.005) and performance on Passage Comprehension, controlling for grade, gender, and Peabody Picture Vocabulary Test scores. Hyperopia was associated with worse baseline reading scores. The effect sizes were -0.67 for Letter-Word, -0.61 for Passage Comprehension, and -0.37 for Word Attack.

Conclusion: Significant refractive error was present in 21.5 % of students. It was being corrected in only a small proportion of inner-city elementary school children. Poor baseline visual acuity and hyperopia were associated with reduced reading achievement. Follow-up vision and reading assessments are planned one year after enrollment and will determine if study-provided glasses and vergence exercises affected reading performance.

References:

Oregon Elks Preschool Vision Screening Astigmatism Referral Criterion

Joannah Vaughan MBA Talitha Dale Daniel Karr MD
Elks Children’s Eye Clinic at Casey Eye Institute
Portland, Oregon U.S.A.

Introduction: The Oregon Elks Preschool Vision Screening program screens Head Start children ages 36 to 60 months old to identify children at risk for amblyopia and referral warranted refractive error. The goal of this study is to determine the accuracy of the 2.25D referral criterion for astigmatism when using the plusoptiX S12 photo-screening device.

Methods: Between September and October 2014, 4,194 plusoptiX S12 vision screenings were performed by the Elks visioning screening program using an astigmatism referral criterion of 2.25D (currently option 4 settings). IRB consent was obtained to follow-up on referrals and to review exam chart notes.

Results: The plusoptiX referred 354 for astigmatism. Chart note review was conducted on 156 children who were referred by the plusoptiX photo-screening screening for potential astigmatism and received dilated eye exams from their local eye doctor. The mean age was 4-years old. Treatment for astigmatism (glasses) was prescribed to 131 children when using the 2.25D astigmatism setting.

Discussion: The program goal is to maintain high quality vision screening referrals. In 2013, the program used the factory default setting for astigmatism of 1.50D. Chart note analysis revealed that astigmatism was the most common reason for over referrals. A decision was made to change the astigmatism setting to 2.25D. When astigmatism settings were set to option 4 settings (2.25D), 84% referrals required treatment.

Conclusion: After chart note review, we have determined that the plusoptiX settings could remain at the 2.25D referral criterion for the astigmatism setting.
Notes
Notes
# Workshop Schedule

## Thursday, April 7, 2016

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<thead>
<tr>
<th>Time</th>
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<tr>
<td>2:45 PM - 4:00 PM</td>
<td><strong>Workshop #1</strong>&lt;br&gt;OMIC Risk Management Workshop: Pediatric Malpractice Claims Alleging Failure to Diagnose&lt;br&gt;Robert E. Wiggins, Jr., MD, MHA; Anne M. Menke, RN, PhD</td>
<td>Room 10, 11, 12</td>
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## Friday, April 8, 2016

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<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>8:00 AM - 4:00 PM</td>
<td><strong>Workshop #2</strong>&lt;br&gt;Practice Management Workshop - Administrators Program&lt;br&gt;Heather H. Dunn, COA; Anne Menke; Jenny Edgar, CPC, CPCO, OCS; Michael J. Bartiss, OD, MD</td>
<td>Room 14</td>
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<td>7:00 AM - 8:15 AM</td>
<td><strong>Workshop Session A</strong>&lt;br&gt;The Evolving Multimodal Imaging Approach to the Pediatric Eye&lt;br&gt;Lea Ann Lope; Kanwal K. Nischal; Giulio Zuccoli; Christin L. Sylvester; Ellen B. Mitchell</td>
<td>Room 10-12</td>
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<tr>
<td>8:00 AM - 9:45 AM</td>
<td><strong>Workshop Session B</strong>&lt;br&gt;Size Matters! The Management of Extra-large (XXL) Strabismus&lt;br&gt;Manoj V. Parulekar, FRCS, FRCOphth; Ramesh R. Kekunnaya, MD; David Plager, MD; David Hunter, MD; Lionel Kowal, MD; Venkateshwar B. Rao, MD</td>
<td>Room 1-3</td>
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<tr>
<td>8:00 AM - 9:45 AM</td>
<td>Struggling Resident Surgeons: Educational Strategies for Success&lt;br&gt;R. Michael Siatkowski, MD; Tammy L. Yanovitch, MD; Janine E. Collinge, MD; W. Walker Motley, MS, MD; Graham Quinn, MD</td>
<td>Room 8 &amp; 15</td>
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<td>8:30 AM - 9:45 AM</td>
<td>What's New and Important in Pediatric Ophthalmology and Strabismus in 2016&lt;br&gt;Jitka L. Zobal-Ratner, MD; Sudha Nallasamy, MD; Erin Herlihy, MD; Darron Bacal, MD; Hilda Capo, MD; Ayse Erzurum, MD; Melanie Schmitt, MD; Linda Dagi, MD; Leemor Rotberg, MD; W. Walker Motley, MS, MD</td>
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<tr>
<td>8:30 AM - 9:45 AM</td>
<td>Adult Strabismus Workshop&lt;br&gt;David B. Granet, MD; David L. Guyton, MD; Edward G. Buckley, MD; Steven M. Archer, MD; David G. Hunter, MD; David Stager, Jr., MD; Forrest J. (Jim) Ellis, MD</td>
<td>Exhibition Hall A</td>
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<tr>
<td>8:30 AM - 9:45 AM</td>
<td>Dyslexia: What Pediatric Ophthalmologists and Families Need to Know&lt;br&gt;Sheryl M. Handler, MD; Walter M. Fiersen, MD; A. Melinda Rainey, MD; Kim Cooper, MD</td>
<td>Room 1-3</td>
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<tr>
<td>8:30 AM - 9:45 AM</td>
<td>Pediatric Retina: Pearls to Diagnose and Treat&lt;br&gt;Aparna Ramasubramanian; Mary E. Hartnett; Julia Shulman; Thomas C. Lee</td>
<td>Room 10-12</td>
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<tr>
<td>8:30 AM - 9:45 AM</td>
<td>Intraoperative Signs and Findings that Change Surgical Algorithms in Pediatric Cataract Surgery&lt;br&gt;Marcia Tartarella, MD, PhD; Ramesh Kekunnaya, MD; Deborah VanderVeen, MD; Ken K. Nischal, MD, FRCOphth</td>
<td>Room 8 &amp; 15</td>
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<tr>
<td>Time</td>
<td>Workshop Session</td>
<td>Workshop #11</td>
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<td>10:30 AM - 11:45 AM</td>
<td>Workshop Session C</td>
<td>AAP Workshop: Myopia - Pathogenesis, Control and Treatment - A Practical Update for the Clinician</td>
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<td>Sharon Lehman, MD; Ken K. Nischal, MD, FRCOphth; Evelyn Paysse, MD; Seo Wei Leo, MD; Audrey Chia, MD; David B. Granet, MD</td>
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<td>Room 8 &amp; 15</td>
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<td>1:15 PM - 2:30 PM</td>
<td>Workshop Session D</td>
<td>Room 1-3</td>
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<td>2:45 PM - 4:00 PM</td>
<td>Workshop Session E</td>
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<tr>
<td>4:30 PM - 6:00 PM</td>
<td>NO CME</td>
<td>Room 10-12</td>
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## Saturday, April 9, 2016

