STATE BOARD OF OPTOMETRY
2450 DEL PASO ROAD, SUITE 105, SACRAMENTO, CA 95834
P (916) 575-7170 F (916) 575-7292 www.optometry .ca.gov

Continuing Education Course Approval Checklist

Title: Fall 2016 Optometry Symposium - Pediatric Eye Disorders

Provider Name: Loma Linda University Eye Institute c/o Mr. Jason Polanco

☑Completed Application
Open to all Optometrists? ☑Yes ☐No
Maintain Record Agreement? ☑Yes ☐No

☑Correct Application Fee

☑Detailed Course Summary

☑Detailed Course Outline

☑PowerPoint and/or other Presentation Materials

☑Advertising (optional)

☑CV for EACH Course Instructor

☑License Verification for Each Course Instructor
Disciplinary History? ☐Yes ☑No

CALIFORNIA STATE BOARD OF OPTOMETRY

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

$50 Mandatory Fee

1-1775 802599 802599 50

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title	**Course Presentation Date**
Fall 2016 Optometry Symposium Pediatric Eye Disorders	7:30 AM - 3:15 PM 11/13/2016

Course Provider Contact Information

Provider Name
LOMA LINDA UNIVERSITY EYE INSTITUTE
(First) (Last) (Middle)

Provider Mailing Address
11370 ANDERSON ST.
Street #7025 **City** Loma Linda **State** CA **Zip** 92354

Provider Email Address jpolanco@llu.edu

Will the proposed course be open to all California licensed optometrists?	☑ YES ☐ NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	☑ YES ☐ NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name
Michael Rauser
(First) (Last) (Middle)

License Number G85469	**License Type** MD
Phone Number (909) 558.2076	**Email Address** jpolanco@llu.edu

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Signature of Course Provider *Date* 11/14/16

Form CE-01, Rev. 5/16

Physician	Medical License #	email
Affeldt, John C. MD	G38490	jaffeldt@llu.edu
Esmail, Fatema Q. MD	A126363	fesmail@llu.edu
Guan, Howard D. MD	A119766	hguan@llu.edu
Khazaeni, Leila M. MD	A92331	lkhazaeni@llu.edu
Luke, Priscilla K. MD	A107548	pluke@llu.edu
Rauser, Michael E. MD	G85469	mrauser@llu.edu
Sierpina, David I. MD	A126092	dsierpina@llu.edu
Cotter, Susan O.D., M.S.	7784TPA	cottlee@ohsu.edu

Fall 2016
Optometry Symposium

SCHEDULE OF EVENTS

7:30 a.m. Registration & Breakfast

7:55 a.m. Michael Rauser, MD
Welcome and Overview

8:00 a.m. Frank Hwang, MD
Phakic Intaocular Lenses

8:30 a.m. Timothy Winter, MD
Challenging Strabismus Cases

9:00 a.m. Fatema Esmail, MD
Myopia

9:30 a.m. Leila Khazaeni, MD
Adult Strabismus

10:00 a.m. Break
Visit with Speakers at Designated Tables

10:30 a.m. Sue Cotter, OD
The Preschool Eye Exam Made Easy

11:15 a.m. Sue Cotter, OD
Management of Refractive Error in Preschool Children

12:00 p.m. Buffet Lunch

12:30 p.m. Michael Rauser, MD
Department Update

12:45 p.m. Michael Rauser, MD
Refractive Cataract Surgery, A Cost Effective Approach

1:15 p.m. John Affeldt, MD
Update on Dry Eye

1:45 p.m. Priscilla Luke, MD
The Mystery of Meibomian Gland Dysfunction

2:15 p.m. Howard Guan, MD
The Usual (Glaucoma) Suspects

2:45 p.m. David Sierpina, MD
Current Research Activities at Loma Linda University Eye Institute

3:15 p.m. Closing Remarks and Adjournment

LOMA LINDA UNIVERSITY
Eye Institute

LLUMCMKTG#FMG-106-18/1116/200

Loma Linda University Eye Institute

Fall 2016

Optometry Symposium

Sunday, November 13, 2016
7:30 a.m. – 3:30 p.m

LOMA LINDA UNIVERSITY
Eye Institute

FALL 2016 Optometry Symposium

SCHEDULE OF EVENTS

7:30 A.M.	**Registration & Breakfast**
7:55 A.M.	Michael Rauser, MD **Welcome and Overview**
8:00 A.M.	Frank Hwang, MD *Phakic Intaocular Lenses*
8:30 A.M.	Timothy Winter, MD *Challenging Strabismus Cases*
9:00 A.M.	Fatema Esmail, MD *Myopia*
9:30 A.M.	Leila Khazaeni, MD *Adult Strabismus*
10:00 A.M.	**Break** *Visit with Speakers at Designated Tables*
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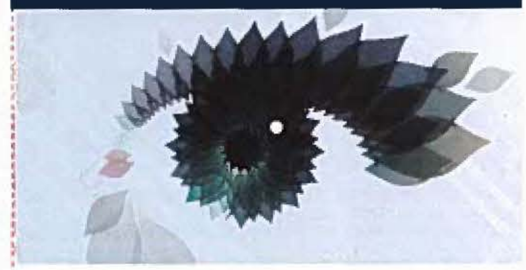
2:45 P.M.	David Sierpina, MD *Current Research Activities at Loma Linda University Eye Institute*
3:15 P.M.	**Closing Remarks and Adjournment**

LOMA LINDA UNIVERSITY
Eye Institute

Loma Linda University Eye Institute

Fall 2016

Optometry Symposium



Registration Form

Name ______________________

Mailing Address ______________________

City ____________ State ______ Zip ______

Telephone ____________ License # ____________

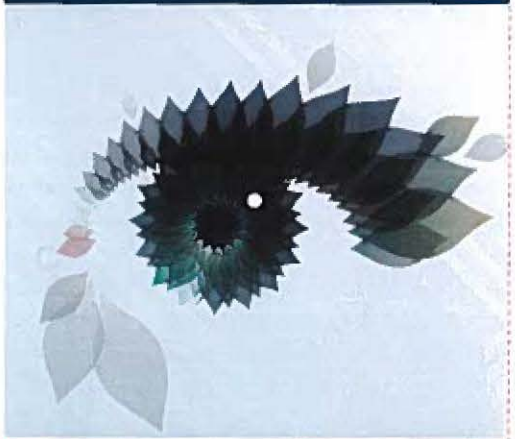
Email ______________________
(Needed for RSVP Confirmation)

Please RSVP by mailing registration form with payment to: LLU EYE INSTITUTE
Attn: Jason Polanco
11370 Anderson Street, Suite 2025
Loma Linda, CA 92354
Fee: $25.00

Please make check payable to:
LLU Eye Institute
*No refunds will be given after Monday, October 31, 2016.

Loma Linda University Eye Institute

Fall 2016
Optometry Symposium



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STATEMENT OF OBJECTIVES

Upon completion of this course, participants will be able to:

1. Understand how structural abnormalities in the visual pathway correspond to visual field pattern defects
2. Better understand the clinical entity of neurotrophic keratitis
3. Recognize the clinical findings of common yet often overlooked corneal causes for suboptimal vision.
4. Know the role of Aflibercept in the treatment of age-related macular degeneration, diabetic macular edema and retinal vein occlusion
5. Understand the potential etiologies of ocular torticollis including cranial nerve palsies, strabismus syndromes, pattern strabismus and nystagmus and how to manage each
6. Know the clinical indications for functional eyelid surgery

ACCREDITATION

This course is pending approval from the State Board of Optometry for a total of 6.0 CE.

COURSE DESCRIPTION

Loma Linda University Eye Institute is pleased to invite you to the Fall 2016 Optometry Symposium.

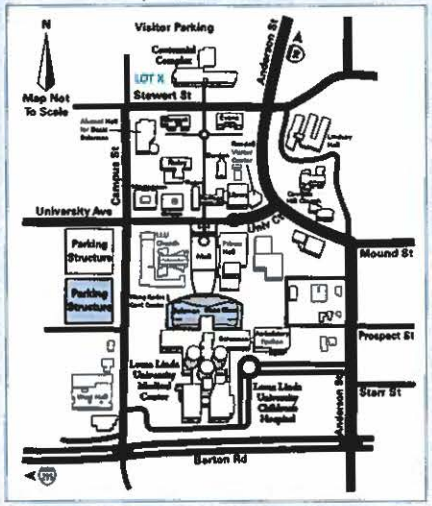
The symposium will emphasize when to appropriately treat or refer patients for specific eye conditions. The use of new pharmacological agents and
new technologies in the diagnosis and treatment of ophthalmic disorders will be highlighted. The fee for this meeting is $25.00 and **six hours of CE credits** will be provided for attendance. All attendees will receive a gift at the end of the conference.

We sincerely hope you will join us for this meeting. Please RSVP by Monday, October 31, 2016, as seating is limited.

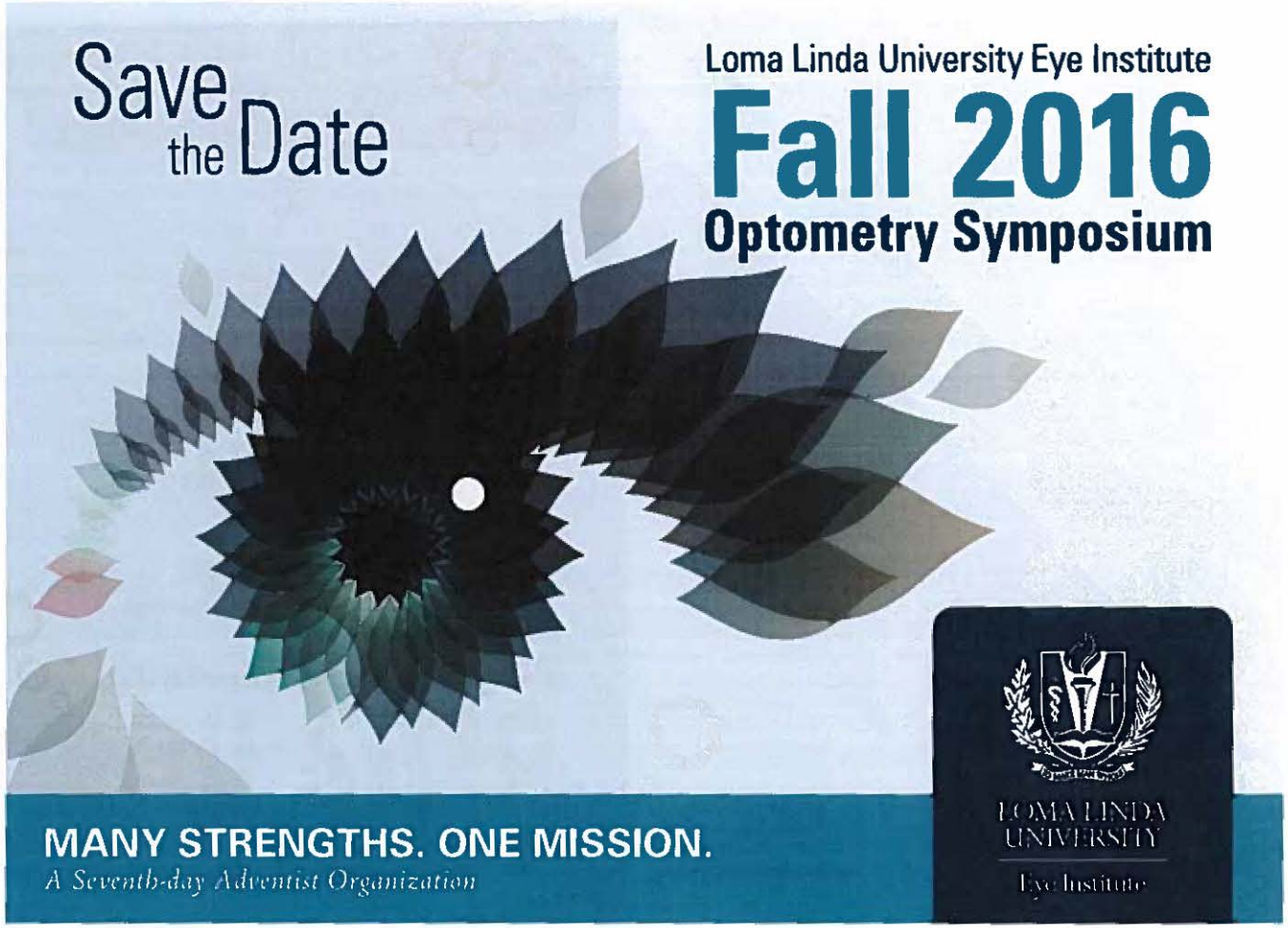
For further information regarding this conference, please contact Jason Polanco at 909-558-2076 or jpolanco@llu.edu.

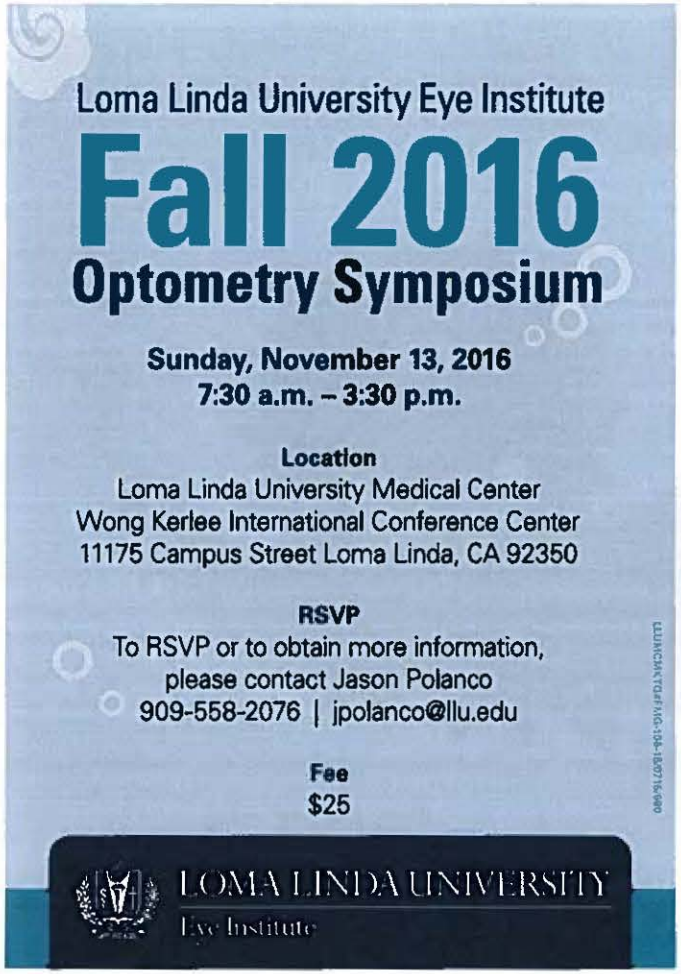
LOCATION & PARKING

The meeting will be held at the Loma Linda University Medical Center Wong Kerlee International Conference Center located at the Coleman Pavilion. Parking is available in the parking structure on Campus Street and in Lot X – turn west on Stewart Street (behind Centennial Complex).



Wong Kerlee International Conference Center
Loma Linda University Campus
11175 Campus Street
Loma Linda, CA 92354


Save the Date
Loma Linda University Eye Institute
Fall 2016
Optometry Symposium
MANY STRENGTHS. ONE MISSION.
A Seventh-day Adventist Organization
LOMA LINDA UNIVERSITY
Eye Institute



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Dear Optometric CE Board,

Attached is the supplemental materials required for obtaining Optometric CE credit for the Nov 13, 2016 Optometry Symposium sponsored by the Loma Linda University Eye Institute. We followed the usual submission process for obtaining CE credit as in previous years; but became aware of the new additional requirements shortly before the scheduled conference date. In the future we will ensure that a complete application following the new requirements will be received by your office at least 45 days prior to the scheduled date, as now required.

Our annual conference is composed of lecture topics that provide updates in the management of common ocular disorders. This year's symposium can be grouped into 3 main categories :

1. Anterior segment/ Ocular surface :
   Phakic Intraocular lenses
   Refractive Cataract Surgery – A Cost Effective Approach
   Update on Dry Eye
   The Mystery of Meibomian Gland Dysfunction
   The Usual (Glaucoma) Suspects

2. Pediatric Eye Disorders:
   Challenging Strabismus Cases
   Myopia
   Adult Strabismus
   The Preschool Eye Exam Made Easy
   Management of Refractive Error on Preschool Children

3. Current Research Studies at the Loma Linda University Eye Institute

Based on the current application requirements, this symposium would require 3 separate applications to obtain CE approval for the conference. Thanks for your consideration.

Sincerely,

Michael Rauser, MD
Chairman, LLU Eye Institute
Associate Professor, LLU SOM Ophthalmology

Dr Timothy Winter- Challenging Strabismus Cases

Acute presentations of strabismus can be challenging, and indicate the possible presence of a new or established neurologic disorder. A case of sudden onset vertical diplopia was presented, with an initial 4th nerve palsy, followed by interval development of 3rd nerve palsy, will be presented. The differential diagnosis and neuroanatomy associated with this case will be reviewed. This is a case of probable Miller Fisher variant of Guillain Barre Syndrome. The need for neuroimaging and lab testing tailored to the differential diagnosis will be emphasized.