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<th>Workshop #23</th>
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<tr>
<td>2:00 PM - 3:15 PM</td>
<td>SEC Contracting and Benchmarking Workshop: I Never Learned This in Residency: Contracting with Insurance Companies and Hospitals</td>
<td>Exhibition Hall A</td>
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<td>Shira L. Robbins, MD; Robert D. Gross, MD, MBA; Eric A. Lichtenstein, MD; Merrill Stass-Isern, MD; Robert E. Wiggins, Jr, MD, MHA; Lisa Bohra, MD; Michael J. Bartiss, OD, MD</td>
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<tr>
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<th>Workshop #24</th>
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<tr>
<td>3:30 PM - 5:30 PM</td>
<td>Coding - A Day in the Life of the Pediatric Ophthalmologist</td>
<td>Exhibition Hall A</td>
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<td>Jenny Edgar, CPC, CPCO, OCS; Michael J. Bartiss, OD, MD; Robert S. Gold, MD, FAAP; Heather Dunn, COA</td>
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## Sunday, April 10, 2016

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<tr>
<th>Time</th>
<th>Workshop #25</th>
<th>Location</th>
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<tr>
<td>7:15 AM - 8:15 AM</td>
<td>Video Demonstrations of Signs, Diseases, and Complex Surgical Procedures in Pediatric Ophthalmology and Strabismus</td>
<td>Exhibition Hall A</td>
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<td></td>
<td>Federico G. Velez, MD; Sharon F. Freedman, MD; Joseph L. Demer, MD, PhD; Deborah K. VanderVeen, MD; Christopher J. Lyons, MD; Hilda Capo, MD</td>
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<tr>
<th>Time</th>
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<tr>
<td>8:25 AM - 9:25 AM</td>
<td>Difficult Non-Strabismus Problems In Pediatric Ophthalmology</td>
<td>Exhibition Hall A</td>
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<td>Elias I. Traboulsi, MD, MEd; Arlene V. Drack, MD; Mays A. El-Dairi, MD; Audina Berrocal, MD; Erick Bothun, MD</td>
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<tr>
<th>Time</th>
<th>Workshop #27</th>
<th>Location</th>
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<tr>
<td>9:35 AM - 10:35 AM</td>
<td>Difficult Problems Strabismus Workshop</td>
<td>Exhibition Hall A</td>
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<td>Linda R. Dagi, MD; Edward G. Buckley, MD; Andrea Molinari, MD; Lionel Kowal, MD; Stacy L. Pineles, MD; Gregg T. Lueder, MD</td>
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Pediatric malpractice claims alleging failure to diagnose
Robert E Wiggins Jr. MD, MHA and Anne M Menke RN, PhD
OMIC (Ophthalmic Mutual Insurance Company)
655 Beach Street, San Francisco, CA 94109

Purpose/Relevance: Diagnostic error occurs in up to 15% of patients. OMIC conducted an analysis of seven years of malpractice claims, and found that 12% of claims related to diagnostic error. These errors impact pediatric patients and lead to delay in treatment, permanent harm, and professional liability lawsuits. Pediatric ophthalmologists can learn ways to reduce the incidence of these claims.

Target Audience: Ophthalmologists who treat pediatric patients

Current Practice: OMIC’s analysis of diagnostic error claims (in preparation for publication, to be presented at the 2015 AAO meeting) shows that physician factors are responsible for the majority of these claims, while systems issues related to follow up played a minor role. Cognitive processes integral to the diagnostic process play a crucial role. In many instances, however, ophthalmologists did not obtain thorough and accurate histories, conduct complete eye exams, order appropriate tests, or interpret test results correctly. Failure to track appointments, test results, and referrals led to delays in care.

Best Practice: Ophthalmologists need help discerning common conditions for which cognitive shortcuts and ‘fast thinking’ are adequate, from complex patient presentations when ‘slow thinking’ is required. They need to learn indicators of a wrong diagnosis and techniques that can assist in the development of a robust differential diagnosis. Ophthalmologists need to utilize tracking systems for appointments, test results, and referrals to ensure timely follow-up.

Expected Outcomes: Ophthalmologists will have a better understanding of the types of patient presentations that require a more deliberate decision-making process and meticulous follow up. They will conduct a more careful history following trauma, and consider early referral to sub-specialists when patients are not responding to treatment as expected.

Format: Presentation of data from OMIC’s study of ophthalmic diagnostic error
Case presentations from clinical and risk management perspective

Summary: OMIC Risk Manager Anne Menke will present the results of a study of 7 years of claims alleging failure to diagnose. She will then focus on the claims impacting pediatric patients. Dr. Wiggins and Dr. Menke will then present two case studies from a clinical and risk management perspective to illustrate common problems in these type of cases.

Malpractice risks in the diagnostic process. 2014 CRICO Benchmarking Report.ww.rmfstrategies.com
OMIC study of diagnostic error
**Workshop 3**  
**Friday**  
7:00 - 8:15 am  
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**Workshop 4**  
**Friday**  
7:00 - 8:15 am  
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**The Evolving Multimodal Imaging Approach to the Pediatric Eye**  
Lea Ann Lope Kanwal K Nischal Giulio Zuccoli Christin L Sylvester Ellen B Mitchell  
Children’s Hospital of Pittsburgh of University of Pittsburgh Medical Center  
Pittsburgh, Pennsylvania  
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**Purpose/Relevance:** The world of ocular and neuroimaging has changed dramatically in the last decade. While OCT has been a disruptive technology, pediatric ophthalmologists are still very dependent on MRI and ultrasound (USS) for diagnostic evaluation, which have evolved also. This workshop aims to explain these evolutions and how they help improve diagnostic accuracy in pediatric ophthalmology.  
**Target Audience:** pediatric ophthalmologists, general ophthalmologists, neuro-radiologists, orthoptists, and trainees  
**Current Practice:** Pediatric ophthalmologists are often reliant on radiologists to report MRI scans. Recent MRI techniques such as diffusion weighted imaging (DWI), susceptibility weighted imaging (SWI), post contrast volumetric fluid attenuated inversion recovery (FLAIR) and fast imaging employing steady-state acquisition (FIESTA), have allowed differentiation of various pathologies in a way not previously possible. Similarly, the availability of linear ultrasound and doppler ultrasound, and an understanding of the role of the pediatric lens in ultrasound attenuation, has improved diagnostic capability and understanding. If pediatric ophthalmologists or orthoptists are unaware of these changes, the ability to confirm or concur with diagnostic conclusions may be compromised.  
**Best Practice:** Ophthalmologists should be able to understand the techniques used in MRI. Similarly, confidence in understanding the type of ordinary ultrasound (not UBM) being used, and how to avoid false negative testing, especially in children with swollen optic discs, should improve diagnostic accuracy.  
**Expected Outcomes:** The workshop will raise awareness of these evolutions in MRI and USS, and help initiate bridging the gap in knowledge in this type of imaging.  
**Format:** With a panel of four pediatric ophthalmologists and one pediatric neuroradiologist, we will conduct clinical case presentations and a panel discussion. Audience participation is a crucial part of this workshop.  
**Summary:** Techniques in MRI and USS have evolved. Ophthalmologists may not be fully aware of the implications of these developments. This workshop will help them use the correct imaging.  

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**Size matters! The management of Extra-large (XXL) Strabismus**  
Manoj V Parulekar FRCS, FRCOphth Ramesh R Keckunnaya MD David Plager MD  
David Hunter MD Lionel Kowal MD Venkateshwar B Rao MD  
Birmingham Children’s Hospital, Birmingham, United Kingdom  
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**Purpose/Relevance:** Very large angle (80-100 PD) strabismus cannot be managed using the usual surgical dosage tables, and legitimate differences of opinion exist. Strategies include two, three, or even four muscle operations, extra large resections or recessions, or staged operations. This workshop delivered by a panel of experienced surgeons from tertiary referral institutes will discuss principles of treatment, pros and cons of the various approaches, and share treatment algorithms.  
**Target Audience:** Pediatric Ophthalmologists, Ophthalmology Residents.  
**Current Practice:** If a surgeon encounters these situation he/she will review sparse and anecdotal literature review or listserv to find an answer to manage these cases.  
**Best Practice:** Very large angle (80-100 PD) strabismus cannot be managed using the usual surgical dosage tables. The clinical situations include 1. Large angle Esotropia; 2. Large angle Exotropia; 3. Large Superior Oblique palsy; 4. Myopic Strabismus fixus; 5. WEBINO syndrome, Myasthenia, CFEOM?; 6. Large Dissociated Vertical Deviation; 7. Large strabismus due to thyroid myopathy. Meeting patient expectations and achieving safe outcomes can be challenging in such situations.  
**Expected Outcomes:** Strategies vary and include two-, three-, or even four-muscle operations, extra large resections or recessions, or staged operations, and will be discussed, with illustrative cases.  
After completing the workshop, participants should be able to manage this challenging group of patients with large angle strabismus using treatment algorithms discussed above.  
**Format:** Case and video presentation. Relevant literature will be referenced. Audience quiz will be encouraged.  
**Summary:** Very large angle (80-100PD) strabismus cannot be managed using the usual surgical dosage tables, and legitimate differences of opinion exist. Strategies include two, three, or even four muscle operations, extra large resections or recessions, or staged operations. This workshop will discuss principles of treatment, pros and cons of the various approaches, and share treatment algorithms.  
Struggling Resident Surgeons: Educational Strategies for Success

R. Michael Siatkowski MD Tammy L Yanovitch MD Janine E Collinge MD W. Walker Motley MS, MD Graham Quinn MD
Dean McGee Eye Institute/University of Oklahoma Health Sciences Center Oklahoma City, Oklahoma

Purpose/Relevance: In a survey of United States ophthalmology residency programs conducted in 2006, 9% of residents were labeled as struggling with surgical competency. These residents have the potential to present challenges to patients, colleagues, and faculty members, and may face significant uncertainty regarding their own professional futures. This course will teach early warning signs of poor surgical development and provide management strategies to overcome surgical training barriers.

Target Audience: Pediatric Ophthalmologists

Current Practice: Often, strabismus surgery serves as an introduction to the operating room experience for trainees and may be the first time residents have the opportunity to demonstrate their surgical skills. In some instances, faculty members may fail to recognize or overlook ‘red flags’ regarding poor surgical performance and/or avoid implementing a corrective action plan early on in training.

Best Practice: An example of a timeline for the normal development of surgical skills will be presented. A standardized grading system for strabismus surgery will be reviewed. Various management strategies shown to help improve surgical performance will be discussed. These management strategies will address specific underlying physical (tremor and lack of hand-eye coordination) and emotional/psychological (overly-timid and overly-confident) barriers.

Expected Outcomes: At the conclusion of this presentation, attendees will be able to: (1) formulate a timeline for surgical skill development, (2) utilize a standardized strabismus surgery performance grading tool, (3) identify the physical and emotional/psychological barriers in surgical skill development, and (4) develop background data and action plans to assist trainees in overcoming these barriers.

Format: Didactic lecture and panel discussion

Summary: When a trainee lags behind in surgical skill development, the situation in the operating room becomes quite stressful for all stakeholders. This course will present ways to identify struggling trainees and highlight some of the more common barriers trainees encounter when learning surgical skills. The panel will discuss various strategies for helping trainees overcome these barriers.


What's New and Important in Pediatric Ophthalmology and Strabismus in 2016

Jitka L Zobal-Ratner, MD Sudha Nallasamy, MD Erin Herlihy, MD Darron Bacal, MD Hilida Capo, MD Ayse Erzurum, MD Melanie Schmitt, MD Linda Dagi, MD Leemor Rotberg, MD W. Walker Motley, MS, MD

Other Contributors from the AAPOS Professional Education Committee:
Melanie Kazlas, MD Stacy Pineles, MD Tina Rutar, MD Douglas Fredrick, MD Nisha Krishan Dave, MD Graham E. Quinn, MD Rebecca S. Braverman, MD Leslie Arguello Sr, MD, MSC C. Corina Gerontis, MD Jason H. Peragallo, MD Hee-Jung Park, MD, MPH

Purpose/Relevance: The authors will investigate the literature for articles of interest to the sub-specialty of Pediatric Ophthalmology and Strabismus for the time period March 2015-February 2016. Ophthalmic journals are stressed but journals from other specialties such as pediatrics, neurology and comprehensive medicine will be included. The authors will summarize the key findings in the major topics including, but not limited to, vision screening, amblyopia, neuro-ophthalmology, retinopathy of prematurity, strabismus, cataract, glaucoma, genetics, retina, orbit, uveitis and practice management. The presentations in these topic areas will summarize and emphasize second-order analyses of the material.

Target Audience: Pediatric and Comprehensive Ophthalmologists who examine, diagnose and treat children and adults with strabismus, Orthoptists

Current Practice: Pediatric Ophthalmology is a rapidly evolving sub-specialty. It is difficult to remain current with all of the literature in this field.

Best Practice: The authors will summarize, analyze and present the most current and important information from more than 20 medical journals. This will allow the audience to have an overview of the most current and important literature.

Expected Outcomes: The audience will understand the most current published information in this sub-specialty.

Format: Didactic lecture

Summary: More than 20 medical journals will be reviewed for relevant new findings in the sub-specialty of Pediatric Ophthalmology and Strabismus from March 2014-February 2015. The material presented will educate the Ophthalmologists and Orthoptists in new research.

References: Journal of AAPOS, Ophthalmology, Pediatrics

Workshop 5
Friday
7:00 - 8:15 am

Workshop 6
Friday
7:00 - 8:15 am
**Purpose/Relevance:** The surgical treatment of the adult with strabismus comprises a significant portion of the clinical and surgical volume of many pediatric ophthalmologists. This workshop is designed to educate attendees regarding surgical treatment of adults with strabismus, which can vary considerably from the treatment of children.

**Target Audience:** Pediatric ophthalmologists, Strabismologists & Orthoptists interested in evaluating and treating adults with strabismus.

**Current Practice:** Pediatric ophthalmologists may be intimidated by adults with complicated forms of strabismus. A variety of challenges often deter surgical intervention including fear of post-operative diplopia and a lack of confidence in managing torsion, re-operations and adjustable sutures.

**Best Practice:** Clinicians will gain a more thorough understanding of the surgical approaches and techniques which yield better outcomes in adults with strabismus.