Speaker: Timothy Winter, MD

Title: The Struggle of Strabismus

Objectives

1. Review the sensorimotor exam and ancillary testing to provide tips for reimbursement
2. Consider uncommon causes for strabismus and how to differentiate each from the others
3. Discuss strategies for timely and appropriate treatment

Outline:

I. Introduction

   a. Presentation of an unusual case

   b. Description of the salient features of the history and physical exam

II. Appraisal of anatomy related to strabismus

   a. Cranial nerves involved in ocular motility

   b. Extraocular muscles

   c. Orbital structures

III. Consideration of the infrequent causes of strabismus

   a. Ischemic

   b. Compressive

   c. Orbitopathies

   d. Neuromuscular

   e. Paraneoplastic

IV. Evaluation of diagnostic and management considerations

   a. Serology

   b. Neuroimaging

   c. Medical and Surgical consultations

Timothy Winter, MD

THE STRUGGLE OF STRABISMUS

Timothy W. Winter, DO
Assistant Professor, Pediatric and Adult Neuro-ophthalmology
Department of Ophthalmology LLUEI
November 13, 2016

FINANCIAL DISCLOSURES

- None

OVERVIEW

- Present an unusual case
- Review anatomy related to strabismus
- Consider causes of strabismus
- Evaluate diagnostic and management options

CASE, 1852

CASE

- 73 yo male with new onset of vertical diplopia x 2 days
  - Presented to outside eye care provider
  - PMH: IDDM, high cholesterol, HTN
  - FSBS have been WNL last few days
- ROS was negative for HA, scalp tenderness, jaw claudication, fever, or night sweats
- Exam showed normal motility OU but RHT worse in left gaze and R head tilt; normal otherwise
- Diagnosed with ischemic R CN 4 palsy
- Ordered MRI orbits w/wo contrast, MRA head and neck, Acetylcholine TSH receptor Abs, anti-MUSK, and TSH, free T4
  - All WNL

CASE

- Pt returns 1 week later with new symptoms of droopy L upper lid
- Exam showed:
  - Normal pupils both eyes
  - Abnormal motility with -3 ADduction L eye, as well as -2 elevation/depression L eye
  - LHT and L exotropia
  - No retinal hemorrhages either eye
- Diagnosed with ischemic R CN 4 palsy and new L CN 3 palsy
- Referred to Neuro-ophth for further evaluation/treatment

CASE

- 73 yo male with well-controlled IDDM, high cholesterol, and HTN with LUL ptosis and bilateral ophthalmoplegia
- POH: POAG, NS cataracts
- PSH: Quadruple bypass, tonsillectomy, knee
- Social Hx: ½ ppd x 60 years, quit 3 years ago; no EtOH / IVDA
- Family Hx: hemorrhagic CVA (Mother, deceased @42)
- Meds: Simvastatin 80mg PO Q PM; Plavix 75mg PO Daily; Lantus 100 U/mL SC QHS; Diovan160mg/12.5mg PO Daily, Glipizide 10mg PO Daily; Toprol XL 25mg PO Daily
- Allergies: NKDA

CASE

Eye Exam	Right	Left
• VA c corr	20/20-1	20/25-3
• Pupils:	3→2, no APD	3→2, no APD
• CVF:	Full	Full
• IOP:	14mm Hg	16mm Hg
• MRD1	5mm	0mm
• SLE:	2+ Meibomitis	2+ Meibomitis
	2+ NS	2+ NS
• DFE:	WNL	WNL

CASE

Sensorimotor Exam	R eye	L eye
• Motility	Full	-4 ADduction
		-2 elevation
		-2 Depression
• Saccades	Hyper, AB	Hypo, AD
• Nystagmus	None	None
• Sensory exam (W4D)	2 lights	Suppression

CASE

Sensorimotor Exam

25-30 XT
20 LHT

	25 XT	20 XT
unable	16 LHT	18 LHT

Near: 30 XT
20-25 LHT

CASE

- Summary findings
  - IDDM, high cholesterol, and HTN
  - RHT, then…
  - LUL ptosis
  - L eye ophthalmoplegia with LHT and LXT
  - L INO
  - Normal MRI orbits w/ wo contrast
  - Normal MRA head / neck
  - Normal AChR, TSH / MUSK Abs
- Further diagnostic testing was performed
- RTC 3 months

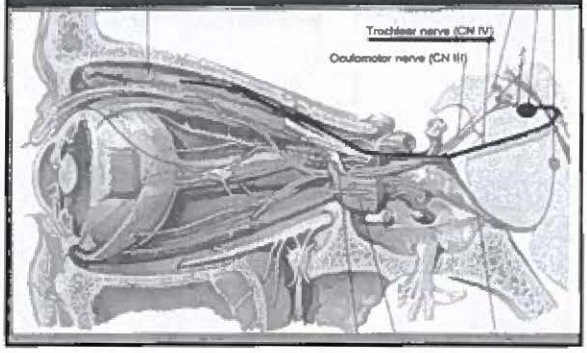
DIFFERENTIAL DX

- Ischemic cranial neuropathy
- Compressive cranial neuropathy
- Orbitopathy
- Neuromuscular disease

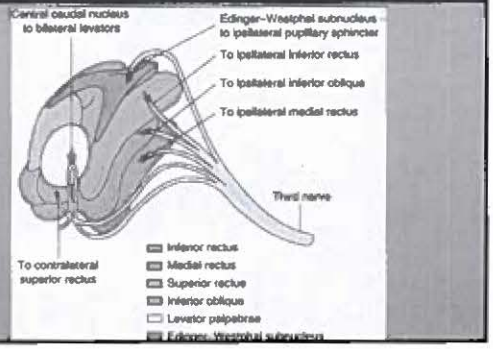
DIFFERENTIAL DX

- **Ischemic cranial neuropathy**
- **Compressive cranial neuropathy**
- Orbitopathy
- Neuromuscular disease

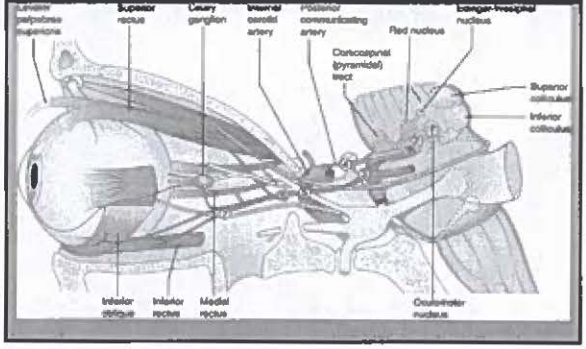
CRANIAL NERVE 4



CRANIAL NERVE 3



CRANIAL NERVE 3

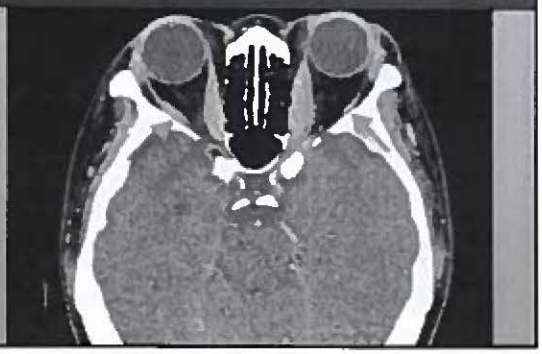


DIFFERENTIAL DX

- Ischemic cranial neuropathy
- Compressive cranial neuropathy
- **Orbitopathy**
- **Neuromuscular disease**

WHICH IS IT?

ORBITOPATHY



DIFFERENTIAL DX

- Ischemic cranial neuropathy
- Compressive cranial neuropathy
- Orbitopathy
- Neuromuscular disease
  - Well-controlled medical problems
  - Findings are non-localizing
  - Normal neuroimaging
  - Normal serology
- Others?

NEUROMUSCULAR

NEUROMUSCULAR

Sero-negative Myasthenia Gravis (MG)

- Ocular MG may be sero-negative in 50% of patients
  - Generalized MG has Abs in 85-90%
- 10% have thymoma
- 5% are associated with dysthyroidism
- Findings include:
  - Cogan lid twitch
  - Lightning saccades

NEUROMUSCULAR

Drug-induced myopathies

- Numerous pharmacologic agents can decrease transmission at the neuromuscular junction
  - Anticonvulsants (phenytoin)
  - β-blockers
  - Corticosteroids
  - Cisplatin, Vincristine/Vinblastine
  - Lithium
  - Magnesium
  - Antibiotics (Polymyxin B, Azithromycin)

NEUROMUSCULAR

Miller-Fisher Syndrome (MFS)

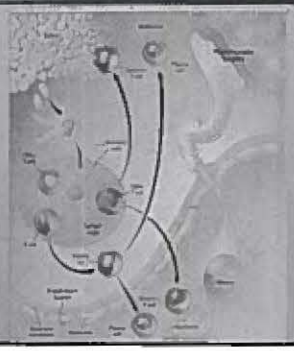
- Classic triad of ophthalmoplegia, ataxia, areflexia following a viral illness
- Bulbar variant of Guillain-Barré (GBS) which may produce unilateral or bilateral cranial polyneuropathies
- Elevated CSF protein without a cellular response
- May have elevation of anti-ganglioside Abs
  - GQ1b
- Thought to be a lymphocyte-mediated autoimmune reaction
- Not always represents a variant of Guillain Barre

NEUROMUSCULAR

Acute/Chronic Inflammatory Demyelinating Polyneuropathy (AIDP, CIDP)

- Rare disorder with inflammation of myelin from nerve roots and peripheral nerves
  - Weakness of arms/legs; sensory disturbance may also be present
  - EMG and/or nerve biopsy may be necessary for diagnosis
- In contrast to MFS, most patients cannot identify a preceding illness
  - May have other anti-ganglioside Abs (anti-asialo, GQ1a)
- AIDP is the most common form of GBS
- CIDP has ongoing symptoms for over 8 weeks and does not usually resolve without treatment
- Prednisone

PARANEOPLASTIC

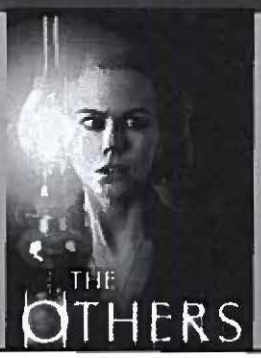


PARANEOPLASTIC

Lambert-Eaton Myasthenic Syndrome (LEMS)

- Disorder of neuromuscular junction that produces proximal limb weakness and fatigability
  - EMG shows incremental response to repetitive nerve stimulation (opposite of MG)
- Ocular involvement is rare, but show ptosis and/or ocular motility disorders
- Has antibodies to voltage-gated calcium channel
- 70% harbor malignant neoplasms
  - Usually small cell bronchogenic carcinoma

OTHERS



OTHERS

- **Progressive Supranuclear Palsy**
  - Degenerative of parkinsonism
  - Usually affects vertical gaze first, especially depression
- **Chronic progressive external ophthalmoplegia (CPEO)**
  - Symmetric total/subtotal ophthalmoplegia
  - Symmetric ptosis
  - Normal pupils
  - Biopsy of EOM → "Ragged-red fibers"
- **Myotonic Dystrophy**
  - Ptosis
  - PEO
  - Face, neck, limb myopathy with atrophy
  - Frontotemporal baldness
  - Cataracts

BACK TO OUR CASE

- Tensilon Test
  - Negative
- Serology
  - Anti-ganglioside Abs → POSITIVE
    - Anti-asialo GM1 Abs
  - Anti-Ca^{2+} channel Abs → Neg
- Curbside Neurology Consult
  - MFvGB vs AIDP/CIDP vs MG
  - Pyridostigmine 60mg PO TID
  - Immunomodulation → Prednisone 0.5mg/kg/day

BACK TO OUR CASE

- 1 month after Pyridostigmine…
  - No improvement in ptosis or diplopia
- 1 month after Prednisone…
  - No ptosis!
  - Motility full both eyes
  - 8 X(T) with 2 LHT
- Likely diagnosis
  - MFvGB vs AIDP
  - Will continue monitoring with assistance from Neurology

SUMMARY

- Beware of strabismus that CANNOT be localized
- Look for clues in the sensorimotor exam
  - Motility
  - 9 cardinal gazes
  - Saccades
- Associate other findings from the history/physical
  - Medical problems and medications
  - Variability of symptoms and diurnal fluctuations
  - Ptosis vs retraction
- Evaluate serology, neuroimaging, and consider consultation

REFERENCES

1. Oliver JE. Neuro-ophthalmology. 3rd edition. Philadelphia: Lippincott Williams and Wilkins; 1999
2. Chronic Inflammatory Demyelinating Polyneuropathy. WebMD. 12 Feb. 2016. http://www.webmd.com/brain/guide-inflammatory-demyelinating-polyneuropathy

TIMOTHY WENDELL WINTER

5227 Camino Sandia NE, Albuquerque, NM 87111 · twwinter@salud.unm.edu · (918) 504-7009

EMPLOYMENT

07/2013—Present **University of New Mexico, Division of Ophthalmology/Department of Surgery** (UNM: Albuquerque, NM)

- Director, Pediatric Ophthalmology and Adult Strabismus Service
- Assistant Professor, Adult and Pediatric Neuro-ophthalmology

EDUCATION

07/2012—06/2013 **University of Iowa, Ophthalmology and Visual Sciences** (UI: Iowa City, IA)
Pediatric Ophthalmology Fellowship

07/2011—07/2012 **University of Miami, Bascom Palmer Eye Institute** (BPEI: Miami, FL)
Neuro-Ophthalmology Fellowship

07/2008—06/2011 **Oklahoma State University Medical Center** (OSUMC: Tulsa, OK)
Ophthalmology Residency

07/2007—06/2008 **Oklahoma State University Medical Center** (OSUMC: Tulsa, OK)
Traditional Rotating Internship

08/2003—05/2007 **Western University of Health Sciences** (WUHS: Pomona, CA)
Doctor of Osteopathic Medicine

08/1996—12/2002 **Brigham Young University** (BYU: Provo, UT)
Bachelor of Arts: Spanish, with minor in Chemistry

CERTIFICATION & LICENSURE

05/2012—Present **Certified**, #1027, American Osteopathic Board of Ophthalmology

05/2013—Present **Licensed**, #A-1745-13, State of NM Board of Osteopathic Medical Examiners

05/2012—10/2014 **Licensed**, #4303, Iowa Board of Medicine

05/2011—03/2014 **Licensed**, #OS11326, State of Florida Department of Health

06/2008—06/2012 **Licensed**, #4701, Oklahoma State Board of Osteopathic Examiners

01/2008 **Certified**, National Board of Osteopathic Medical Examiners

PUBLICATIONS

Journal, 10/2015 Kolomeyer AM, Laviolette R, **Winter TW.** Wyburn Mason Syndrome. Ophthalmology. 2016 Jan;123(1):50.

Book Chapter, 10/2015 **Pediatric Ophthalmology/Strabismus Learning Center, AAO ONE Network** Spasmus Nutans.

Journal, 04/2014 Longmuir SQ, **Winter TW**, Gross JR, Boldt HC. Primary retinal nonperfusion in a family with Loeys-Dietz Syndrome. J AAPOS. 2014 Jun;18(3):288-90.

Journal, 03/2014 Huang LC, **Winter TW**, Rosa PR, Schiffman JC, Pasol J, Trombly RS, Tawfik M, Lam BL. Ventriculoperitoneal shunts as a treatment in idiopathic intracranial hypertension. Journal of Neuroophthal. 2014 Sep;34(3):223-8.

Journal, 12/2013 McConnell LK, **Winter TW**, Olson RJ, Longmuir SQ. Inadvertent intrastromal injection of ophthalmic viscoelastic. J AAPOS. 2013 Dec; 17(6):639-41.

Journal, 11/2013 **Winter TW**, Olson RJ, Larson SA, Oetting TA, Longmuir SQ. Resident and Fellow participation in strabismus surgery: Effect of level of training and number of assistants on operative time and cost. Ophthalmology. 2014 Mar;121(3):797-801.

Journal, 02/2013	**Winter TW**, Anwar Z, Lam BL, Schatz NJ, Sternau L, Guy JR. Optic nerve involvement from *Pseudomonas aeruginosa*-Associated Skull Base Osteomyelitis. JAMA Ophthalmol. 2013;131(2):253-5.
Journal, 2002	Ding B, Guan Q, Walsh JP, Boswell JS, **Winter TW**, Winter ES, Boyd SS, Li C, Savage PB. Correlation of the Antibacterial Activities of Cationic Peptide Antibiotics and Cationic Steroid Antibiotics. Journal of Medicinal Chemistry. 2002;45(3):663-669.
Journal, 2001	Schmidt EJ, Boswell JS, Walsh JP, Schellenberg MM, **Winter TW**, Li C, Allman GW, Savage PB. Activities of Cholic Acid-Derived Antimicrobial Agents Against Multidrug-Resistant Bacteria. Journal of Antimicrobial Chemotherapy. 2001;47:671-674.