**Expected Outcomes:** At the conclusion of the workshop, attendees will have a better understanding of effective strategies for managing adults with complicated forms of strabismus - especially adjustable sutures.

**Format:** The workshop will include case presentations and discussions by a panel of experts. In addition, time for audience participation with questions of the panelists is planned. Use of video for teaching will be included. Throughout the discussions, pertinent scientific literature will be presented and reviewed.

**Summary:** Topics will include challenging cases of adults with complicated forms of strabismus; including re-operation strategies, management of torsion and incomitant deviations, and correction after other ocular surgery or disease, as well as tips, pearls, and advice regarding adjustable sutures all from surgeons with years of experience.

**References:**

**Dyslexia: What Pediatric Ophthalmologists and Families Need to Know**

Sheryl M Handler  Walter M Fierson  A. Melinda  Rainey  Kim Cooper

**Purpose/Relevance:** Dyslexia, also called reading disability, is the most common learning disability. Most parents are unfamiliar with dyslexia and may believe that it is a vision-based disorder. Pediatric ophthalmologists need to be thoroughly informed about dyslexia, its controversial treatments, evidence-based educational treatments, and resources available to be able to provide information and guidance to families of struggling readers.

**Target Audience:** Pediatric Ophthalmologists and Certified Orthoptists

**Current Practice:** Pediatric Ophthalmologists are often asked to evaluate children with reading or learning problems early in the process but may not have enough information to guide families.

**Best Practice:** Pediatric ophthalmologists will be able to evaluate and manage children with reading and learning problems, become familiar with the new AAPOS Learning Disabilities Package and guide families to resources and local educational experts.

**Expected Outcomes:** The participant will gain a thorough understanding of the issues, controversies, evidence and resources on dyslexia to be better equipped to evaluate the patient who is experiencing reading difficulties, discuss dyslexia and provide guidance to our patients and their families.

**Format:** Didactic lecture with question and answer session.

**Summary:** This workshop will give a comprehensive summary of the latest information on language acquisition, reading, dyslexia, evidence-based educational treatments, the eye functions necessary to read and how to test for them in the ophthalmic exam. It will explore the controversial topics of vision therapy and colored lenses and filters. It will also provide information and guidance on what to tell parents using the new AAPOS Learning Disabilities Package as an aid so that we can assist our patients in receiving the correct diagnoses and beneficial evidence-based therapies and accommodations.

Pediatric Retina: Pearls to diagnose and treat
Aparna Ramasubramanian  Mary E Hartnett  Julia Shulman  Thomas C Lee

Purpose/Relevance: Retinal diseases account for approximately 40% of low vision in patients without other medical problems.1 This workshop will provide diagnostic and management tips to crack some of the mysteries of pediatric retinal diseases and provide tips regarding overall management.

Target Audience: Pediatric Ophthalmologists, General Ophthalmologists & Retina Specialists

Current Practice: Pediatric ophthalmologists often encounter diagnostic difficulties with pediatric retinal diseases, because these diseases are rare and clinical acumen is required as often examinations are brief. New diagnostic tests that provide key information to clinch diagnoses are now available for children. Teams of experts may be needed for optimal management.

Best Practice: Management of pediatric retinal diseases requires ascertaining historical details, recognizing key clinical features, ordering appropriate diagnostic tests, and instituting appropriate treatment. Coordination of teams of professionals can optimize the final outcome of the child.

Expected Outcomes: At the conclusion of this presentation, attendees would be able to recognize key clinical features encompassing aspects of important pediatric retinal diseases. The workshop will aid in ordering the appropriate diagnostic tests and provide key management tips to the audience.

Format: Case Presentations

Summary: The specialty of pediatric retina is often considered one of the toughest in ophthalmology as the exam is difficult in small children and there are many diseases that can present with atypical features. With the use of multiple cases an overview of the spectrum of pediatric retinal diseases will be provided. The topics covered will include vascular diseases, degenerations, inflammatory/infectious conditions, trauma, posterior segment manifestations of systemic diseases, benign and malignant tumors.


Intraoperative Signs and Findings that Change Surgical Algorithms in Pediatric Cataract Surgery

Marcia B Tartarella MD PhD Ramesh Kekunnaya MD Deborah Vanderveen MD
Ken K Nischal MD FRCOphth
Federal University of Sao Paulo / Boston Children’s Hospital
Sao Paulo, Brazil / Boston USA

Purpose/Relevance: The purpose of this workshop is to demonstrate that decision making for different pediatric cataract scenarios can vary depending on the anatomical peculiarities of that particular eye which may not be apparent until the child is in the operating room. This last minute surgical planning can have a profound effect on outcome.

Target Audience: Pediatric ophthalmologists, orthoptists, general ophthalmologists and trainees.

Current Practice: Pediatric ophthalmologists are often faced with decision-making in the OR because of unexpected findings when the child is asleep. Lack of adequate experience may mean that decision making on the spur of the moment maybe difficult. There maybe preoperative signs or peroperative findings prior to entering the eye and once the eye is entered that may prove helpful to the surgeon to choose the surgical algorithm.

Best Practice: Surgeons should ideally be able to make last minute surgical decisions according to evidence based literature but often surgical experience often influences this type of decision making.

Expected Outcomes: We aim to discuss 5 pediatric surgical scenarios that in the experience of the panel demonstrate signs and findings that help to alter the surgical plan in a manner most helpful to ensuring a good outcome. This should help bridge any gaps in experience with such pediatric cataract scenarios.

Format: Four experienced pediatric cataract surgeons will discuss 5 pediatric cataract scenarios where the intraoperative findings changed the surgical plan using surgical video and audience participation.

Summary: Pediatric ophthalmologists often change their surgical plans depending on intraoperative findings in pediatric cataract surgery. Signs and findings preoperatively can influence surgical planning in a manner that allows for better outcomes if the correct surgical algorithm is chosen. Discussion of the commonest instances where this has happened in the surgical lifetimes of 4 experienced pediatric cataract surgeons may allow better surgical planning.
AAP Workshop: Myopia - Pathogenesis, Control and Treatment: A Practical Update for the Clinician

Sharon Lehman MD Ken K Nischal MD,FRCOphth Evelyn Paysse MD
Seo Wei Leo MD Audrey Chia MD David Granet MD
American Academy of Pediatrics - Section of Pediatric Ophthalmology

Purpose/Relevance: Myopia has become an epidemic affecting vast numbers of children in the world. The purpose of this workshop is to describe current knowledge about its etiology, point out which genetic conditions cause pathological myopia, and discuss treatment modalities to arrest myopia or treat it once it has developed.

Target Audience: Pediatric ophthalmologists, orthoptists, general ophthalmologists and trainees.

Current Practice: The plethora of studies available about myopia is at best confusing and at worst misleading. Yet, pediatric ophthalmologists, general ophthalmologist and orthoptists are increasingly seeing children who have progressive myopia or high myopia. These professionals may not have a succinct guideline as to what therapies are available and what may be causing either high myopia or progression of childhood myopia.

Best Practice: Ideally we should all be aware of the etiology of childhood myopia, when to recognize pathological myopia secondary to an ocular or a systemic disease and be able to counsel parents appropriately.