ABSTRACTS

Poster, 02/2016	**North American Neuro-Ophthalmology Society** "Complete Bilateral Ophthalmoplegia in the Setting of Elevated Intracranial Pressure that Improved with Transverse Venous Sinus Stenting" Tucson, AZ
Poster, 02/2016	**North American Neuro-Ophthalmology Society** **"**Supranuclear Palsy and Ataxia Related to Anti-Ma2 Paraneoplastic Syndrome: a Diagnostic and Therapeutic Dilemma"
Poster, 02/2015	**North American Neuro-Ophthalmology Society** "Bilateral, Sequential Anterior then Posterior Ischemic Optic Neuropathy in a Young Migraineur" Coronado, CA
Poster, 02/2015	**North American Neuro-Ophthalmology Society** "Visual Outcomes after Treatment of Venous Sinus Thrombosis with Dural Venous Sinus Stenting" Coronado, CA
Poster, 02/2012	**North American Neuro-Ophthalmology Society** "Ventriculoperitoneal shunts as a treatment in idiopathic intracranial hypertension" Snowbird, UT
Poster, 04/2010	**Assembly of the American Osteopathic Colleges of Ophthalmology and Otolaryngology-Head & Neck Surgery** "A Description of Vitreoschisis in Uncomplicated Rhegmatogenous Retinal Detachments" Orlando, FL
Poster, 04/2008	**Association for Research in Vision and Ophthalmology** "Epidemiology of Two Important Risk Factors for Permanent Corneal Endothelial Damage in Cataract Surgery" Fort Lauderdale, FL
Poster, 05/2007	**Association for Research in Vision and Ophthalmology** "Attrition of the Retinal Nerve Fiber Layer in the Unaffected Eye of Patients with Unilateral Optic Neuritis Associated with Multiple Sclerosis" Fort Lauderdale, FL
Poster, 05/2006	**Association for Research in Vision and Ophthalmology** "Differential Effects on the Axonal Population in Human HIV Optic Nerves With and Without CMV Retinitis" Fort Lauderdale, FL
Poster, 05/2005	**Assembly of the American Osteopathic Colleges of Ophthalmology and Otolaryngology-Head & Neck Surgery** "Retinal Prosthetic Implants and Retinitis Pigmentosa: How Implants Affect Entrainment of Circadian Rhythm in Patients with Outer-Retinal Disease" Scottsdale, AZ
Poster, 10/2002	**Food Microbiology Symposium** "Evaluation of the Abilities of Cationic Antibiotics to Inhibit Microbial Growth in Food" River Falls, WI

NATIONAL & STATE SOCIETY GUEST LECTURES

05/07/2015 **High Risk Medical Screening**, 99th Annual Clinical Assembly of the American Osteopathic College of Ophthalmology and Otolaryngology, Hyatt Regency Grand Cypress, Orlando, FL

09/28/2013 **The Eyes in Pediatric Disease**, New Mexico Academy of Ophthalmology Annual Scientific Meeting, Hotel Albuquerque, Albuquerque, NM

02/12/2012 **Turning a Blind Eye that Karma Wouldn't,** Walsh Session of the 38th Annual North American Neuro-Ophthalmology Society, JW Marriot San Antonio Hill Country Resort & Spa, San Antonio, TX

PROFESSIONAL ASSOCIATIONS

2014—Present	North American Neuro-Ophthalmology Association (NANOS)
2014—Present	American Association for Pediatric Ophthalmology and Strabismus (AAPOS)
2007—Present	American Academy of Ophthalmology (AAO)
2007—Present	American Osteopathic College of Ophthalmology (AOCO)
2007—2013	International Society of Refractive Surgery (ISRS)
2006—2009	Association for Research in Vision and Ophthalmology (ARVO)
2003—Present	American Osteopathic Association (AOA)
2003—2009	American Medical Association (AMA)
2003—2007	California Medical Association (CMA)
2003—2007	Los Angeles County Medical Association (LACMA)

EXTRACURRICULAR ACTIVITIES

01/2016—Present	**Quality Champion**, Division of Ophthalmology, Department of Surgery, UNM
01/2014—01/2016	**ICD-10 Champion**, Division of Ophthalmology, Department of Surgery, UNM
10/2013—Present	**President**, Elders Quorum, Church of Jesus Christ of LDS, Bear Canyon Ward
02/2013—Present	**Reviewer**, Journal of American Medical Association Ophthalmology
07/2011	**Missionary Ophthalmologist**, Eye Surgery Mission Trip, Piura, Peru
05/2011	**Volunteer Ophthalmologist,** Special Olympics, Stillwater, Oklahoma
05/2010	**Half Marathon Participant**, Jenks Aquarium Half Marathon, Jenks, OK
04/2010	**Missionary Ophthalmologist**, Just Hope Mission Trip, Leon, Nicaragua
07/2009	**Alumni,** Bay Area Ophthalmology Course, Stanford, CA
2008—2009	**Coach**, Metro Tulsa Soccer Club, Under-6 Girls, Tulsa, OK
2006—2007	**Cub Master,** Pack 123/Sunset District/Old Baldy Council, Southern CA
2004—2005	**President**, Latter-day Saint Student Association, WUHS
2004—2005	**Regional Chair**, Region 1, AMA-Medical Student Section (AMA-MSS)
2004—2005	**Delegate,** WUHS, Governing Council of CMA-MSS
2001—2002	**Spanish Teacher**, Missionary Training Center, Provo, UT
1998—2000	**Church Missionary**, Church of Jesus Christ of LDS, Andalucia, Spain

AWARDS & HONORS

2011—2012	**Fellow of the Year**, BPEI Residency & Fellowship Program, Miami, FL
2011—2012	**Highest Attendance Award**, BPEI Grand Rounds, Miami, FL
2010—2011	**Chair,** OSUMC Council of Chief Residents, Tulsa, OK
2010—2011	**Chief Resident,** OSUMC Ophthalmology Residency, Tulsa, OK
05/2008	**First Place,** Research Day at OSUMC, Intern Class 2008, Tulsa, OK
04/2008	**ARVO Travel Grant**, National Eye Institute, ARVO Annual Meeting

2005	**Sigma Sigma Phi**, National Osteopathic Medicine Honors Fraternity
2000	**Sigma Delta Pi**, National Collegiate Hispanic Honor Society
1996	**Eagle Scout**, Boy Scouts of America

PERSONAL INTERESTS

Fluent in Spanish · Enjoy crossfit, softball, golf, tennis, soccer, fishing, cooking, and making movies

Dr Fatema Esmail – Myopia

Myopia is a common refractive error with an increasing prevalence that is associated with adverse eye effects, especially in high myopes. The categories of myopia will be reviewed. The anterior segment, extra ocular muscle, and retinal complications associated will be reviewed. Population studies indicate that sunlight exposure in children may be protective against myopia development. The atropine clinical trials to slow myopic progression will be reviewed. Consider reducing" screen time" for children < 18 months old.

Outline- Fatema Esmail , OD Topic – Myopia

Introduction

Categories of myopia
- mild
- moderate
- high 6.25-8
- severe (pathologic) > 8.25 D or AL > 32.5

Structural changes in high myopia lead to :
- cataract
- optic nerve insertion
- retinal and scleral thinning
    - lacquer cracks
    - RPE and choroidal atrophy of the macula
    - Choroidal neovascularization
        - Fuch's spot
        - Disciform scar
    - Posterior staphyloma
    - Peripheral pathology
        - Lattice degeneration
        - Cobblestone degeneration
    - Retinal detachment
- Glaucoma
- Strabismus

Population incidence and prevalence

Why is myopia on the rise?
- risk factors with myopic development and progression
- potential protective effect of sunlight

Treatment options to slow myopic progression
- Atropine use studies

Summary

Myopia:
Current Knowledge and Future Directions

FATEMA ESMAIL MD
ASSISTANT PROFESSOR, PEDIATRIC OPHTHALMOLOGY AND STRABISMUS, LOMA LINDA UNIVERSITY

NOVEMBER 13 2016

Myopia

In recent years, there has been a large interest in treatment and prevention of myopia progression.

Myopia can lead to loss of vision through multiple mechanisms

It is associated with high costs – both for refractive correction, and for treatment of other ocular sequelae

Myopia can affect the quality of life in numerous ways

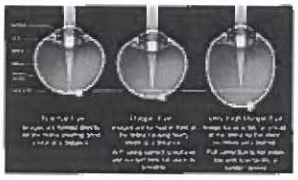
Levels of Myopia

Mild: -0.25 to -3.00 Diopters

Moderate: -3.25 to -6.00 Diopters

High: -6.25 to -8.00 Diopters, or Axial length over 26.5 mm

Severe (Pathologic): Over -8.25 Diopters, or Axial length over 32.5mm



High Myopia leads to Structural Changes

-Association with earlier cataracts

-Tilted disc insertion

-Thinning of the retina leads to risk of severe retinal pathology and vision loss

-Thinner Sclera = surgical implications

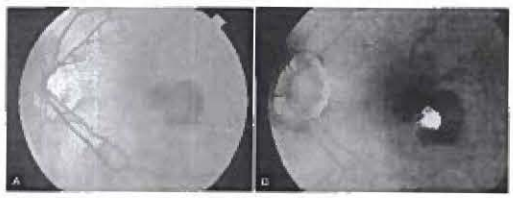
-Elongation and atrophy of the ciliary body

High Myopia and the Retina

LACQUER CRACK = SPONTANEOUS BREAK IN BRUCHS MEMBRANE

ATROPHY OF RPE AND CHOROID

Choroidal Neovascularization present in 5-10% of High Myopia



High Myopia and the Macula

FUCHS SPOT- RPE HYPERPLASIA IN RESPONSE TO SMALL AREA OF CNV

SUBRETINAL FIBROSIS IN RESPONSE TO LARGE AREA OF CNV

Posterior Staphyloma

Peripheral Retina Changes in High Myopia

-Lattice Degeneration
-Cobblestone Degeneration
-Cystoid Degeneration

-Peripheral Retinal Thinning and Holes
-Retinal Detachment

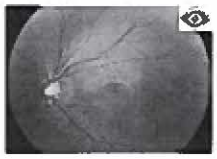
High Myopia and Glaucoma

-Higher association with POAG
-More difficult to clearly diagnose and monitor for progression

-Myopic Crescent vs. PPA

-Tilted Disc – will have an abnormal OCT

-Similar Visual Field Changes

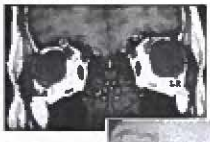


High Myopia and Strabismus

-Elongated globe (axial length over 30mm) causes the posterior aspect of globe can herniate out of the muscle cone – displaces the lateral rectus either up or down

-Eye movements can be restricted

-Most severe form is esotropia fixus



Lifestyle and Self-Image Implications

Limitations on Recreational Activities
-Water Sports
-Protective Headgear Sports
-Dance

Hobbies

Career Implications

Minifying Effect of Myopic Lenses

Myopia is on the rise

"Guess who I bumped into Today? EVERYBODY!"

Rates of myopia are approaching 30-50% in the US

Myopia projected to affect 50% of the world's population by 2020

A large amount of our population is at risk of significant visual loss

Myopia in Southeast Asia

Rates of myopia growing at an alarming rate in Southeast Asia

Prevalence of Myopia is reported to be up to 80% in Southeast Asia

Severe myopia rate is approaching 20% of the population in Southeast Asia

Why is Myopia on the Rise?

Myopia noted more in populations where there was:

-more schooling

-higher rigor of education

-students earning higher qualifications/degrees

-students with higher test scores

Could this be related to the environment – time spent in sunlight?

Or to accommodative demands - increased educational demands, increased time on computers and electronic devices?

Effect of sunlight on axial length elongation

Large studies performed in both Singapore and Australia both demonstrate clear relationship between increased time spent outdoors and reduction of myopia. Studies were largely observational/retrospective, but associations are clearly demonstrated.

Both populations had a different genetic base, but both showed similar findings.

Trend was also noted regardless of what parents refractive status was

Other studies have noted seasonal variation in myopia progression - slower rate of myopia progression in summer vs winter/school year

Light-Dopamine Hypothesis: Light stimulated dopamine release in the retina reduces axial elongation

More questions arise . . .

Are kids who don't see that well less likely to engage in outdoor sports?

Outdoor activity was mostly measured in time spent playing sports. So, is it in fact something to do with the sports altering the blood flow and endorphins that is beneficial to axial length (rather than the light itself)?

Is it the reduction of time spent on accommodative tasks while playing outdoors that is the true benefit?

Atropine

Atropine is thought to have an inhibitory action in one of the steps that regulate eye growth, presumably at the level of the retina and/or sclera, which inhibits thinning/stretching of sclera, and therefore eye growth.

Affects the role of accommodation in myopia progression

Atropine for the Treatment of Myopia (ATOM) Study

ATOM 1 – Randomized controlled trial that established the safety and efficacy of Atropine 1% eyedrops for myopia treatment.

These children demonstrated a hyperopic shift at the end of the 8 month trial

ATOM 2 – What is the lowest effective dose of atropine for myopia control?

3 phases over 5 years

400 kids enrolled

Ages 6-13

91% of Chinese origin

ATOM 2 – Phase 1 "Treatment"

Tested Atropine at 3 different doses: 0.5%, 0.1%, and 0.01%

1 drop used in both eyes at bedtime for 1 year

Conclusions:

-higher dose atropine more effective at slowing myopia in the first 12 months

-lower dose atropine had the least pupillary dilation, least affect on accommodation and near vision

ATOM 2 – Phase 2 "Washout"

Washout period was 12 months of no treatment

At the end of the period, it was noted that the group treated on the highest dose of atropine (0.5%) had the most rapid increase in myopia during the washout period.

The group on the lowest dose (0.01%), showed relatively little change.

This achieved statistical significance.

ATOM 2 – Phase 3 "Re-Treatment"

Kids whose myopia progressed over 0.5 diopters/year in at least one eye during the washout year were retreated with 0.01% atropine for 24 months.

Conclusions:

5 year overall progression of myopia was the least in the 0.01% group.

In the 3rd phase, those who needed re-treatment (regardless of which initial group they were in) all showed similar rates of progression.

Minimal adverse effects were noted with the 0.01% dose of atropine daily

More questions . . .

What is the effect of atropine in anisometropic amblyopia? Could we be worsening the anisometropia in hyperopes? Is it counterproductive?

Can the atropine data be extrapolated to non-Asian populations?

How long should treatment be continued to avoid the increase in myopia after treatment cessation?

Is this ready to try here?

Key points

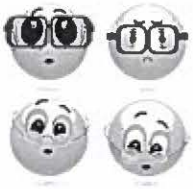
- Each child with myopia needs a thorough dilated eye exam to evaluate for any retinal pathology.
- High myopia is also associated with POAG, and often it can be difficult to diagnose because of the anomalous optic nerve and atrophic changes.
- Sunlight is beneficial to slowing myopia.
- Reduce screen time! The new guidelines from the American Academy of Pediatrics recommend no screen time under the age of 18 months (unless it is facetime/video chat with family members). From 15 months to age 2, they can have limited educational programs with parental participation and engagement. And from 2 years to 5 months no more than 1 hour per day.
- Atropine 0.01% is not commercially available in the US, as it is in Asia. Studies have not been done in non-Asian populations in the US. Stay tuned for updates on this!

References

French, A N et al. Time Outdoors and the Prevention of Myopia. Experimental Eye Research (114). May 2013. p 58-68.

Chia, et al. Five-Year Clinical Trial on Atropine for the Treatment of Myopia 2: Myopia Control with Atropine 0.01% Eyedrops. Ophthalmology. Vol. 123, No. 2. February 2016. p. 391-399.

THANK YOU



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CURRENT POSITION:

Loma Linda University
Department of Ophthalmology
Pediatric Ophthalmology and Adult Strabismus
2195 Club Center Drive, Ste L
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April 2014 - Present

California Eye Professionals
Group Private Practice
Comprehensive and Pediatric Ophthalmology; Adult and Pediatric Strabismus
41637 Margarita Road, Ste 100, Temecula, CA 92591
December 2013 - Present

PAST POSITION:

Marietta Eye Clinic
Group Private Practice
Comprehensive and Pediatric Ophthalmology; Adult and Pediatric Strabismus
895 Canton Road NE, Marietta, GA 30060
January 2011 – October 2013

FACULTY APPOINTMENTS:

Associate in Ophthalmology, Clinical Track
Emory University School of Medicine
The Emory Clinic
July 2009 – June 2011

EDUCATION:

FELLOWSHIP:

Pediatric Ophthalmology
Emory University School of Medicine
1365 B Clifton Road, 4th Floor, Atlanta, GA 30322
July 2009 – June 2010

RESIDENCY:

Ophthalmology
Mount Sinai School of Medicine
One Gustave L. Levy Place, New York, NY 10029
July 2006 – June 2009

Chief Resident, Ophthalmology
Mount Sinai School of Medicine
One Gustave L. Levy Place, New York, NY 10029
July 2008 – June 2009

INTERNSHIP:

Internal Medicine, Preliminary
Graduate Hospital (Drexel University College of Medicine)
1800 Lombard Street, Philadelphia, PA 19146
June 2005 - June 2006

MEDICAL SCHOOL:

Mount Sinai School of Medicine
One Gustave L. Levy Place, New York, NY 10029
2003-2005

Rush Medical College
600 S. Paulina Street, Chicago, IL 60612
2001-2003 (Transferred to Mount Sinai School of Medicine)

UNDERGRADUATE:

Eastern Illinois University
600 Lincoln Avenue, Charleston, IL 61920
B.S. - Zoology, *Summa Cum Laude*, 2001
B.A. - Psychology, *Summa Cum Laude*, 2001
1997-2001

CERTIFICATION AND LICENSURE:

California State Medical License	Active
Georgia State Medical License	Active
American Board of Ophthalmology	Board Certified

PROFESSIONAL MEMBERSHIPS:

Fellow, American Academy of Ophthalmology (AAO)
American Association of Pediatric Ophthalmology and Strabismus (AAPOS)
Association for Research in Vision and Ophthalmology (ARVO)

HONORS/AWARDS:

***USA Today* All Academic Team, Honorable Mention**
National award recognizing the top 100 college students in America.
2000

RESEARCH:

PUBLICATIONS:

Vision Screening in the Pediatrician's Office,
*Couser NL, **Esmail FQ**, Hutchinson AK.*
Open Journal of Ophthalmology. 2012 ; 2(2): 9-13.

Ten-Year Follow-Up of 360 Degrees Intrastromal Corneal Rings for Myopia.
*Schwartz AP, Tinio B, **Esmail F**, Babayan A, Naikoo HN, Asbell PA.*
Journal of Refractive Surgery. 2006 November; 22(9): 878-83.

BOOK CHAPTER:

Pediatric Cataracts,
***Esmail F**, Lambert SR.*
Section 6: Pediatric Ophthalmology and Strabismus Surgery. In DM Albert and MJ Lucarelli (Eds.), Clinical Atlas of Procedures in Ophthalmic and Oculofacial Surgery (2nd Ed., pp. 612-19). New York, New York: Oxford.

POSTERS:

The Effect of Intravitreal Bevacizumab (Avastin) on Systemic Blood Pressure.
***Esmail FQ**, Radhakrishnan R, Lieberman RM, Fischer RM.*
ARVO, May 2008

Long Term Visual Outcomes in Patients Receiving Intravitreal Bevacizumab (Avastin).
*Radhakrishnan R, Zatezalo C, **Esmail F**, Lieberman RM, Fischer RM.*
ARVO, May 2008

Intrastromal Corneal Rings for Myopia: A Ten-Year Follow-Up on Visual Outcomes.
*Schwartz AP, **Esmail F**, Naikoo HN, Babayan A, Tinio B, Asbell PA.*
ARVO, May 2005.

LANGUAGES:

Fluent in English, Spanish, Gujarati, and Hindi

REFERENCES:

Available upon request

Dr Leila Khazaeni- Adult Strabismus

Adult strabismus is a common and potentially visually and socially debilitating disorder. The categories of adult strabismus will be reviewed. Diplopia usually develops in acquired strabismus in patients with a mature visual system. Examples of acute adult strabismus (restrictive from thyroid orbitopathy, ischemic nerve palsies) will be reviewed. Strabismus has about an 80% single surgery success rate, so education of patients regarding the potential for future reoperation needs to be emphasized.

Speaker: Leila Khazaeni, MD

Title: Adult Strabismus

Objectives:

1. To understand the common etiologies of adult strabismus

2. To understand the social and economic impacts of strabismus in adulthood

3. To understand the indications and timing of surgical treatment of strabismus in adult patients

Title: Adult Strabismus

November 13, 2016

Leila M. Khazaeni, MD

Goals/Objectives:

Objectives:
1. To understand the common etiologies of adult strabismus
2. To understand the social and economic impacts of strabismus in adulthood
3. To understand the indications and timing of surgical treatment of strabismus in adult patients

Outline:

I. Definition of the problem – what constitutes adult strabismus?
   a. Etiologies
      i. Decompensated childhood strabismus
      ii. Trauma – cranial nerve palsies
      iii. Iatrogenic – s/p intraocular or sinus surgery
      iv. Thyroid Associated Ophthalmopathhy
   b. Symptoms
      i. Diplopia
      ii. Asthenopia
      iii. Poor eye contact
II. Societal and Economic Impact of Adult Strabismus
   a. Scope of adult strabismus – population data
   b. Impact on quality of life
   c. Economic impact
III. Treatment options in Adult strabismus
   a. Monocular occlusion
   b. Prism glasses
   c. Surgical correction
IV. Conclusions

LEILA KHAZAENI MD

ADULT STRABISMUS: is it too late?

Leila M. Khazaeni, MD
Associate Professor of Ophthalmology
Loma Linda University Ophthalmology
November 15, 2016

CONCLUSIONS

Adult Strabismus: it's never too late

Stager, David Jr. J AAPOS 2014;18:103-104.

OUTLINE

- What is Adult Strabismus?
- Why does it matter (is it a problem)?
- ***Why do we think it might be too late to treat?***
- What are the treatment options?
- Should Adult Strabismus be treated and how?

VOCABULARY

- **Strabismus** –
  from the Greek "strabis" = to squint
- Amblyopia –
  from the Greek "amblyos" = dullness of vision
- "Lazy Eye"
  - This is a useless term, because it is not specific. It may mean an eye that is amblyopic, an eye that "wanders" or is misaligned, or even a droopy eyelid

WHAT IS ADULT STRABISMUS?

- An adult with strabismus!
- An adult whose eyes are **misaligned**
- Who MAY or MAY NOT have double vision

ADULT STRABISMUS

- Types
  1. Acquired After Visual Maturation (AVM)
  2. Acquired Before Visual Maturation (BVM)
  3. Sensory Deviations

ONSET AFTER VISUAL MATURATION

- Acute, or acquired strabismus
- often diplopic
- Etiologies:
  - Cranial nerve palsies
  - Trauma
    - sometimes iatrogenic - glue from surgery, scleral rupture
  - Tumor
  - Microvascular disease
  - Thyroid Eye Disease, myasthenia gravis

AFTER VISUAL MATURATION

- Cranial nerve palsies
  - 48 year old male with acute double vision

- Acute sixth nerve palsy

AFTER VISUAL MATURATION

- Trauma
  - 33 year old woman fell while horseback riding and hit her head

- Traumatic left fourth nerve palsy

AFTER VISUAL MATURATION

- Thyroid Eye Disease
  - Misalignment due to enlarged extraocular muscle bellies
  - Tendons are spared
  - Rectus muscles are affected
  - Eye disease may lag behind systemic thyroid disease, so that thyroid levels are normal at the time of presentation to the ophthalmologist

ONSET BEFORE VISUAL MATURATION

- Chronic, longstanding strabismus
  - Persistent or recurrent childhood deviations

(sensory adaptations are in place which prevent diplopia)
  - They tried to fix it but the surgery didn't work
    - Strabismus surgery success rate = 90%
    - [illegible] rate = 20%
  - Decompensated strabismus – has shifted over time
- The need of treatment for this category has often been questioned

BEFORE VISUAL MATURATION

- 36 year old male with history of eye muscle surgery as a child for esotropia

- Consecutive exotropia with bilateral inferior oblique overaction

BEFORE VISUAL MATURATION

- 45 year old male with childhood strabismus, no history of eye muscle surgery
  - Eyes seem to be wandering out more x 5 years

- Duane's Retraction Syndrome

SENSORY DEVIATIONS

- Sensory deviations
  - Poor vision in one eye
  - May be esotropic or exotropic
  - May or may not be diplopic

RECAP: WHAT IS ADULT STRABISMUS?

1. Adult Strabismus is a misalignment of the eyes
2. Adult Strabismus may be acute or chronic; with onset BEFORE visual maturation or AFTER VISUAL MATURATION
3. Adult Strabismus may produce diplopia or may not

IS IT A PROBLEM?

- Adult strabismus may cause
  - Diplopia
  - Decreased binocularity, depth perception
  - Decreased field of vision
  - Abnormal head position in an effort to eliminate diplopia
  - Lack of eye contact
  - Difficulty with self image
  - Difficulty with interpersonal relationships
  - Difficulty with school
  - Difficulty reaching employment
  - Increased anxiety and depression
    - Satterfield D, Keltner JL, Morrison TL. Psychosocial aspects of strabismus study. Arch Ophthalmol. 1993;111:1100-5.

WHY DOES IT MATTER?

- Magnitude of the problem:
  - Adult Strabismus has a prevalence of 4%
  - 9.68 million adults in this country are likely affected

IS IT A PROBLEM?

Adults with strabismus have stated it has a negative impact on their lives

- In fact, the average adult strabismus patient undergoing surgery would give up 10% of his or her remaining life expectancy to be rid of the strabismus
- The level of importance of this condition to patients is similar to that of a mild stroke.

IS IT A PROBLEM?

Is there a negative social bias against adults with strabismus that affects interpersonal relationships and limits employment opportunities?

IS IT A PROBLEM?

- Study: a person WITHOUT strabismus was photographed in primary, right and left gazes
- Photographs were altered to show esotropia and exotropia
- College students judged photos
- Each analyzed 1 photograph and then filled out a questionnaire about 11 personality traits
  - Olitsky et al

IS IT A PROBLEM?

1. Scores for strabismic photographs were significantly lower vs orthotropic photographs
2. Esotropic photographs got lower scores than exotropia
3. The strabismic photographs were judged significantly more negatively than orthotropic photographs for communications skills and intelligence
4. The esotropic face was considered to be more sincere than the exotropic face.

Olitsky SE, Sudesh S, Graziano A, Hamburn J, Marsh JE, Sharma SK. The Negative Psychosocial Impact of Strabismus in Adults. Journal of AAPOS 1999;3:205-211

IS IT A PROBLEM?

- Studies like this one demonstrate that:
  - Successful communication with others depends on ocular alignment
  - Judgements about an individual are frequently based on ocular alignment
- Lack of eye contact is a disability that necessitates compassion, rehabilitation, occupational counseling and psychotherapy

IT IS A PROBLEM.

- The vast majority of adult strabismus is undiagnosed, and even fewer receive surgical correction
- 0.68% of medicare beneficiaries (adults age 65 or older) in 2010 had a diagnosis of strabismus
- 2.6% of that group had strabismus surgery
- Why?

RECAP: IT IS A PROBLEM

1. 9.68 million adults in the U.S. have strabismus
2. Strabismus causes significant functional and psychosocial deficits
3. According to a medicare database, only 2.6% of those diagnosed have surgery

OBSTACLES

- 4 most common reasons
  - "Nothing can be done for adults with strabismus"
  - "Strabismus surgery in adults is not effective"
  - "Surgery is 'cosmetic' and does not improve binocular functions"
  - "There is a high risk associated with strabismus surgery, including a substantial risk of intractable postoperative diplopia."

-Rushner, BJ several papers and articles

1. NOTHING CAN BE DONE FOR ADULTS WITH STRABISMUS????

- Strabismus is falsely thought of as a childhood problem
  - It is treated by pediatric ophthalmologists (some neuro, plastics)
  - It is often confused with amblyopia, which IS time-sensitive and critical to treat as early as possible

2. STRABISMUS SURGERY IN ADULTS IS NOT EFFECTIVE???

- ***Treatment options*** include
  - Monocular occlusion
  - Use of prism in glasses
  - Strabismus surgery
- ***Good clinical and functional outcomes*** have been reported for the treatment of strabismus in adults
  - Expanded binocular visual fields
  - Improvement in binocularity and stereoacuity, even in cases of longstanding strabismus
  - Elimination of diplopia
  - Elimination of anomalous head postures

3. "STRABISMUS SURGERY IN ADULTS IS "COSMETIC"

- The goal in treating strabismus in adults is to realign the visual axes to:
  - Eliminate diplopia (if present)
  - Improve/expand the visual field
  - Achieve or restore binocular function (if possible)
  - ***Restore*** normal anatomic appearance
- ***Strabismus surgery in adults is RESTORATIVE or RECONSRTUCTIVE***
  - The use of the term "cosmetic" in the treatment of strabismus is incorrect
  - Strabismus is a result of an underlying defect or defects which leads to a objective deviation
  - Strabismus surgery is performed to correct an abnormality

4. THERE IS A HIGH RISK ASSOCIATED WITH STRABISMUS SURGERY IN ADULTS????

- Surgical treatment of strabismus in adults is generally safe and effective
  - Mills MD, Coats DK, Donahue SP, Wheeler DT. Strabismus surgery for adults. A report by the American Academy of Ophthalmology. Ophthalmology 2001;111:1255-62

RECAP: OBSTACLES

It is critical to educate our primary care colleagues as well as all eye care providers about the potential obstacles to treatment of adult strabismus.

Remember:

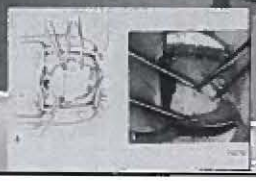
1. Strabismus is a disability
2. Treatment of strabismus is RECONSTRUCTIVE and RESTORATIVE
3. Strabismus CAN be effectively and safely treated in adulthood

TREATMENT

- The goal of treatment in adult strabismus is to realign the visual axes
  - Eliminate diplopia
  - Produce or restore binocular vision
  - Expand the binocular visual field
  - Provide a normal appearance

TREATMENT OPTIONS

- Occlusion of one eye
- Prism in glasses
- Botox
- Strabismus surgery



TREATMENT: MONOCULAR OCCLUSION

- Occlusion of one eye
  - Pirate patch
  - Adhesive patch
  - Scotch tape placed over one lens of the glasses
  - Occlusive contact lens

TREATMENT: PRISM IN GLASSES

- Fresnel prisms may be placed temporarily over the lens of a pair of glasses (cut and fit to the size of the lens)
  - This is a great option in cases where the deviation is not stable
  - This is a great option for intermittent strabismus
  - This is a great trial prism to ground in prism
  - As the magnitude of the prism increases, there is greater distortion so not useful for large angles of strabismus
- Prism may be ground into the lens
  - This is a great option for patients with small angles of strabismus
  - Up to about 10 prism diopters may be ground into each lens
  - Adjustment/adaptation period
    - In order to view side gaze, patient is need to turn their head

TREATMENT: STRABISMUS SURGERY

- Horizontal surgery
  - Recessions – weakening of a muscle
  - Resections/Plications – strengthening of a muscle
- Vertical surgery
  - Rectus muscle surgery (recessions and resections/plications
  - Oblique surgery
    - Superior oblique weakening procedures
    - Inferior oblique weakening procedures
- Transpositions
  - Performed often for cranial nerve palsies

TREATMENT: STRABISMUS SURGERY

- Special considerations in adults with strabismus undergoing strabismus surgery:
  - Preserving blood flow to avoid anterior segment ischemia
    - Fornix incisions work well (as opposed to limbal incision)
  - Recess-Resect procedures often work very well in adults
    - "one eye surgery" vs "two eye surgery"
    - Recovery is easier if we only mess with one eye
    - Recovery is really about 1-2 weeks
  - Adjustable suture surgery is beneficial for select patients
    - Must be stoic enough to undergo adjustment
    - Young adult male patients seem to vagal (pass out) most easily

RECAP: TREATMENT

1. The effective treatment options for adult strabismus include monocular occlusion, prism glasses, botox and strabismus surgery
2. Special surgical considerations are taken for adult patients

SHOULD ADULT STRABISMUS BE TREATED AND HOW?

- Yes. The earlier it is recognized and treated, the shorter the period of disability
- It is a prevalent but underrecognized problem which may cause significant functional and psychosocial deficits
- Treatment includes:
  - Monocular occlusion, prism glasses or strabismus surgery
  - And is effective and relatively safe
- "We should begin to view our adult patients with strabismus as having a disability that requires compassion from both physicians and the general public"

Rosenbaum, 1999 editorial on adult strabismus

CONCLUSIONS

Adult Strabismus:

it's never too late

Stager, David Jr. J AAPOS 2014;18:103-104.

THANK YOU

GEORGE P. CHENG, MD CHILDREN'S VISION SCREENING PROGRAM

Loma Linda Pediatric Ophthalmology partnered with the Lions Clubs of Riverside & San Bernardino County

Funded by the Cheng Family Foundation

Presented by: Robert Tirrac, BS Program Manager

Nov. 13th 2016 | A Childs Vision Cant Wait

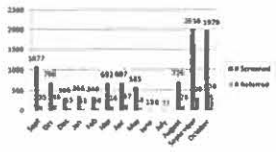
Our Mission

- Our Mission is to promote vision development to children **(6 months to 7 years old)** by providing free vision screenings and by connecting parents to a network of informed caregivers. We are dedicated in providing children with access to resources and to improve the culture of vision care for children.

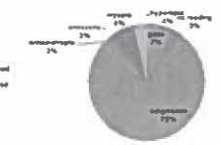
Where are we now...

- Number of Children Screened: **9,506**
- Number of Children Referred: **1,665 (17.5%)**
- Number of different sites: **192**

Screened by month



Reason for Referral



How you can get involved!

- If you are willing, we would like to refer the children who do not pass a screening to you for a complete eye exam including cycloplegic refraction and dilated fundus exam.

Fill out form and email, fax or mail form back. Contact info on Form!

Visit our Webpage for more information

LLUeyes.org/kids

Thank you for listening!