Expected Outcomes: We aim to discuss the etiology of myopia in childhood so that an assessment can be made as to whether myopia arresting therapies are viable and valid treatment options and also whether refractive surgery is an option or not.

Format: Experienced pediatric ophthalmologists will discuss 6 topics: emmetropisation, recognizing myopia secondary to ocular or systemic disease, the role of peripheral retina in myopia progression, using atropine to arrest myopia, using orthokeratology and refractive options in pediatric myopia.

Summary: An understanding of the causes of myopia will be discussed. Interactive discussion will help delineate viable and valid myopia arresting strategies.

References:

Management of Childhood Nystagmus: Knapp Lecturer Workshop

Pradeep I Sharma MD,FAMS Richard Hertle MD Lionel Kowal MD Ramesh Kekunayya FRCS Sobi Pandey MS
All India Institute of Medical Sciences, New Delhi, India

Purpose/Relevance: To summarize the instructors’ experience and provide the scientific basis of recommendations for a simplified medical and surgical treatment plan for childhood forms of nystagmus to the practicing clinician.

Target Audience: Clinicians who care for infants and children with nystagmus.

Current Practice: Practitioners have limited understanding of the types of nystagmus and the medical, optical or surgical treatment options to offer.

Best Practice: Newer techniques have simplified the management options and improved the functional outcomes in childhood nystagmus.

Expected Outcomes: At the conclusion of this presentation, attendees will have acquired clear knowledge to offer children with nystagmus of infantile nystagmus syndrome, fusional maldevelopment nystagmus, spasmodic nystagmus or sensory nystagmus. They will be equipped with additional optical, medical and surgical treatment options to improve the anomalous head postures and/or visual functions.

Format: Via a didactic lecture format, eye-movement data, videos and case examples to illustrate an organized treatment technique and expected outcomes. Time will be allotted for the audience to ask the instructors for an opinion regarding diagnosis, evaluation and treatment strategies.

Summary: First, a brief introduction of nystagmus classification and a simplified approach to diagnose the common childhood nystagmus and the value of electrophysiology will be presented. Next, the instructor’s approach to treatment, using a thorough clinical examination, illustrated by patient examples of different types of nystagmus will be presented. Finally, there will be an opportunity for audience participation, questions and discussion.

References:
The Use of Ocular Coherence Tomography in Pediatric Ophthalmology

Lance M Siegel MD, Thomas Lee MD
Children’s Hospital Los Angeles

Purpose/Relevance: The use of the Ocular Coherence Tomography (OCT) is now required in the standard of care for the diagnosis and management of many pediatric conditions. This course will discuss the principal layers of the retina, and show the use of the OCT to treat and diagnose many pediatric ophthalmologic conditions including the following: Optic Nerve Drusen, Plaquenile toxicity, Optic cupping (physiologic and glaucomatous), Papilledema, Macular hypoplasia, Optic atrophy, Optic nerve hypoplasia, NF gliomas, CNV, CME, Shaken Baby Syndrome, Retinopathy of Prematurity, and more.

Target Audience: All pediatric ophthalmologist should be able to diagnose, treat and document retinal and optic nerve pathology, and need to understand how to perform, read and interpret such studies.

Current Practice: Many pediatric ophthalmologist don’t have or know how or when to use the OCT machine. This will teach how and when the use is necessary or important.

Best Practice: Many pediatric ophthalmologist do not have or know they need access to such modalities, this course will demonstrate why it is needed.

Expected Outcomes: To better incorporate OCT studies into their practice (particularly those in private practice, whom may not have thought about OCT studies).

Format: Power presentation with OCT images, handout with the same images. Discussion and teaching the findings.

Summary: The retinal and optic nerve layers as seen by OCT, what they mean, and pictures of corresponding pathology, and how to incorporate OCT studies into a practice.


I Made a Mistake: Presentation and Discussion of Cases in Pediatric Ophthalmology and Strabismus When the Unexpected Happened. What Happened and Why? How Can I Treat It? Prevent It? What I Learned From It?

Tamara Wygnanski-Jaffe MD Alex V Levin MD Sharon F Freedman MD Joseph L Demer MD Itay Ben-Zion MD Gregg T Lueder MD Stephen P Kraft MD Goldschleger Eye Institute, Sheba Medical Center Tel Hashomer, Israel, 52621

Purpose/Relevance: The workshop is designed to share mistakes, unpredicted findings and outcomes with a discussion on preventive measures and management.

Target Audience: Pediatric ophthalmologists, general ophthalmologists, and trainees.

Current Practice: It's much more difficult to present and discuss mistakes in history taking, diagnosis, imaging, surgical techniques, and unexpected surgical findings and complications than it is to present treatment successes. Sharing others experiences can teach us to expect, be aware, avoid and plan for the unexpected, if/when it should occur.

Best Practice: This workshop allows participants to observe cases with unexpected outcomes with an explanation and discussion by the presenting clinician and discussion with the panel and the audience.

Expected Outcomes: At the conclusion of the workshop the audience and the panel will have shared their experience with unexpected findings in common and rare clinical scenarios. It encourages the participants to expect the unexpected, seek and plan for it appropriately.

Format: Members of the panel will present clinical and surgical cases in which they experienced an unusual finding due to a clinical anomaly or a clinical, imaging, or surgical mistake. An ARS (audience response system) will allow anonymous polling from the audience, and engagement between presentors and participants.

Summary: Clinical and surgical cases with appropriate audio and visual material will be presented for discussion. These presentations will attempt to give the participants something to think about and take back to their respective practices.
AOC/AACO/AAPSO Workshop: Things We Were Never Taught in Training - Lessons from the School of Hard Knocks

Stephen P Christiansen MD Laurie Hahn-Parrott CO Burton J Kushner MD Kyle A Arnoldi CO Constance E West MD Christy Giligson OC(C) Ken K Nischal MD Vaishalli Mehta OC(C) Natalie Kerr MD

**Purpose/Relevance:** The formal post-graduate training of ophthalmologists and orthoptists prepares young professionals to manage a broad spectrum of vision-related disorders. Inevitably, however, and regardless of training, the provider encounters a diagnostic challenge, a difficult patient, or a clinical dilemma that leaves them stumped. This workshop presents the clinical pearls that experienced orthoptists and ophthalmologists have learned from their own patient encounters that members of the audience should find helpful in their own practices.

**Target Audience:** Orthoptists, Pediatric Ophthalmologists

**Current Practice:** The uncooperative child, the highly defensive parent, the difficult retinoscopic reflex, the perfectionistic adult with diplopia, the hugely over-corrected thyroid patient, the patient with a heart-stopping diagnosis, the cyclovertical torsion that doesn’t seem to fit are all examples of clinical challenges that ophthalmologists and orthoptists must face and resolve in the course of their practice. Some will be tempted to refer the patient to a colleague. In this workshop, however, the experience of others will equip and prepare members of the audience with highly practical tips for managing these patients themselves.

**Best Practice:** Informed, data-driven, experience-based care of clinically challenging patients.

**Expected Outcomes:** Attendees will be prepared to manage clinically-challenging patients whose care they may not have encountered in their training.