My contact:
Ronela Tavoc
Email: rtavoc@llu.edu
Direct Line: 909-651-1958
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Curriculum Vitae

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Education and Training:

2005	Fellowship	The Children's Hospital of Philadelphia	Pediatric Ophthalmology
2004	Residency	University of Pennsylvania, Scheie Eye Institute	Ophthalmology
2001	Internship	Oakwood Hospital Medical Center	Transitional Internship
2000	M.D.	University of Michigan Medical School	Medicine
1996	A.B.	Princeton University	Chemistry

Board Certification:

2006 Ophthalmology

Academic History:

Associate Professor, Department of Ophthalmology, LLU	12/2015- present
Assistant Professor, Department of Ophthalmology, LLU	6/2006- 12/2015
Clinical Instructor, Department of Ophthalmology, LLU	12/2005- 6/2006

Employment Appointments:

Attending Physician, Department of Ophthalmology, LLU	12/2005 - present
Attending Physician, Adult Strabismus, Ophthalmology Service, Loma Linda VA	12/2013 - present

Academic and Administrative Activities:

Loma Linda University Department of Ophthalmology

Associate Residency Program Director	7/2014 – present
Clinical Competency Committee	7/2014 – present
Program Evaluation Committee	7/2014 – present
Annual Program Evaluation Committee	7/2014 - present

Loma Linda University Medical Center

Institutional Review Board, Alternate Member	1/2007 - present

Publications:

Ransbarger KM, Dunbar JA, Choi SE, **Khazaeni LM.** Results of a community vision-screening program using the Spot photoscreener. *J AAPOS.* 17(5):516-20, October 2013.

Khazaeni LM, Davidson SL, Quinn GE, Forbes BJ. Amblyopia Treatment: 1998 versus 2004. *J of Pediatric Ophthalmol Strabismus.* 46(1): 19-22, January/February 2009.

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Forbes BJ, **Khazaeni LM**. Evaluation and Management of an Infant With Poor Vision. *Pediatric Case Reviews.* 3(3):168-170, 2003.

Forbes BJ, **Khazaeni LM**. Evaluation and Management of a Premature Infant's Eyes. *Pediatric Case Reviews.* 3(2):105-110, 2003.

Forbes BJ, **Khazaeni LM**. Evaluation and Management of an Infant With Tearing and Eye Discharge. *Pediatric Case Reviews.* 3(1):41-43, 2003.

Elner SG, Strieter R, Bian ZM, Kunkel S, **Mokhtarzadeh L**, Johnson M, Lukacs N, Elner VM, Interferon-induced protein 10 and interleukin 8: C-X-C chemokines present in proliferative diabetic retinopathy. *Archives of Ophthalmology.* 116:1597-1601, Dec 1998.

Bowe CL. **Mokhtarzadeh L.** Venkatesan P. Babu S. Axelrod HR. Sofia MJ. Kakarla R. Chan TY. Kim JS. Lee HJ. Amidon GL. Choe SY. Walker S. Kahne D. Design of compounds that increase the absorption of polar molecules. *Proceedings of the National Academy of Sciences of the United States of America.* 94(22):12218-23, Oct. 28, 1997.

Recognition and Awards:

LLU Department of Ophthalmology Teacher of the Year	2013
LLU Department of Ophthalmology Teacher of the Year	2010
Magna Cum Laude, Princeton University	1996
National Science Foundation Scholarship	1992-1996

Memberships in Professional Organizations:

American Association of Pediatric Ophthalmology and Strabismus (AAPOS) Subspecialty Task Force Committee	7/2015 - present
American Academy of Pediatrics, Section on Ophthalmology	4/2013- present
American Association of Pediatric Ophthalmology and Strabismus	7/2004 - present
American Academy of Ophthalmology	7/2001- present

Journal Editor/Reviewer:

Journal of AAPOS	2013-present
Journal of Public Health	2014-present

Abstracts/Posters:

Khazaeni LM, Kim DJ, Dunbar JA. Physician Effort in Pediatric Examination Under Anesthesia. Poster Presentation, AAPOS national meeting, Vancouver, British Columbia, Canada April 2016.

Rheem JY, Camarena DJ, Eshete BD, **Khazaeni LM**, Dunbar JA. Parental Understanding of Amblyopia and Compliance with Follow-Up After Vision Screening. J AAPOS S, 17(1):e26-27. Poster presentation, AAPOS national meeting, Boston, MA April 2013.

Khazaeni LM, Chun J, Rittenhouse J, Gruzensky M, Ransbarger KM, Dunbar JA. Results of Vision Screening Using the SPOT Photoscreener. J AAPOS, 16(1):e21. Poster presentation, AAPOS national meeting, San Antonio, TX March 2012.

Khazaeni LM, Davidson SL, Quinn GE, Forbes BJ. Amblyopia Treatment: 1998 versus 2004. Poster presentation, AAPOS national meeting, Orlando, FL March 2005.

Khazaeni LM, Volpe NJ. Adjustable Medial Rectus Resection in Adult Exotropia. Oral Presentation, AAPOS national meeting in Washington, D.C., March 2004.

Books/Chapters:

Mills M, **Khazaeni LM.** "Amblyopia", "Strabismus", "Nasolacrimal Duct Obstruction", and "Red Eye" in *Current Pediatric Therapy, 18th ed.* Philadelphia: Saunders (Elsevier), 2006

Young, TL, **Khazaeni LM.** "Genetics of Eye Disease" in *Harley's Pediatric Ophthalmology, 5th ed.* Philadelphia: Lippincott, 2005.

Khazaeni LM, Mills M. "Ophthalmologic Infections" in *Blueprints Guide – Pediatric Infectious Diseases.* Massachusetts: Blackwell Publishing, 2005.

Community Service:

Annual Vision Screening – provided to Montessori In Redlands	2012 - present

Dr Sue Cotter - The Preschool Eye Exam Made Easy

It can be a challenge to perform eye exams on preschool children! Exams are designed to access ocular health and need to be tailored to children of this age. The purpose of exams for preschool children is to assess for amblyopia, strabismus, significant refractive error, color vision deficits, and any other ocular abnormality. Fixation targets need to be bright and varied in order to keep their attention and accurately assess for ocular motility disorders. Consider doing the easier portions of the exam first before assessing visual acuity, which takes longer. Assessment of stereovision is also important. Techniques to achieve a comprehensive exam in preschool children will be reviewed. The importance of a cycloplegic refraction for new patients will be emphasized.

The Preschool Eye Exam Made Easy

Loma Linda Eye Institute
Fall 2016 Optometry Symposium
November 13, 2016

Susan Cotter, OD, MS, FAAO
Marshall B Ketchum University

A simple and efficient approach to conducting an eye examination for preschool children is presented. Age-appropriate techniques for the assessment of visual acuity, eye alignment, stereopsis, refractive error, and ocular health are discussed. Clinical pearls for maximizing patient cooperation are provided.

Objectives:

1. To outline the components of a preschool eye exam and highlight age-appropriate evaluation methods for visual acuity, ocular alignment, refraction, stereopsis, color vision, & eye health.
2. To emphasize the importance of performing a cycloplegic refraction at the initial eye exam for a preschool child.
3. To review recently published normative data for visual acuity for 3-, 4- , and 5-year old children.

I. Introduction

1. Course objectives
2. Rationale for eye examinations
   - Early detection & treatment to maximize child's potential
   - Prevent vision loss and/or loss of binocularity
   - Detect and treat vision problems that can potentially affect development or learning
   - Treatment often easier because of plasticity of visual system

3. U.S. Preventive Services Task Force (USPSTF) recommends children 3 - 5 years be *screened* at least once to detect amblyopia & amblyogenic risk factors such as strabismus & significant refractive error

II. Examination Strategy

1. General Guidelines

2. Case History
   - Chief complaint
   - Signs and symptoms
   - Ocular health hx
   - Medical health hx (allergies/medications)
   - Pre- & peri-natal hx
   - Developmental Hx
   - Ocular and medical family hx

3. Routine Examination (Minimum data base)
   - Monocular visual acuities: equal and normal VA?
   - Refractive error: magnitude that would place at risk for strabismus, amblyopia, or other visual problems or symptoms
   - Ocular alignment: strabismus present?
   - Ocular Health: sight or life threatening?
   - Color Vision

4. Visual Acuity
   A. Objective
   B. Desired characteristics of Preschool VA test (Fern & Manny, 1986)
      - High contrast, single, isolated optotypes
      - 2-alternative forced choice or matching
      - Avoidance of verbal or directional response
      - Reduced testing distance (3m)
      - Crowding bars: better amblyopia detection than letters without
   - Other desired characteristics
      - logMAR steps
      - Inability to memorize

   C. Best Preschool tests: 1) HOTV or 2) Lea symbols
      - H, O, T, and V: vertical symmetry
      - Lea symbols:
        - 4 well standardized optotypes (house, heart/apple, circle, square)
        - Blur equally & scaled to reflect comparable VA's obtained with Snellen letters
      - Most ≥ 3 years can successfully complete VA testing with both kinds
      - Formats: hand-held cards or computer based; MassVAT is rectangular bar surrounding a line of letters

   - General considerations
      - Demonstrate task to child first
      - Use lap card for matching
      - Careful with monocular occlusion
        - Adhesive patch
        - Micropore™ or Blenderm™ hypoallergenic surgical tape
        - Fresnel - Blue Roll Eye Patch - Bi-Lingual
        - Special occluder glasses

   - Tests NOT recommended - should be replaced:
      - Landolt C and Tumbling E
      - Lighthouse cards
      - Allen Preschool Vision Test & Kindergarten Eye Chart
        - Not standardized & variable inter-line gap widths and shape cues; thus, some pictures more readily identified than others
        - Some cultural bias and some outdated pictures
        - Pictures not readily recognizable by all children

- Normative VA (Pan et al., MEPEDS; *Optom Vis Sci* 2009;86(6):607-12)

Age Months	Mean VA	5th %ile Snellen threshold	% with worse VA	Alternate Threshold††	% with worse VA
30-35	20/35	20/63	4.2	20/50	7.6
36-47	20/30	20/50	2.9	20/40	6.5
48-59	20/25	20/40	1.1	20/32	4.6
60-72	20/21	20/32	0.8	20/25	9.0

†Nearest Snellen-equivalent line tested by ATS HOTV protocol.
† † Alternate threshold is next better VA level

- Near VA: binocular VA okay if all else normal
  - HOTV or LEA
  - LEA SYMBOLS® Pocket Box Stick: 20/125, 20/100, 20/80, 20/60, 20/50, 20/40, 20/30, and 20/20 lines.

- Fixation preference (*Cotter et al. Ophthalmology* 2009; 116(1):145-53)
  - Sensitivity
    - Any amblyopia = 31% (17/55)
    - Anisometropic amblyopia = 20% (8/40)
    - Strabismic amblyopia = 80% (8/10)
  - False Positives
    - High number of strabismic children
    - Of strabismic kids with grade C/D FP, only 32% (8/25) had amblyopia

- Resistance to occlusion
- Fix and follow

5. Refractive Error Assessment

A. Static vs. cycloplegic retinoscopy
- Indications
- Procedure
  - Proparacaine (some docs don't use)
  - 1% cyclopentolate (can use 0.5% in infants)
  - Tropicamide or phenylephrine for DFE
  - 1% cyclopentolate

B. Autorefraction
- Young patients often overminused or missed hyperopia
- If you need to use, use <u>only</u> after cycloplegia

6. Ocular Alignment Assessment
   A. Direct observation: strabismus?; anomalous head posture; lid fissure width or facial asymmetry

   B. Cover testing
      - Control fixation and accommodation: use small age-appropriate interesting target

   C. Hirschberg/Kappa: binocular corneal reflex test
      - Determines direction & estimated magnitude of strabismus
      - Compare to Angle Kappa (lambda) under monocular conditions
      - 1 mm = 22 Δ

   D. Krimsky: estimate of magnitude of strabismus
      - Start with Hirschberg
      - Add appropriate base prism over deviated eye until corneal reflexes symmetric

7. Stereopsis Testing
   A. Lateral disparity
      - Titmus Stereo-fly, Stereo reindeer, animals, Wirt circles
      - Also some lateral disparity on many of the Randot books (1 side)
      - Monocular cues are problematic

   B. Random dot stereopsis –monocular cues absent; generally indicates bifixation
      - Randot Test
      - Randot LEA Symbols Stereoacuity Test
      - Lang Stereotest
        - No polarized glasses needed
      - Randot Preschool Stereoacuity Test
      - Preschool Assessment of Stereopsis with a Smile (PASS-3)
        - 6 Cards (480", 240", 120", 60", Demo & Blank)

8. Extraocular muscles – versions
   - Voluntary - Move target –
     - Use penlight / transilluminator or toys for target
     - Restrain head movement
   - Involuntary: Doll's head phenomenon
     - Move child's head

9. Ocular Health Assessment
   - Pupil evaluation
   - IOP
     - TonoPen
     - iCare
   - Dilation
     - Tropicamide
     - Phenylephrine
     - May use dilation spray in young children

- External ocular structures
  - 20D lens and BIO or 20D lens and transilluminator
  - Bluminator®
  - Hand-held slit lamp
- Internal ocular structures
  - 20D lens with BIO or transilluminator
  - Direct ophthalmoscope

10. Supplemental Testing for Preschool Kids – when indicated or desired

- Near visual acuity
  - Binocular okay for routine exam
  - I always do for kids with developmental disabilities
- Accommodation
  - Accuracy – MEM to measure lag/accuracy
    - Very important for kids with Down syndrome
- Second degree fusion: Fusion, suppression, diplopia responses
  - Worth 4 dot
  - Pediatric flashlight
- Near point of convergence
- Vergence ranges: prism bar

11. Reward time – trip to the treasure chest

SUE COTTER, MD

The Preschool Eye Exam Made Easy

Susan Cotter, OD, FAAO
Southern CA College of Optometry
Marshall B Ketchum University
Fullerton, CA

Disclosures

- No financial interest in materials or methods
- Funding / Salary Support: EY14472, EY03040 and EY14483

NIH National Eye Institute

Course Objectives

For Preschool Children

- Rationale for eye exam / risk factors
- Examination strategy
- Age-appropriate evaluation methods
- Clinical tips

Rationale for Examination

- Prevention
- Early Detection
- Early Treatment

Potential Consequences of Untreated Childhood Vision Disorders

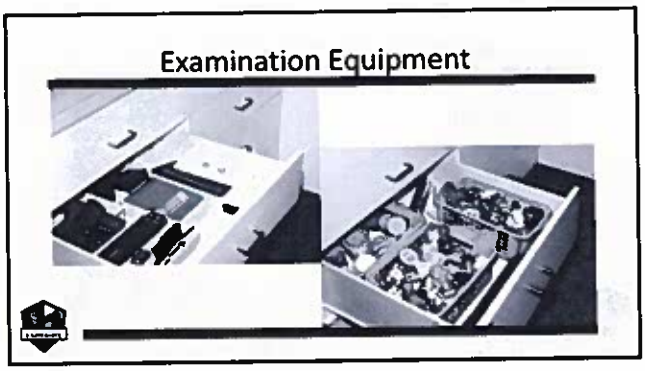
- Social
- Emotional
- Physical
- Educational
- Economical
- Quality of Life

Preschool Kids: What Are We Looking For?

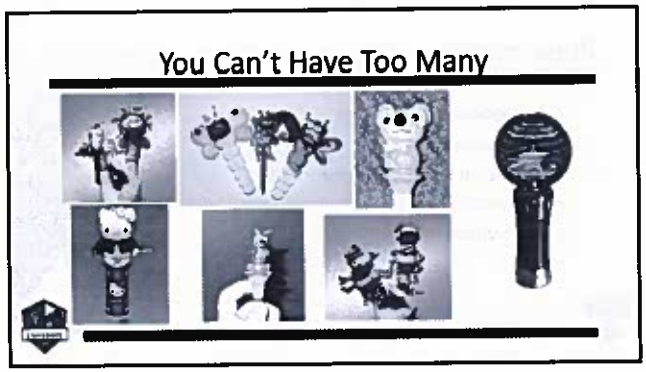
- Amblyopia or risk factor
- Strabismus
- Significant refractive error
- Eye health disorder
- Color vision defect


Helpful Tips!


Examination Equipment


Examination Equipment


You Can't Have Too Many


You Can't Have Too Many


The Working Position
Alternately

Bribery Will Get You Everywhere

Case History

Collect beforehand?

- Reason for visit
- Symptoms
- Eye history
- Child & family medical history
- Medications / allergies

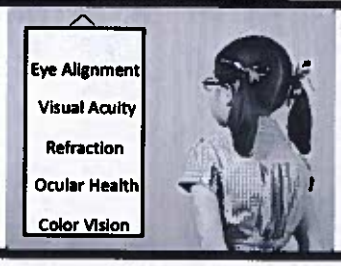
✓Developmental delays

✓Academic performance

Routine Preschool Eye Examination

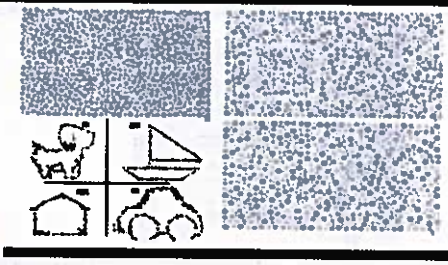
Routine Preschool Eye Examination

- Eye Alignment
- Visual Acuity
- Refraction
- Ocular Health
- Color Vision



Test Sequence?

Color Vision Testing Made Easy Test



Cotter, Lee, French. *Optometry & Vision Science* 1999;76(9):631-6

Ocular Alignment

- Observation
- Random dot stereopsis
- Cover testing
- Hirschberg/Krimsky
- EOM's

Head Tilt or Turn? Chin Tip?

Stereopsis Testing

RDS: No monocular cues; typically must have bifoveal fixation

Pass Stereotest

Randot Preschool Stereotest

Lang Stereotest

Lang Stereotest

Randot Stereotest & Random Dot LEA

RDS Stereotests

Titmus Fly

Cover Testing - Distance

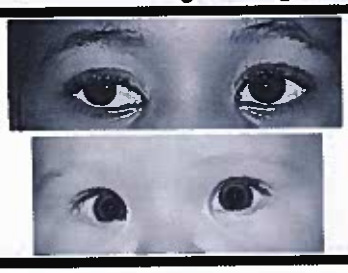
Cover Test AT Near

Use Accommodative Target & Stress Clarity

Alternate Cover Testing - Near

Hirschberg Testing

Hirschberg Testing



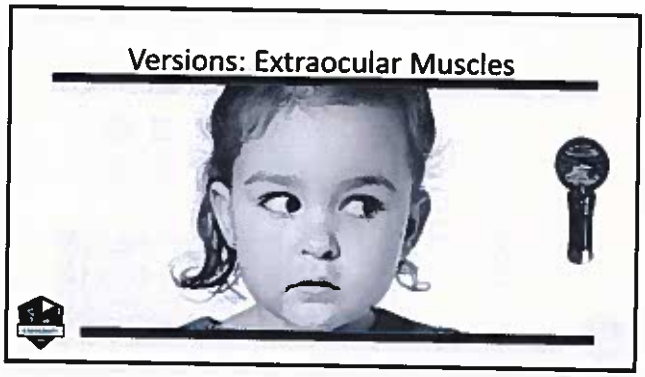
Hirschberg Testing

Krimsky Test

Krimsky Test

Versions: Extraocular Muscles

Versions: Extraocular Muscles



Visual Acuity Testing

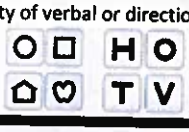
Distance VA
- Normal for age?
- RE & LE equal?

Not Recommended

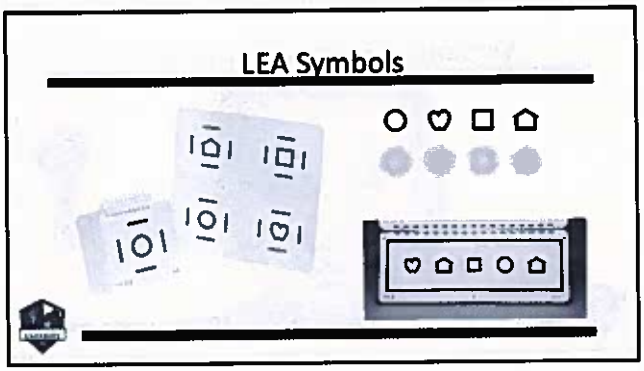
Recommended

Preschool VA test: Desirable Characteristics

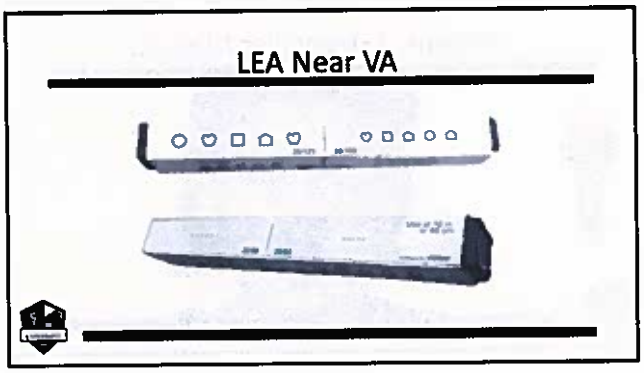
- High contrast, single, surrounded optotypes
- LogMAR progression
- Reduced (3 meter) test distance
- 2-alternative forced choice or matching
- Avoid necessity of verbal or directional response



LEA Symbols



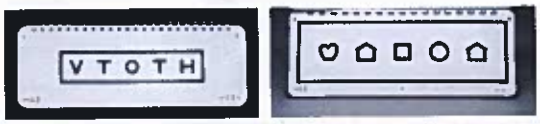
LEA Near VA



HOTV Letters

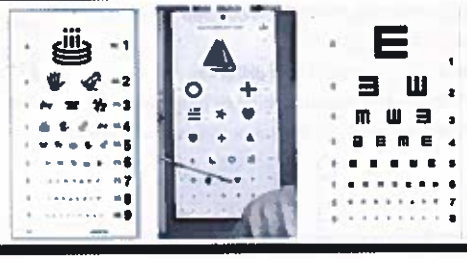
Screening with HOTV & LEA Symbols Testability & Agreement (3-5 yrs)

- Testability = 99% for both
- Identical results for 67%
  - When different, 3-year-olds better VA wiyj LEA

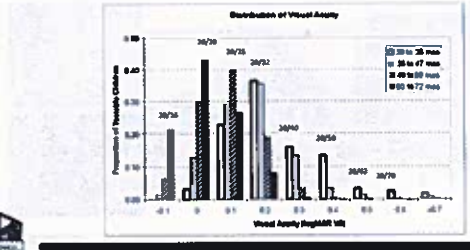


Vision in Preschoolers Group. Optom Vis Sci 2004;81:678-683

Problematic Charts



Frequency Distribution - logMAR VA by Age Defining *Normal* Visual Acuity



Pan et al., MEPEDS; *Optometry and Vision Science* 2009;86(6):607-12.

Normal Presenting Monocular VA

Age	Threshold Visual Acuity (Snellen equivalent)	% Children with Worse VA
2.5 years	20/63 or better	4.2%
3 years	20/50 or better	2.9%
4 years	20/40 better	1.1%
5 years	20/32 or better	0.5%

Pan et al. MEPEDS. Optom Vis Sci 2009;86(6):607-12.

Determine Refractive Error

To Cycloplegia or Not?

Administering Eye Drops

Cycloplegic Refraction

- Topical anesthetic
- 2 drops cyclopentolate (5 min separation?)
- Tropicamide (0.5%) or phenylephrine (2.5%) for DFE
- Wait 30 minutes

Georgia 2.5 Years

Dry
- OD: +2.00 -2.00 X 090
- OS: +0.50 DS

Cycloplegic
- OD: +3.50 DS
- OS: +3.00 DS

CURRICULUM VITAE

SUSAN A. COTTER, O.D., M.S.

PERSONAL BACKGROUND

Home Address:	808 E. Union Ave Fullerton, CA 92831
Home Phone:	(714) 447-0507
Business Address:	Southern California College of Optometry Marshall B Ketchum University Fullerton, CA 92831
Business Phone:	(714) 449-7488
FAX:	(714) 992-7846
E-mail:	scotter@ketchum.edu
Cell phone:	714-357-9349
Date of Birth:	April 1, 1957
Place of Birth:	Chicago, IL

EDUCATION

B.S., Biology, Cum Laude, Loyola University, Chicago, IL, 1979
Doctor of Optometry, Cum Laude, Illinois College of Optometry, Chicago, IL, 1983
Residency in Children's Vision, Southern California College of Optometry, Fullerton, CA, 1984
M.S., Clinical & Biomedical Investigations, University of Southern California, Keck School of Medicine, Los Angeles, 2006

ACADEMIC APPOINTMENTS & PROFESSIONAL EXPERIENCE

Assistant Professor, Division of Clinical Education, Illinois College of Optometry, 1984–1988
Private Practice, Southland Eye Associates, Olympia Fields, IL, 1988–1997
Associate Professor, Division of Clinical Education, Illinois College of Optometry, 1988–1997
Professor, Division of Clinical Education, Illinois College of Optometry, 1997
Professor of Optometry, Southern California College of Optometry, Marshall B Ketchum University, 1997 – present
Research Professor, Dept. of Ophthalmology, University of Southern California, Keck School of Medicine, 2002 – 2012
Vice Chair, Pediatric Eye Disease Investigator Group (PEDIG) network, 2008 – 2014
Executive Committee, Pediatric Eye Disease Investigator Group (PEDIG), 2001–2006, 2007–2014, July 2015 - present

AWARDS AND HONORS

Beta Sigma Kappa Honor Fraternity, Illinois College of Optometry, 1981
Tomb & Key Honor Fraternity, Illinois College of Optometry, 1982
Charlotte H. Potter Memorial Award, Illinois College of Optometry, 1983
Fellow, American Academy of Optometry, 1987
Fellow, College of Optometrists in Vision Development, 1990
Diplomate, Binocular Vision, Visual Perception, & Pediatric Optometry Section, American Academy of Optometry, 1990
Garland W. Clay Award for Excellence in Writing, American Academy of Optometry, 1993
Faculty Excellence Award, Southern California College of Optometry, 2000

Dr. Richard Hemenger Research Award, Southern California College of Optometry, 2002
William C. Ezell Fellowship, American Optometric Foundation, 2003
Centennial Honoree, Southern California College of Optometry, 2004
A.M. Skeffington Award for Excellence in Optometric Writing, College of Optometrists in Vision Development, 2008
Alumna of the Year, Illinois College of Optometry, 2010
Excellence in Optometric Education Award, California Optometric Association, 2011
Dr. Walter Chase Faculty Teaching Excellence Award, Southern California College of Optometry, 2011
Behavioral Scholar in Residence, New England College of Optometry, Boston, MA, 2012
Glenn A. Fry Medal for Distinguished Achievements in Vision Research,
The Ohio State University College of Optometry, 2016
Dr. Richard Hemenger Faculty Research Award, Southern California College of Optometry, 2016

Student Teaching Awards

Outstanding Faculty of the Year Award, Class of 1989, Illinois College of Optometry, 1988
Outstanding Faculty of the Year Award, Class of 1990, Illinois College of Optometry, 1989
Outstanding Faculty of the Year Award, Class of 1991, Illinois College of Optometry, 1990
Outstanding Faculty of the Year Award, Class of 1992, Illinois College of Optometry, 1991
Outstanding Faculty of the Year Award, Class of 1993, Illinois College of Optometry, 1992
Outstanding Faculty of the Year Award, Class of 1998, Illinois College of Optometry, 1997
Teacher of the Year, Class of 2000, Southern California College of Optometry, 1999
Teacher of the Year, Class of 2001, Southern California College of Optometry, 2000
Teacher of the Year, Class of 2002, Southern California College of Optometry, 2001
Teacher of the Year, Class of 2003, Southern California College of Optometry, 2002
Teacher of the Year, Class of 2004, Southern California College of Optometry, 2003
Teacher of the Year, Class of 2006, Southern California College of Optometry, 2005
Teacher of the Year, Class of 2007, Southern California College of Optometry, 2006
Teacher of the Year, Class of 2009, Southern California College of Optometry, 2008
Teacher of the Year, Class of 2011, Southern California College of Optometry, 2010
Teacher of the Year, Class of 2012, Southern California College of Optometry, 2011
Teacher of the Year, Class of 2013, Southern California College of Optometry, 2012
Teacher of the Year, Class of 2015, Southern California College of Optometry, 2014

NATIONAL ADVISORY / CONSULTANT ROLES

External Advisory Committee Member, Vision in Preschoolers (VIP) Study, National Eye Institute, 2000–2005
Classification of Eye Movement Abnormalities & Strabismus (CEMAS) Working Group, National Eye Institute, 2001
Scientific Review Panel Member, National Eye Institute, National Institutes of Health

- Special Emphasis Panel - ZEY1-VSN (02), 2001
- Cooperative Agreement Review Committee - ZEYI VSN (01), 2007
- Training Grant Applications Review Committee - ZEY1 VSN (06), 2008
- Special Emphasis Panel ZEY1 VSN 04, April 2012
- Special Emphasis Panel ZEY1 VSN 04, April 16, 2014
- Special Emphasis Panel/Scientific Review Group 2014/10 ZEY1 VSN (05), August 6, 2014

Scientific Program Committee, Fourth U.S. Symposium on Ocular Epidemiology, National Eye Institute, 2006–2007
Scientific Review Panel Member, National Science Foundation SBIR Program, Medical Instrumentation, 2007
Pediatric Vision Advisory Committee, Prevent Blindness America, Member 2008–2011
Fight for Sight, Project Grant Reviewer for Research Strategy Advisory Group, 2012
National Expert Panel, National Center for Children's Vision and Eye Health, May 2010 – Dec 2012
National Advisory Committee for National Center for Children's Vision and Eye Health, Dec 2012 – present

Prevent Blindness Joanne Angle Investigator Award, Review Panel Member, 2014, 2015
Invited Panelist/Speaker for first meeting of the Institute of Medicine's Committee for Public Health Approaches to Reduce Vision Impairment and Promote Eye Health (IOM-HSP-14-24) April 2015
Scientific Review Panel Member, NIH / National Institute of Biomedical Imaging and Bioengineering, Special Emphasis Panel, 2015-10 SBIR Health Disparities Review ZEB1 OSR-E (O1), June 24, 2015
Invited Participant, Lasker/International Retinal Research Foundation's Initiative for Innovation in Vision Science on Amblyopia, August 2015, March 2016 - present
Co-Chair of Targeted Session: Early Diagnosis of Amblyopia and New Approaches
Data and Safety Monitoring Board Member, National Eye Institute project: Improving Quality Vision Outcomes in the Managed Care Setting While Reducing Cost by Use of Accurate, Automated Screening (1R44EY025926-01; PI: Shaka), August 2015 – present
Consultant: Welch Allyn Vision Screening Advisory Group, June 2016 - present

NATIONAL ORGANIZATIONS/PROFESSIONAL SOCIETIES

American Academy of Optometry
Ellerbrock Continuing Education Committee, 1992–1993
Admittance Committee, Ad-Hoc Member, 1992–1994
Binocular Vision, Perception, & Pediatric Optometry Section
- Vice-Chair, Diplomate Program 1992–1994
- Chair, Diplomate Program, 1994–1996
- Vice-Chair, 1996–1998
- Program Chair, 1998–2000
- Section Chair, 1998–2000
- Immediate Past Chair, 2001–2003
- Diplomate Case Report Reviewer, 1992–present

Faculty Liaison for Illinois College of Optometry, 1993–1995
Director, Illinois Chapter of the AAO, 1994–1995
Continuing Education Committee, 1996 International AAO Meeting, 1995–1996
Writing Committee, Position Statement on Vision, Learning Disabilities, and Dyslexia, 1996–1997
Writing Committee, Joint Organizational Policy Statement on Vision Therapy, 1998–1999
Nominating Committee, 1999–2002
Editorial Board, *Journal of Optometry & Vision Science*, 1999–2004
Topical Editor, *Optometry & Vision Science*, 2006–2010, 2012 – present
Research Committee, 2008 – 2012
Board of Directors, October 2011 – present
American Academy of Ophthalmology & American Academy of Optometry Joint Symposium Task Force for 2015, 2016

American Optometric Association (and State/Local)
Board of Directors, Chicago-South Suburban Society, Illinois Optometric Association, 1989–1992
Journal of the American Optometric Association (Binocular Function Editor), 1991–1996
Education Executive Committee, Illinois Optometric Association, 1993–1995
Clinical Expert Review Panel, Consultant and Author, American Optometric Association
- Clinical Practice Guideline on Amblyopia, 1993–1994
- Clinical Practice Guideline on Strabismus, 1993–1995
- Clinical Practice Guideline on Accommodative and Vergence Disorders, 1996–1998

Residency Consultant, Council on Optometric Education, 1993–1996
Pediatric, Binocular Vision, & Perception Committee, 1995–1999
Consultant & Writing Committee

- Position Statement on Vision, Learning Disabilities, and Dyslexia, 1996–1997
- Joint (AOA & AAO) Organizational Policy Statement on Vision Therapy, 1998–1999

Senior Residency Consultant, ACOE: Residency Program Evaluation, 1996 – present
Clinical Programs Committee Manpower Pool, 1997–1998
Committee for Updating the *Guidelines for Preventive Care*, 1997–1998
Council on Research member, 1997 – 2015
Optometric Residency Committee, Accreditation Council on Optometric Education, 1999–2003
Continuing Education Committee, Optometry's Meeting, 2012 – 2015

College of Optometrists in Vision Development
External Insurance Committee, 1990–1996
Editorial Council, *Journal of Optometric Vision Development*, 1991–1992
Special Task Force for Liaison with Colleges during the Annual Meetings, 1991–1994, Chair 1992–1994
Authored column, Strabismus & Amblyopia Abstracts, *Journal of Optometric Vision Development*, 1993–1995
International Examination and Certification Board, 1995–1998
Program Advisory Council, 1996–1997
National Education Advisory Task Force, 1998
Skeffington Award Committee, 2009 – 2011, Chairperson 2009

Society for Clinical Trials
Education Committee, 2007–2008

Association for Schools and Colleges of Optometry (ASCO)
Task Force on Functional Standards for Didactic and Clinical Optometric Education, 1997–1998
Mentor for Summer Institute for Faculty Development Program, 2013