**Format:** Case-based vignettes that highlight difficult clinical entities.

**Summary:** Topics which will be addressed in this workshop include: Prisms Before Surgery; Conversion of a Non-Believer; American Horror Story: Managing Diplopia in the Age of Perfection; Refractive Pearls for Children; Finding the Balance: Avoiding Late Overcorrections in TED; Difficult Patients, Difficult Parents; Adaptive Care: Special Care for Special Needs; Breaking Bad...News - Managing the Patient with Bad Disease; and, Twists and Turns: Torsion in Unexpected Places.


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**Order in the Court: The Art and Ethics of the Witness Stand and Other Legal Issues in Pediatric Ophthalmology**

S. Grace Prakalapakorn MD, MPH Kara Cavuoto MD Lisa Bohra MD Janine Collinge MD Rebecca Leenheer MD Robert S Gold MD Anne N Menke RN, PhD Ron W Pelton MD, PhD Robert E Wiggins, Jr MD Christie L. Morse, MD

Submitted and officially sponsored by the AAPSO Young Ophthalmologist Committee

**Purpose/Relevance:** While Young Ophthalmologists are taught to provide excellent patient care, there is no formal education during residency or fellowship regarding legal issues that ophthalmologists may face during their careers. This workshop provides an introduction to legal and ethical issues that pediatric ophthalmologists may encounter, techniques to limit legal liability and malpractice claims, and how operating within the parameters set by the Academy’s Code of Ethics improves patient care and establishes public trust.

**Target Audience:** Pediatric ophthalmologists in their first ten years of practice, fellows and residents pursuing a career in pediatric ophthalmology, and established pediatric ophthalmologists.

**Current Practice:** There is no formal education on legal issues ophthalmologists may encounter both during and after their training. New pediatric ophthalmologists frequently rely on residency and fellowship mentors and peers for guidance in legal issues as they arise.

**Best Practice:** A strong foundation of facts on the role of the pediatric ophthalmologist in the legal system, skills to improve vigilance on the witness stand, and tips on practice management to avoid malpractice claims will be imparted.

**Expected Outcomes:** Attendees will learn skills to help successfully navigate challenges in the modern day practice of pediatric ophthalmology with emphasis on their role in the legal system and how to avoid malpractice claims. These skills will be of use to both young and more experienced pediatric ophthalmologists in the private practice and academic settings.

**Format:** Presentations including short lectures and case presentations followed by panel discussion and question and answer forum.

**Summary:** This workshop will introduce legal and ethical issues that pediatric ophthalmologists may encounter. Case presentations will be used to highlight what is appropriate and is not appropriate to say in the courtroom. The ethics of testimony and the role of office staff and physicians in malpractice lawsuits involving ophthalmologists will be discussed.

How to Avoid a Disaster In the Operating Room?

Donny W Suh  Sonal Farzavandi  Scott Olitsky  Daniel Weaver  David K Coats
University of Nebraska Medical Center, Omaha, NE

Purpose/Relevance: No surgeon can completely eliminate the possibility of encountering a complication. During this symposium, experienced strabismus surgeons will share their own personal stories of complications they have experienced along with how they handled them as well as tips to decrease the chances of having them happen in the first place.

Target Audience: Pediatric Ophthalmologists

Current Practice: Topics:
Wrong Site Surgery; Personal experience and results of Survey; Why does it Happen and Risk factors; What have we learned?
Lost muscle, How to Avoid and Surgical Tips
Needle misadventures and Scleral perforations; How to Treat Fire in Operating Site!
Deep Needle Passes
Wound Closure concerns following complicated strabismus surgery

Best Practice: Will discuss how to avoid these potential complications

Expected Outcomes: Will discuss how these complications can occur from personal experiences and discuss what we do differently to avoid these complications.

Format: Case presentations by each speakers
Followed by Open questions and answers
Audience participations will be encouraged

Summary: Synopsis: During this symposium, experienced strabismus surgeons will share their own personal experiences of complications they have experienced along with how they handled them as well as tips to decrease the chances of having them happen in the first place. Photos and Videos will be shown to demonstrate. Survey of Listserv members will be presented on Wrong Site Surgeries.

References: No reference. This is the first time we are presenting this Workshop. We hope to continue on a yearly basis.

Controversies in Retinopathy of Prematurity

David Wallace MD, MPH Michael Chiang MD, MA William Good MD Sharon Freedman MD Helen Mintz-Hittner MD Thomas Lee MD
Duke Eye Center, Oregon Health and Science University, Smith-Kettlewell Eye Research Institute, The University of Texas Health Science Center, The University of Southern California
Durham, NC, Portland, OR, San Francisco, CA, Houston, TX, Los Angeles, CA

Purpose/Relevance: Clinical care of infants with ROP is rapidly advancing, and there are many questions about methods of screening, choice of treatment, and indications for re-treatment. In this workshop, 6 ophthalmologists who are experienced in ROP treatment will discuss several controversial topics.

Target Audience: Pediatric ophthalmologists and researchers

Current Practice: 6 clinical care quandaries will be addressed, one by each of the panelists: Can I look at images instead of doing exams? (Michael Chiang); ROP is getting worse - do I have to wait for type 1? (William Good); Severe ROP in posterior zone II - laser or anti-VEGF? (Sharon Freedman); Which anti-VEGF drug and what dosage? (David Wallace); ROP has recurred after anti-VEGF treatment - now what? (Helen Mintz-Hittner); Retinal detachment - when is surgery indicated? (Thomas Lee).

Best Practice: Clinicians will consider all treatment options and use the best evidence to guide their care of infants with severe ROP.

Expected Outcomes: After participating in this workshop, attendees will have additional knowledge that will help them to manage difficult clinical scenarios in infants with severe ROP. They will consider alternatives to their current treatment strategies, apply evidence when available to guide treatment decisions, and be abreast of current research in the field.

Format: Each panelist will present for 8-10 minutes, and other panelists will then comment for 1-2 minutes after each talk. There will be 5-10 minutes for audience questions and open discussion at the end.

Summary: Advances in imaging and the use of anti-VEGF agents have dramatically changed the care of infants with severe ROP. Clinicians are encountering new scenarios that do not have clear-cut guidelines for follow-up or treatment. In this fast-paced workshop, six panelists who are experience in the care of infants with severe ROP will discuss controversial topics including screening methods, treatment selection, recurrent disease, and indications for re-treatment and/or vitrectrectinal surgery.

How Recent Technology Should Change Your Practice Patterns
Yasmin Bradfield MD Burton Kushner MD Michael Struck MD Melanie Schmitt MD
University of Wisconsin Department of Ophthalmology and Visual Sciences
Madison, Wisconsin

Purpose/Relevance: Recent technology advances that affect clinical practice include extraocular muscle imaging, OCT, visual evoked potential testing, and binocular treatments for amblyopia. Each technology will be presented with their benefits and pitfalls, practical use in a clinic setting, specific competing equipment will be discussed, and a conclusion whether the individual technology should be adopted in clinical practice today.

Target Audience: Pediatric ophthalmologists, General ophthalmologists

Current Practice: The diagnosis of the following clinical entities: papilledema, glaucoma, anomalous or slipped extraocular muscles, extraocular muscle activity in thyroid disease, and vision assessment in preverbal children using standard methods is challenging. Newer technologies may offer a clearer diagnosis. In addition, current amblyopia treatments are not always effective in children.