National Board of Examiners in Optometry
Item Writer, 1995–1999
Part I - Applied Basic Science (ABS) Refraction Examination Development Committee, 2011 – present
Part I - Applied Basic Science (ABS) Council member, 2016 - present

COLLEGE COMMITTEES / SERVICE

Marshall B Ketchum University
Faculty Senate Member representing Optometry, 2015 – present

Southern California College of Optometry
Faculty Tenure Committee, 1997–1998, 2000–2003
Residency Committee, 1998–2000
Faculty Merit & Promotion Committee, 1998–2000
Continuing Education Committee, 1998–2008
Ad-Hoc Professor Emeritus Committee, Chair 1999
Faculty Research Committee Chair, 1999–2001, 2004–2005; Member 1997–2010, 2012-present
Institutional Review Board, 1999–2000
Faculty Council Executive Committee, Director, 2000–2003
Student Evaluations Committee-Ad Hoc, 2001
Student Professional Attire & Conduct Committee, 2008–2009
Faculty Emeritus Committee, Chair, 2008–2009
Faculty Discipline Committee, 2008–2009
Ad-Hoc Committee for AY 2008 Faculty Merit, 2010-2012
Faculty Workload Committee, 2009–2010

Faculty Sabbatical Committee, 2006–2009, 2011 – present; Chair 2006–2009
Ad-Hoc Committee for Walter Chase Faculty Teaching Excellence Award, 2012
Faculty Promotion & Tenure Committee, 2012-present
Ad-hoc Student Code of Conduct Committee, 2015
Dean's Advisory Committee, 2016-present

Illinois College of Optometry
Academic Appeals Committee, 1984–1985
Faculty Representative, Faculty Relations Committee, Board of Trustees Annual Meeting, 1985
Dean's Curriculum Committee, 1985–1986
Faculty Selection Committee, 1985–1988
Faculty Promotions Committee, 1985–1988
Faculty Travel Committee, 1985–1988
Chairperson, Binocular Vision / Pediatric Optometry Curriculum Revision Committee, 1985–1986
Admissions Committee, 1985–1993
Faculty Seminar Series Committee, 1986–1987
Coordinator, Clinical Proficiency Evaluations and Remediation Program, Binocular Vision & Pediatric Service, 1991
Chairperson, Clinical Remediation Task Force, 1991
Faculty Liaison to American Academy of Optometry, 1993–1995
Student Promotions Committee, Ad-Hoc Member, 1994
Binocular Vision Curriculum Review Committee, 1994
Committee to Review Faculty Examinations, 1996–1997

FUNDED STUDIES

Vision Therapy for Intermittent Exotropia (1991–1992)
Executive Planning Committee & Investigator
NIH-NEI R21 EYO9633 (PI – B. Wick)

Convergence Insufficiency and Reading Study (CIRS) (1995–1996)
Executive Committee & Investigator
Grant from College of Optometrists in Vision Development

Myopia Development in Children (Collaborative Longitudinal Evaluation of Refractive Error Study) (1997–2007)
Principal Investigator at SCCO site 2004–2007 (Investigator 1997–2004)
NIH-NEI U10-EY08893 (PI: K. Zadnik)

Clinical Trials in Strabismus and Pediatric Ophthalmology (1997 – present)
NIH-NEI U10 EY11751-11 (PI R. Beck, followed by R. Kraker; current 2014-2019)

- Vice Chair, Pediatric Eye Disease Investigator Group (PEDIG) network, Nov 2008 – Dec 2014
- Executive Committee, 2001–2006, 2007–2014, July 2015 - present
- Steering Committee, Amblyopia Treatment Study (ATS) (for all ATS studies), 2001 – 2015
- Strabismus Steering Committee, 2009 – 2015
- ATS 1: Operations Subcommittee (2000-2002); Investigator
- ATS 2: Planning Committee Member & Investigator 2001–2003; Writing Committee
- ATS -3 Pilot: Planning Committee Member 2000; Writing Committee; Investigator 2000–2002
- ARS 3: Planning Committee Member (2001–2002); Writing Committee; Investigator (2002–2005)
- ATS 4: Co-Protocol Chair (2002–2003); Planning Committee Member (2001–2002); Writing Committee; Investigator 2002–2003

- Intermittent Exotropia Observational Study (IXOS); Planning Committee Member (2002–2009)
- ATS 5: Co-protocol Chair, 2003–2005: Planning Committee Member; Writing Committee; Investigator 2004–2005
- ATS 6: Planning Committee Member; Investigator (2005–2008)
- ATS 7: Planning Committee Member, Investigator (2004–2006)
- ATS 8: Co-Protocol Chair & Planning Committee, 2003–2008; Writing Committee; Investigator 2005–2008
- ATS 9: Planning Committee Member; Investigator (2005–2008)
- ATS 10: Planning Committee Member (2005); Investigator (2005 – 2008)
- ATS 11: Planning Committee Member (2006 –2007); Investigator (2006 –2009)
- ATS 12: Planning Committee Member (2005 – 2009); Writing Committee
- ATS 13: Protocol Chair, Planning Committee Member; Writing Committee; Investigator (2006–2010)
- Central Corneal Thickness Study; Investigator (2008 – 2009)
- ATS 15: Planning Committee & Investigator, Planning Committee, Investigator, 2009 – 2013
- ATS 16: Planning Committee & Investigator, Planning Committee, Investigator, 2009 – 2013
- Intermittent Exotropia Trial-2: Co-protocol Chair, Planning Committee, Writing Committee, Investigator, 2009 – present
- Hyperopia Treatment Study (HTS): Planning Committee Member and Investigator, 2010 – present
- Convergence Insufficiency Treatment Study (CITS): Planning Committee Member, clinical site for pilot study, Writing Committee, and Investigator, 2009 – 2014
- Intermittent Exotropia Study-3: A Pilot Randomized Clinical Trial of Overminus Spectacle Therapy for Intermittent Exotropia: Planning Committee Member, 2010 – 2014; Investigator 2014 - 2015
- Binocular Computer Activities for Treatment of Amblyopia: Planning Committee Member, 2012 – 2014; Investigator 2014 - 2016
- Strabismus Registry Planning Committee Member, 2012 – 2014
- Refractive Surgery for Anisometropia Planning Committee Member, 2015 – present
- Bifocals versus Single Vision Lenses for Treatment of Amblyopia Planning Committee Member, June 2016 – present

Convergence Insufficiency Treatment Trial (2000–2002)
Planning Committee Member, Principal Investigator at SCCO Site
NIH-NEI R21 EY13164-01 (PI – M. Scheiman)

PIR-205: A One-Year Multi-Center, Double-Masked, Placebo-Controlled, Safety & Efficacy Study of 2% Pirenzepine Ophthalmic Gel in Children with Myopia (FDA IND 57,300) (2000–2002)
Principal Investigator at SCCO site
Valley Forge Pharmaceuticals, Inc.

PIR-205A: A Second Year of Treatment in a One-Year Multi-Center, Double-Masked, Placebo-Controlled, Parallel, Safety & Efficacy Study of 2% Pirenzepine Ophthalmic Gel in Children with Myopia (2001–2003)
Valley Forge Pharmaceuticals, Inc.
Principal Investigator at SCCO site

Multi-Ethnic Pediatric Eye Disease Study (2002–2012)
Co-Principal Investigator, NIH-NEI U10 EY014472 (PI – R. Varma)

Open Label Study of 2% Pirenzepine Ophthalmic Gel in Children with Myopia (2002–2004)
Principal Investigator at SCCO site
Valley Forge Pharmaceuticals, Inc.

Convergence Insufficiency Treatment Trial (2004–2008)

Principal Investigator, SCCO, NIH-NEI 1 U10 EY014709
Vice-Chair & Executive Committee Member for CITT; NIH-NEI U10 EY01473 (Scheiman)

Accommodative Performance in Children
Role: Co-Principal Investigator at SCCO site; R01 EY 014460 (Candy PI); SCCO subcontract 2010-2013

Convergence Insufficiency Treatment Trial – Attention & Reading Trial (2014–2019)
Principal Investigator, SCCO at Marshall B Ketchum University, NIH-NEI 1 U10 EY022595-01A1
Vice-Chair & Executive Committee Member for CITT-ART, NIH-NEI 1 U10 EY022599-01A1 (Scheiman)

PROFESSIONAL PUBLICATIONS REVIEWS

Editorial Board Member
Journal of the American Optometric Association (Binocular Function Editor), 1991–1996
Journal of Optometric Vision Development, 1992–1999
Optometry and Vision Science, 1999–2004
Optometry and Vision Science, Associate Topical Editor, 2006–2010, 2012 – present
Journal of Optometry, 2008 – present

Journal Reviewer
American Journal of Epidemiology
Archives of Ophthalmology
Binocular Vision & Strabismus Quarterly
British Journal of Ophthalmology
Clinical and Experimental Optometry
Current Eye Research
Expert Review of Ophthalmology
Investigative Ophthalmology & Visual Science
Journal of Optometric Vision Development
Journal of the American Academy of Pediatric Ophthalmology & Strabismus
Journal of the American Optometric Association
Journal of Optometry
Ophthalmic & Physiological Optics
Ophthalmic Epidemiology
Ophthalmology
Optometry and Vision Science
Progress in Retinal & Eye Research
Review of Optometry
Survey of Ophthalmology
Vision Research

PUBLICATIONS

Chapters, Books, & Other Monographs

1. **Cotter SA**. Conventional Therapy for Amblyopia. In: Problems in Optometry: Amblyopia. Rutstein RP (ed). Philadelphia: Lippincott 1991:312-30.

2. **Cotter SA**, Frantz KA. Prescribing Prism for Vertical Deviations. In: Problems in Optometry: Ocular Vertical and Cyclovertical Deviations. London R (ed). Philadelphia: Lippincott 1992:629-45.

3. **Cotter SA**, Caloroso E, Rouse MW. Active Vision Therapy. In: Caloroso E, Rouse MW. Clinical Management of Strabismus. Boston: Butterworths, 1993:127-39.

4. **Cotter SA**. Vision Therapy Techniques. In: Caloroso E, Rouse MW. Clinical Management of Strabismus. Boston: Butterworths, 1993:295-353.

5. **Cotter SA,** Scharre JE. Optometric Assessment: Case History. In: Scheiman M, Rouse MW (eds). Optometric Management of Vision-Related Learning Problems. St. Louis: Mosby, 1994.

6. Rouse MW, Cooper JS, **Cotter SA**, Press LJ, Tannen BM. Optometric Clinical Practice Guideline: Care of the Patient with Amblyopia. St. Louis: American Optometric Association, 1994.

7. **Cotter SA**. (ed). Clinical Uses of Prism: A Spectrum of Applications. St. Louis: Mosby, 1995.

8. Frantz KA, **Cotter, SA**. Idiosyncrasies of Measuring with Prism. In: Cotter SA (ed). Clinical Uses of Prism: A Spectrum of Applications. St. Louis: Mosby, 1995.

9. **Cotter SA**, Frantz KA. Practical Considerations in Prism Implementation. In: Cotter SA (ed). Clinical Uses of Prism: A Spectrum of Applications. St. Louis: Mosby, 1995.

10. Caloroso E, **Cotter SA**. Prescribing Prisms for Strabismus. In: Cotter SA (ed). Clinical Uses of Prism: A Spectrum of Applications. St. Louis: Mosby, 1995.

11. Rutstein RP, Cogen MS, **Cotter SA**, Daum KM, Mozlin RL, Ryan JM. Optometric Clinical Practice Guideline. Care of the Patient with Strabismus: Esotropia & Exotropia. St. Louis: American Optometric Association, 1995.

12. **Cotter SA**. Anisometropic Amblyopia. In: Ettinger E, Rouse MW (eds). Clinical Decision Making in Optometry. Newton, MA: Butterworth Heinemann, 1997.

13. **Cotter SA**, Frantz KA. Strabismus Diagnosis. In: Moore B (ed). Eye Care of the Infant and Young Child. Newton, MA: Butterworth Heinemann, 1997.

14. Cooper JS, Burns CR, **Cotter SA**, Daum KM, Griffin JR, Scheiman MM. Optometric Clinical Practice Guideline. Care of the Patient with Accommodative & Vergence Dysfunction. St. Louis: American Optometric Association, 1998.

15. **Cotter SA**, Barnhardt C. Optometric Assessment: Case History. In: Scheiman MM; Rouse MW (eds). Optometric Management of Learning-Related Vision Problems. 2nd ed. St. Louis: Mosby Elsevier; 2006.

16. **Cotter SA**, Frantz KA. Therapeutic Uses of Prism for Binocular Vision Disorders. In: *Duane's Ophthalmology* (9th Edition) Volume 1, Chapter 57. Tasman, W, Jaeger EA (ed). Philadelphia: Lippincott Williams & Wilkins 2009.

Peer-Reviewed Journal Publications

1. Griffin JR, **Cotter SA**. The Brückner test: Evaluation of clinical usefulness. *American Journal of Optometry and Physiological Optics* 1986;63(12):957-61. PMID:3799807

2. **Cotter SA**, Rouse MW, DeLand PN. Comparative study of the Jordan Left-Right Reversal Test, the Reversals Frequency Test, and teacher's observations. *American Journal of Optometry and Physiological Optics* 1987;64(3):195-03. PMID:3578485

3. Frantz KA, **Cotter SA**, Brown WL, Motameni M. Erroneous findings in polarized testing caused by plastic prisms. *Journal of Pediatric Ophthalmology and Strabismus* 1990;27(5):259-64. PMID: 2246741

4. Scharre JE, **Cotter SA**, Block SS, Kelly SA. Normative contrast sensitivity data for young children. *Optometry and Vision Science* 1990;67(11):826-32. PMID: 2250891

5. Wick B, Wingard M, **Cotter S**, Scheiman M. Anisometropic amblyopia: Is the patient ever too old to treat? *Optometry and Vision Science* 1992;69(11):866-78. PMID:1454304

6. Coffey B, Wick B, **Cotter S**, Scharre J, Horner D. Treatment options in intermittent exotropia: A critical appraisal. *Optometry and Vision Science* 1992;69(5):386-04. PMID:1594200

7. Frantz KA, **Cotter SA**, Wick B. Re-evaluation of the four prism diopter base-out test. *Optometry and Vision Science* 1992;69(10):777-86. PMID:1436999

8. **Cotter SA**. Constant occlusion for amblyopia: Helpful or harmful? *Journal of Optometric Vision Development* 1995;26:57-61.

9. Kelly SA, Chino YM, **Cotter SA**, Knuth J. Orientation anisotropy and strabismus. *Vision Research* 1997;37(1):151-63. PubMed PMID: 9068837

10. Lee DY, **Cotter SA**, French AL. Evaluation of Kojima-Matsubara Color Vision Test Plates: Validity in young children. *Optometry and Vision Science* 1997;74(9):726-31. PMID:9380370

11. Rouse MW, Hyman L, Hussein ME, CIRS Group (**Cotter SA** – Executive Committee). How do you make the diagnosis of convergence insufficiency? Survey results. *Journal of Optometric Vision Development* 1997;28(2):91-97.

12. Rouse MW, Hyman L, Hussein ME, Solan H; CIRS Group (**Cotter SA** – Executive Committee). Frequency of convergence insufficiency in optometry clinic settings. *Optometry and Vision Science* 1998;75(2):88-96. PMID:9503434

13. Johnston E, Carlson N, Colliday T, **Cotter SA**, et al. Functional standards for didactic and clinical optometric education. *Optometric Education* 1998;24:27-28.

14. Rouse MW, Borsting E, Hyman L, Hussein M, **Cotter SA**, Flynn M, Scheiman M, Gallaway M, DeLand PN; CIRS Group. Frequency of convergence insufficiency among fifth and sixth graders. *Optometry and Vision Science* 1999;76(9):643-49. PMID:10498006

15. Borsting E, Rouse MW, DeLand PN; CIRS Group (**Cotter SA** – Executive Committee). Prospective comparison of convergence insufficiency and normal binocular children on CIRS symptom surveys. *Optometry and Vision Science* 1999;76(4):221-28. PMID:10333184

16. **Cotter SA**, Lee DY, French AL. Evaluation of a new color vision test: "Color Vision Testing Made Easy." *Optometry and Vision Science* 1999;76(9):631-36. PMID:10498004

17. Zadnik K, Jones LA, Irvin BC, Kleinstein RN, Manny RE, Shin JA, Mutti DO; **CLEERE Group**. Myopia and ambient night-time lighting. *Nature* 2000;404(6774):143-44. PMID:10724157

18. Holmes JM, Beck RW, Repka MX, Leske DA, Kraker RT, Blair RC, Moke PS, Birch EE, Saunders RA, Hertle RW, Quinn GE, Simons KA, Miller JM; **Pediatric Eye Disease Investigator Group**. The amblyopia treatment study visual acuity testing protocol. *Archives of Ophthalmology* 2001;119(9):1345-53. PMID:11545641

19. Cole SR, Beck RW, Moke PS, Celano MP, Drews CD, Repka MX, Holmes JM, Birch EE, Kraker RT, Kip KE; **Pediatric Eye Disease Investigator Group**. The amblyopia treatment index. *Journal of AAPOS* 2001 Aug;5(4):250-54. PMID:11507585

20. Rouse MW, Borsting E, DeLand PN; CIRS Group (**Cotter SA** – Executive Committee). Reliability of binocular vision measurements used in the classification of convergence insufficiency. *Optometry & Vision Science* 2002;79(4):254-64. PMID:11999151

21. Pediatric Eye Disease Investigator Group (**Cotter SA** – steering and operations committees). A randomized trial of atropine versus patching for treatment of moderate amblyopia in children. *Archives of Ophthalmology* 2002;120(3):268-78. PMID:11879129

22. Hertle RW, National Eye Institute Sponsored Classification of Eye Movement Abnormalities and Strabismus Working Group (**Cotter SA,** member). A next step in naming and classification of eye movement disorders and strabismus. J AAPOS. 2002 Aug;6(4):201-2. PMID: 12185342

23. Pediatric Eye Disease Investigator Group (**Cotter SA –** writing and steering committees; operations sub-committee). The clinical profile of moderate amblyopia in children less than seven years of age: Experience of the Amblyopia Treatment Study 1. *Archives of Ophthalmology* 2002;120(3):281-87. PMID:11879130

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158. Huang K, **Cotter SA**, Tarczy-Hornoch K, Wen G, Borchert M Mckean-Cowdin R, Torres M, Azen S, Varma R. The Brückner test: Detection of strabismus & amblyopia in infants & young children. Optometry and Vision Science 2012; 89:E-abstract 120023.