Best Practice: The workshop will cover the following: 1. OCT for assessing disk swelling; 2. OCT for diagnosing glaucoma; 3. Use of imaging for strabismus (MRI vs CT; inform radiology as to type of scan; muscle heterotopia and anomalies; lost, slipped muscles; use of dynamic scans; muscle edema in Graves); 4. VEP for preverbal vision testing; 5. New binocular therapies for amblyopia

Expected Outcomes: Audience members will gain practical knowledge of new technologies to apply in their clinics, which equipment of specific technologies perform better, and benefits and downsides of each technology including cost, availability, ease of use.

Format: Didactic with panel discussion

Summary: New technologies which can offer more accurate clinical diagnoses will be presented. OCT, extraocular muscle imaging, visual evoked potential testing, and binocular amblyopia treatments will be discussed. The benefits and downsides of each technology including cost, availability, ease of use will be presented.


Stump the chump! Case-based classification and management controversies in childhood glaucoma
Sharon F Freedman MD Allen D Beck MD Alex V Levin MD
Duke Eye Center, Durham, NC, USA

Purpose/Relevance: To apply the new International Classification of pediatric glaucoma/glaucoma suspects to clinical cases spanning the gamut of diagnostic and therapeutic dilemmas, using case-based format and panel discussion to illuminate both management consensus and controversies.

Target Audience: Pediatric ophthalmologists, pediatric-interested comprehensive ophthalmologists, and trainees.

Current Practice: Although various classification systems exist for childhood glaucoma, variability in definitions makes it difficult to compare outcomes across studies and to develop consensus regarding optimal treatment paradigms. As additional diagnostic and treatment modalities emerge, systematic evaluation of their application and efficacy may help minimize resultant visual disability and blindness.

Best Practice: Having a common language (international standard definitions and classification system) for childhood glaucoma/glaucoma suspects worldwide, will allow better comparison of given treatment modalities. This will apply not only to surgical treatment, but to overall development of ‘best practice’ algorithms for treating these children. Ideally we should have well-known and widely agreed-upon strategies for medical and/or surgical management of various types of childhood glaucoma, based upon outcome-driven data, using a common definition/classification of the disease.

Expected Outcomes: At the conclusion of this workshop, participants will have facility applying the international definitions and classification for childhood glaucoma/glaucoma suspect, allowing for immediate use in their practices. Based upon real cases presented, they will have gleaned strategies for management of both suspect and confirmed childhood glaucoma, and will realize where consensus generates a ‘straight-forward’ treatment plan, vs. where there is much room for future study of what truly produces best outcomes.

Format: Case presentation with panel discussion and audience quiz/polling.

Summary: Case-based format will allow familiarity with a uniform definition/classification system for childhood glaucoma/glaucoma suspects*. Clinical cases presented/discussed by panelists will include those with straight-forward management strategies, and more complex cases lacking one ‘best’ treatment, encouraging audience participation and discussion. Surgical videos and pearls will be included.

Strategies for the successful management of complex strabismus resulting from orbital pathology and iatrogenic causes

Ramesh Kekunnaya  Linda Dagi  David Granet  Scott Lambert  Manoj Parulekar  Federico Velez
L V Prasad Eye Institute, Hyderabad, INDIA

Purpose/Relevance: Ocular misalignment following treatment of retinal detachment, after placement of glaucoma drainage devices, post orbital trauma, resulting from thyroid eye disease, craniosynostosis and high myopia, presents a challenge to even the most seasoned strabismus surgeon.

Target Audience: These cases are complex, and often require close coordination with other sub-specialists.

Current Practice: This workshop will address focused clinical assessment and decision making through a mixture of didactic lectures, case presentations and illustrative videos.

Best Practice: We will provide a succinct guide to the pearls and pitfalls guiding treatment of each disorder.

Expected Outcomes: Attendee participation and questions will be encouraged, time permitting.

Format: Didactic lecture, Case and video presentations and panel discussion

Summary: At the end of the course, we anticipate the attendee will enjoy a more sophisticated understanding of the successful management of each form of complex strabismus.

References:

Five Cases in Pediatric Corneal Disease You Don’t Want to Miss

Ken K Nischal MD, FRCOphth  Marcia Tartarella MD  Bibiana Reiser MD  Erin Stahl MD
UPMC Eye Center, Children’s Hospital of Pittsburgh
Pittsburgh, PA

Purpose/Relevance: Increasingly pediatric corneal disease presents to the pediatric ophthalmologist before it presents to the corneal specialist. This workshop provides an insight into immediate treatment options and a knowledge of what might be available so that parents can be appropriately counseled if further referral to a cornea specialist is needed.

Target Audience: Pediatric ophthalmologists, orthoptists and trainees.

Current Practice: Access to corneal specialists for a child presenting with photophobia or with a difficult examine is usually limited, so these children present commonly to pediatric ophthalmologists. Training in the newer concepts of managing corneal disease for pediatric ophthalmologist is scarce which leaves pediatric ophthalmologists vulnerable in such cases.

Best Practice: Ideally pediatric ophthalmologists and orthoptists should be aware of at least 5 common corneal diseases that they are likely to encounter in their daily practice at least once a year or more. They should be aware of their diagnostic and treatment options and also what subspecialty treatments may be available via the cornea specialist.

Expected Outcomes: This workshop aims to help bridge any knowledge gaps the audience may have so that an adequate assessment and treatment plan can be formulated for 5 common pediatric corneal pathologies.

Format: 4 experienced pediatric ophthalmologists with a subspecialty interest in corneal diseases will present cases for interactive discussion with the audience and co-panellists using video and still images. The thrust of the presentations will be to initiate audience participation.

Summary: 5 of the commonest pediatric corneal diseases presenting to pediatric ophthalmologists will be discussed.

Interactive discussion will help delineate tips and clues to reach a diagnosis.

Interactive questions and discussions will allow formulation of treatment plans for each case.

References:
SEC Contracting and Benchmarking Workshop
I Never Learned This in Residency:
Contracting with Insurance Companies and Hospitals
Shira L Robbins MD Robert D Gross MD, MBA Eric A Lichtenstein MD
Merrill Stass-Isern MD Robert E Wiggins, Jr MD, MHA Lisa Bohra MD
Michael J Bartiss MD, OD

Purpose/Relevance: Contracts underlie all commercial relationships, including those between physicians and insurers as well as physicians and patients. In an environment where physician reimbursement is under constant scrutiny, proper contracting is essential to the clinical and financial health of all physicians, regardless of their practice type. Effective contracting also affects the ability and efficacy of physicians to serve the patient population in their catchment area.

Target Audience: The target audience is all pediatric ophthalmologists who have or want to develop hospital and/or insurance company contracts for their services. This directly affects the level of care and range of services that physicians are able to offer their patients.

Current Practice: Physicians inexperienced in business matters often forge their way through the contracting process, rely on mentors for advice, or retain third parties to conduct the negotiation process for them.

Best Practice: Educating physicians as to basic business concepts, including contract negotiation, better prepares physicians to be effective advocates for their patients, their practices and themselves.

Expected Outcomes: After this presentation, participants will be better informed about the basics of contracting with hospitals and insurance companies.

Format: This will be a panel discussion with open questions and answer forum. In addition, there will be a brief presentation of the 2016 Benchmarking Survey results.

Summary: The participating panel will present information for healthy contracting with hospitals and insurance companies, allowing questions and open dialogue with the audience. The results of the 2016 Benchmarking Survey will be briefly presented.


Coding - a Day in the Life of the Pediatric Ophthalmologist
Jenny Edgar CPC, CPCO, OCS Michael J Bartiss OD, MD Robert S Gold MD, FAAP
Heather Dunn COA
American Academy of Ophthalmology, San Francisco, CA

Purpose/Relevance: Audit recoupments are not based upon unique cases. They are based on what pediatric ophthalmologists do every day. With the increase of federal and commercial audits, knowing how to be proactive is crucial for practice survival.

Target Audience: Pediatric ophthalmologists and their staff

Current Practice: Physicians are ultimately responsible for the CPT and diagnosis code selection filed to payers. If they are submitted erroneously due to coding or documentation inaccuracies, failing an audit is a very real possibility.

Best Practice: All sections of this course are designed to help pediatric ophthalmologists document their medical records according to payer requirements to assure appropriate reimbursement, administer their practices more efficiently and bullet proof their documentation in any audit situation.

Expected Outcomes: Upon completion of this course the participant should be able to:
• Accurately answer questions on the fundamentals of pediatric coding
• Apply principles of chart documentation, testing services requirements, and surgical coding for all payers
• Identify and correct claim submission errors which are costly to the practice

Format: Lecture with audience participation

Summary: Section 1 of this intensive two hour course will begin by testing your coding competency with a rapid fire question and answer session. Section 2 will follow with real life case presentations and coding (CPT and ICD-10) options depending upon the payer. Section 3 will address the most common payer denials and how to rectify them.

Video Demonstrations of Signs, Diseases, and Complex Surgical Procedures in Pediatric Ophthalmology and Strabismus

Federico G Velez MD Sharon F Freedman MD Joseph L Demer MD, PhD
Deborah K VanderVeen MD Christopher J Lyons MD Hilda Capo MD

Jules Stein Eye Institute, UCLA; Duke University; Boston Childrens Hospital;
British Columbia Childrens Hospital, Bascom Palmer Eye Institute
Los Angeles, CA; Durham, NC; Boston, MA; Vancouver, BC; Miami, FL

Purpose/Relevance: Video demonstration of unusual and complex signs, diseases, and surgical procedures in pediatric ophthalmology and strabismus
Target Audience: Pediatric Ophthalmologist and Strabismologist, Orthoptists, and Training Ophthalmologist
Current Practice: Some signs and surgical procedures described in textbooks represent a challenge because some conditions are rarely seen in clinics and some surgical procedures are almost exclusively performed at tertiary referring centers.
Best Practice: This workshop allows to see videos of rare signs and surgical procedures, with an explanation by the ophthalmologist who recorded it and a discussion with the panelist and the audience.
Expected Outcomes: Increase the level of awareness and confidence when performing an examination, making a diagnosis and planning treatment.
Format: Six experienced pediatric ophthalmologist and strabismologist will present and discuss videos of signs, diseases, and surgical procedures. Panelist will discuss differential diagnosis and potential treatment options. Audience participation is encouraged.
Summary: Demonstration of classical or rare signs, diseases, surgical procedures using high quality video presentations.

Difficult Non-Strabismus Problems in Pediatric Ophthalmology

Elias I Traboulsi MD, MEd Arlene V Drack MD Mays A AlDairi MD Audina Berrocal MD Erick Bothun MD
Cole Eye Institute, Cleveland Clinic, Cleveland, USA

Purpose/Relevance: Sharing the difficulties in making the diagnosis and managing rare and atypical cases allows practitioners to benefit from each other’s experience and to discuss alternative evaluation and treatment plans. The presentation of several such cases to a broad audience of interested individuals allows the appropriate distribution of such teaching cases.
Target Audience: Pediatric ophthalmologists, orthoptists, vision scientists and trainees
Current Practice: While many pediatric ophthalmologists elect to manage difficult cases, others refer such cases to other pediatric ophthalmologists or subspecialists with advanced or more extensive experience in the particular area of disease or management that the patient needs.
Best Practice: While many difficult diagnostic cases can be addressed via telephone or email communications between the primary treating physician and the expert, others need to visit one or more subspecialists before a final diagnosis is reached and a treatment plan is firmly established. Group presentation of cases in some instances is necessary with the participation of several advanced practitioners, sometimes from specialties outside of ophthalmology.
Expected Outcomes: At the conclusion of the workshop the audience and the panel will have shared their experiences and strategies for the diagnosis and management of a few challenging cases. The practitioner in the audience is expected to gain new insights into the clinical reasoning behind each diagnosis and the purpose of any intervention.
Format: Each panelist will present one case and invite the other panelists to discuss their approaches to diagnosis and treatment. The audience will participate by asking questions or providing personal insights.
Summary: Case-based learning experience involving 5 challenging pediatric ophthalmology non-strabismus cases
Difficult Problems: Strabismus

Linda R Dagi MD Edward G Buckley MD Andrea Molinari MD Lionel Kowal MD
Stacy L Pineles MD Gregg T Lueder MD
Boston Children’s Hospital; Duke Eye Center; Hospital Metropolitano, Quito; Royal
Victorian Eye and Ear Clinic and University of Melbourne; Jules Stein Eye Institute;
Washington University St Louis
Boston, Durham, Quito, Melbourne, Los Angeles, and Saint Louis

Purpose/Relevance: Evaluation and successful remediation of complex strabismus poses
diagnostic and therapeutic challenges even for the experienced surgeon. Repair of strabismus
secondary to cranial nerve palsy, orbital trauma and deformity, or after multiple prior strabismus
procedures is particularly problematic. This workshop will address difficult cases like these to fill
a potential knowledge gap for the practicing ophthalmologist.

Target Audience: Pediatric ophthalmologists, adult strabismus specialists, ophthalmic resi-
dents, fellows and orthoptists

Current Practice: Practitioners utilize strategies and surgical techniques taught in fellowship or
addressed at professional meetings, on the list serve, in journals and as a result of peer-to-peer
discussion.

Best Practice: Enhancing all of the above with the opportunity to discuss treatment options for
particularly challenging cases presented by experienced strabismologists.

Expected Outcomes: As a result of exposure to debate and discussion regarding approaches
to 6 challenging cases, attendees will be introduced to novel strategies and techniques to reme-
diate at least 6 complex strabismus disorders. Exposure is designed to enhance future practice
by enabling participants to apply these concepts.

Format: The workshop will consist of expert panel discussion following presentation of a series
of individual cases. Audience questions and participation will be encouraged, time permitting.
The result of one expert’s surgical intervention will be presented along with a discussion of the
pearls and pitfalls of the intervention chosen.

Summary: All panel participants are internationally recognized experts in the field of strabis-
sum. Each expert will present a difficult case for discussion by the others in an open forum
format. The results of surgery performed to address the strabismus will be shared and advan-
tages and drawbacks to this choice addressed.

References: Strabismus Surgery: Basic and Advanced Strategies Ophthalmology Monographs 17 The American Academy of Ophthalmol-
ogy Oxford University Press, 2004
Notes
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