159. **Cotter SA** on behalf of The Pediatric Eye Disease Investigator Group. Lessons learned from the Amblyopia Treatment Studies. Optical Society of America Meeting in Houston, TX October 2013. *Journal of Vision* 2013;13 (15):T33.

160. Mohney BG, **Cotter SA**, Chandler DL, Holmes JM, on behalf of PEDIG. A randomized trial comparing part-time patching with observation for children with intermittent exotropia. American Academy of Ophthalmology Annual Meeting in New Orleans, LA. November 2013.

161. **Cotter SA**, Mohney B, Chandler DL, Holmes JM, Pediatric Eye Disease Investigator Group. A randomized trial comparing part-time patching with observation for children with intermittent exotropia. Optometry and Vision Science 2013; 90: E-abstract 130867.

162. Mohney BG, **Cotter SA**, Chandler DL, Holmes JM, on behalf of PEDIG. The effect of part-time patching on near stereoacuity, control, and angle in childhood intermittent exotropia. American Association for Pediatric Ophthalmology and Strabismus Annual Meeting in Rancho Mirage, CA. April 2014.

163. Barnhardt CN, Repka MX, Kraker RT, **Pediatric Eye Disease Investigator Group.** A randomized trial of atropine versus patching for treatment of moderate amblyopia: Follow-up at 15 years of age. Optometry and Vision Science 2013; 90: E-abstract 130643.

164. Wallace D, Lazar E, Hoover D, Tamkins S, Pediatric Eye Disease Investigator Group (**Cotter SA**. PEDIG network chair, steering committee). Time course and predictors of amblyopia Improvement with 2 hours of daily patching. Investigative Ophthalmology and Visual Science *2013* 54:E-Abstract 3990.

165. Patel R, **Cotter** SA. Multi-modality treatment regimen leads to stereopsis recovery and elimination of amblyopia & diplopia in a teenage child: Evidence of neuroplasticity. Optometry and Vision Science 2014; 91: E-abstract 145014.

166. Suh DW, Kulp MT, Dean TW, Kraker RT, Erzurum SA, Wallace DK, Pang Y, Shea CJ, Avallone JM, on behalf of the **Pediatric Eye Disease Investigator Group**. The clinical profile of moderate hyperopia in children three to five years of age. Investigative Ophthalmology and Visual Science 2015 56:E-Abstract 2207.

167. Scheiman MM, Hoover DL, Lazar EL, **Cotter SA**, Kraker RT, Wallace DK, Lorenzana IJ, Kulp MT, Rudaitis IM, Gallaway MF, Jenewein EC, on behalf of PEDIG. Home-based therapy for symptomatic convergence insufficiency in children age 9 to <18 years: a randomized clinical trial. Optometry and Vision Science 2015; 92: E-abstract 150015.

168. Chen AM, Holmes JM, Chandler DL, Patel RA, Gray ME, Jensen AA, Erzurum SA, Wallace DK, Kraker RT, on behalf of the **Pediatric Eye Disease Investigator Group**. A pilot randomized clinical trial of overminus spectacles versus observation in children with intermittent exotropia. Optometry and Vision Science 2015; 92: E-abstract 155197.

169. Patel R, Ngo A, **Cotter S.** Cyclic esotropia successfully treated with vision therapy and strabismus surgery. Optometry and Vision Science 2015; 92: E-abstract 155207.

170. **Cotter SA**, Mohney BG, Chandler DL, Holmes JM, Petersen DB, Kraker RT, Wallace DK, for the Pediatric Eye Disease Investigator Group. Natural history of childhood intermittent exotropia over a 3-year period. Investigative Ophthalmology and Visual Science 2016 57: E-abstract 984.

INVITED LECTURES

1987

- Optometry Faculty Seminar, University of Houston College of Optometry, Houston, TX

1988

- Optifair Midwest Meeting, Chicago, IL
- Illinois Optometric Association Convention, Chicago, IL

1989

- North Central States Optometric Conference, Minneapolis, MN
- Ohio Optometric Association, Fall Educational Conference, Huron, OH
- Department of Ophthalmology, University of Iowa, Iowa City, IA
- Chicago South Suburban Optometric Society, Blue Island, IL

1990

- Rehabilitative Institute of Chicago (RIC), Chicago, IL
- North Central States Optometric Conference, Minneapolis, MN
- Vision Expo / Optifair West Meeting, Anaheim, CA
- Frank Brazelton Memorial Symposium, Orange County Chapter of the American Academy of Optometry, Fullerton, CA
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, Nashville, TN

1991

- Continuing Education Course, Chicagoland Cataract Consultants, Chicago, IL
- Vision Expo Meeting, Chicago, IL
- Ohio Optometric Association, Fall Education Conference, Huron, OH
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, Anaheim, CA

1992

- Northern Illinois Optometric Society, Rockford, IL
- Spring Education Meeting, Illinois Chapter, American Academy of Optometry, Oakbrook, IL
- Seminario: Estudios de Casos de Estrabismos y Amblyopías," Centro Boston de Optometría, Madrid, Spain

1993

- Broward County Optometric Association, Ninth Annual Gold Coast Educational Retreat, Ft. Lauderdale, FL
- POA Annual Conference, Pennsylvania Optometric Association Meeting, Hershey, PA
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, Boston, MA

1994

- University of Houston College of Optometry, CE and Ski '94 Meeting, Santa Fe, NM
- Broward County Optometric Association, Tenth Annual Gold Coast Educational Retreat, Ft. Lauderdale, FL
- South Suburban Chicago Chapter of Children with Attention Deficit Disorders Meeting, Homewood, IL

- Spring Seminar, Vision Institute, Toronto, Canada
- Mountain West Council of Optometrists, Congress '94, Las Vegas, NV
- Atlantic Optometric Continuing Education Symposium, New Brunswick, Canada
- American Academy of Optometry International Meeting, Amsterdam
- The Third International Optometry Symposium, Centro Boston de Optometría, Madrid, Spain
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, San Diego, CA

1995

- Southwest Cook County Cooperative Association for Special Education, Oak Forest, IL
- Department of Ophthalmology, Children's Memorial Hospital, Chicago, IL
- Mountain States Congress of Optometry / Colorado Optometric Association, Snowmass, CO
- International Vision Expo Meeting, Anaheim, CA
- Department of Ophthalmology, University of Chicago, Chicago, IL
- Tennessee Optometric Association Meeting, Gaitlinburg, TN
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, New Orleans, LA

1996

- California Optometric Association: Annual Congress & Spring Optica, Anaheim, CA
- Academy Europe '96, International American Academy of Optometry Meeting, Copenhagen, Denmark
- Norges Optikerforbund - Landsmote (Norwegian Optometric Assoc. Annual Meeting), Mo i Rana, Norway
- American Optometric Association, 99th Annual Congress, Portland, OR

1997

- CE and Ski '97 Meeting, Santa Fe, NM
- Mountain West Council of Optometrists, Congress '97, Las Vegas, NV
- American Optometric Association, Centennial Congress, St. Louis, MO
- 1997 Fall Eyecare Conference, Kansas Optometric Association, Wichita, KS
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, San Antonio, TX

1998

- Miami Nice Educational Seminar, Dade County Optometric Association, Miami, FL
- 1998 Fall Annual Spring Conference, Kentucky Optometric Association
- New Mexico Optometric Association, 1998 Annual Convention, Albuquerque, NM
- II Jornadas de Optometría y Contactologia, Region de Murcia, Murcia, Spain
- Invited Lecture, The Elizabeth E. Caloroso Lectures in Binocular Vision & Pediatric Optometry, Southern California College of Optometry Continuing Education Program, Fullerton, CA
- International Vision Expo Meeting, Los Angeles, CA
- Great Western Council of Optometry Congress '98, Portland, OR
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, San Francisco, CA

1999

- Advanced Eyecare Associates, 1999 Cruise Seminar
- Forum on Binocular & Children's Vision, The Ohio State University, Columbus, OH
- Orange County Optometric Society
- Alameda / Contra Costa Counties Optometric Society
- 1999 Mountain States Congress of Optometry / Colorado Optometric Association Conference, Aspen, CO
- Continuing Education Courses, Surf-N-CE, Puerto Vallarta, Mexico
- 26 Congres Biennal de l'Association Canadienne des Optométristes, Quebec City, Canada
- North Dakota Optometric Society 1999 Annual Congress, Fargo, ND

- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, Seattle, WA

2000

- SECO International 2000 Meeting, Atlanta, GA
- California Optometric Association Spring Optica 2000, Long Beach, CA
- Kentucky Optometric Association Fall Education Conference, Lexington, KY
- XIV International Congress of Eye Research, Santa Fe, NM
- Terceras Jornadas de Optometría y Contactologia, Region de Murcia, Murcia, Spain
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, Orlando, FL

2001

- SECO International 2001 Meeting, Atlanta, GA
- American Academy of Pediatric Ophthalmology and Strabismus Meeting, Orlando, FL
- Mountain West Council of Optometrists, La Vegas, NV
- 2001 Mountain States Congress of Optometry / Colorado Optometric Association Conference, Vail, CO
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, Philadelphia

2002

- Visiting Professor, Pediatric Ophthalmology Basic Science Review Course, Department of Ophthalmology, University of California, San Diego
- American Academy of Pediatric Ophthalmology and Strabismus Meeting, Seattle, WA
- Advanced Eyecare Associates, Optometric Cruise Seminar
- Arizona Optometric Conference, 2002 Fall Congress, Sedona, AZ
- Ellerbrock Memorial Continuing Education Program, American Academy of Optometry Meeting, San Diego, CA

2003

- Jules Stein Institute & So. CA College of Optometry, New Technologies & Retina Update Program, Fullerton, CA
- Southwest Council of Optometrists, Dallas, TX
- Optowest 2003, Anaheim, CA
- Alaska Optometric Association 2003 Summer Conference, Girdwood, AK
- The 106th Annual American Optometric Association Congress, San Diego, CA
- University of Houston College of Optometry Continuing Education in Banff, Canada
- 2003 Mountain States Congress of Optometry/Colorado Optometric Assoc. Conference, Steamboat Springs, CO
- Pioneers in Optometry, 2003 Fall Congress, Oklahoma Association of Optometric Physicians, Tulsa, OK
- Great Western Council of Optometry Congress 2004, Portland, OR
- Ellerbrock Memorial Continuing Education Program. American Academy of Optometry Meeting, Dallas, TX
- Inaugural lecture presented at the VIII Jornadas Científicas de la Visión de la Comunidad Valenciana, Sociedad Optometría y Contactología de la Comunidad Valenciana, Alicante, Spain

2004

- International Vision Expo East 2004 Conference, New York, New York
- Kentucky Optometric Association, 102nd Annual Spring Congress, Louisville, KY
- Myopia Special Interest Group Meeting, Association for Research in Vision & Ophthalmology Annual Meeting
- Optowest 2004, Anaheim, CA
- Indian Health Service Biennial Eye Care Meeting, Fullerton, CA
- 2004 Southern Regional Conference, Optometrists Association Australia - Victoria, Melbourne, Australia
- Master Veinte 20 Program, Madrid, Spain
- Vision 2004 Congress, South African Optometric Association, Johannesburg, South Africa
- Rio Hondo Optometric Society, La Mirada, CA

- 2004 Elizabeth E. Caloroso Lecturer, Southern California College of Optometry Centennial Celebration, Fullerton, CA
- 2004 Alabama Optometric Association Convention, Birmingham, AL
- Harris County Optometric Society, Houston, TX
- Continuing Education Program. American Academy of Optometry Meeting, Tampa, FL

2005

- 22nd Annual Island Eyes Conference, Maui, HI
- SECO International 2005 Meeting, Atlanta, GA
- The Royal Society of Medicine, Meeting of the Ophthalmology Section on Myopia – Causes, Prevention, & Treatment, London, England
- Navajo Area Indian Health Service Optometry Continuing Education," Flagstaff, AZ
- Atlantic Continuing Education Symposium, Fredericton, New Brunswick, Canada
- Curso de Experto en Optometría Clínica Avanzada, V Congreso Veinte20.com, Formación Continuada en Optometría, Madrid, Spain
- Los Angeles County Optometric Society Continuing Education Seminar, Los Angeles, CA
- 17th Annual Ocular Pathology Symposium, Orange County Optometric Society, Santa Ana, CA
- EastWest Eye Conference, Cleveland, OH
- Continuing Education Program, American Academy of Optometry Meeting, San Diego, CA

2006

- Southern California Permanente Medical Group: 2006 Optometry Symposium, City of Industry, CA
- 22nd Annual See & Ski Tahoe Conference, Nevada Optometric Association, Lake Tahoe, NV
- The Norwegian Optometric Association Annual Meeting 2006: Paediatric Optometry, Bergen, Norway
- Indian Health Service Biennial National Eye Care Meeting, Fullerton, CA
- Society for Clinical Trials Meeting, Orlando, FL
- Journées Optométriques 2006, Centre de Perfectionnement et de Référence en Optométrie (CPRO), Montréal, Canada
- Vision 2006 Congress, South African Optometric Association, Johannesburg, South Africa
- Clinical Periopsia Program, University of Houston College of Optometry, Houston, TX
- Nova Southeastern University, College of Optometry, Ft. Lauderdale, FL
- Continuing Education Program lecture w/ Rowan Candy, PhD. American Academy of Optometry Mtg. San Diego, CA

2007

- University of Pittsburgh, Department of Ophthalmology & Children's Hospital of Pittsburg
- British Columbia Association of Optometrists, Continuing Education Seminars, Vancouver, Canada
- Optowest 2007, Long Beach, CA
- Oxyopia Vision Science Seminar, Indiana University School of Optometry
- Keynote Speaker, Southern Regional Congress 2007, Optometrists Association Australia - Victoria, Melbourne, Australia
- Optometry's Meeting, American Optometric Association, Boston, MA
- The Canadian Association of Optometrists: Congress 2007, Saskatoon, Canada
- XII Congreso Académico de Optometría Functional. Puerto Vallarta, Mexico
- Kaiser Permanente Regional Orthoptics Meeting, Orange, CA
- Great Western Council of Optometry Congress 2007, Portland, OR
- Continuing Education Program. American Academy of Optometry Meeting, Tampa, FL

2008

- University of Houston College of Optometry, CE and Ski 2008 Meeting, Santa Fe, NM
- Kaiser Permanente 2008 Annual Optometry Symposium, Anaheim, CA

- 47th Annual Contact Lens & Primary Care Congress, Heart of America Meeting, Kansas City, MO
- Orange County Optometric Society Meeting, Irvine, CA
- Indian Health Service Biennial Eye Care Meeting, Fullerton, CA
- New Mexico Optometric Association Mid-Year Convention, Mescalero, NM
- International Vision Expo & Conference, Las Vegas, NV
- Kaiser Permanente Regional Orthoptics Meeting, Glendale, CA
- American Academy of Optometry Meeting, Anaheim, CA

2009

- Annual UCLA Jules Stein Eye Institute & Southern California College of Optometry Symposium, Fullerton, CA
- Sixth International Conference of Optometry, University of Minho, Braga, Portugal
- Internationale Vereinigung für Binokulare Vollkorrektion Meeting, Lahnstein, Germany
- New Zealand Association of Optometrists Conference 2009, Christchurch, New Zealand
- American Academy of Optometry Meeting, Orlando, FL

2010

- Spring Conference, Nebraska Optometric Association, Omaha, Nebraska
- Keynote Speaker, Southern Regional Conference 2010, The Optometrists Association Australia - Victoria, Melbourne, Australia
- Annual Congress 2010, Utah Optometric Association – Midway, Utah
- Binocular and Paediatric Vision Conference, South Africa
- American Academy of Optometry Meeting, San Francisco, CA

2011

- Optowest 2011 Conference, Indian Wells, CA
- Oklahoma Chapter Meeting, American Academy of Optometry, Oklahoma City, OK
- American Academy of Optometry 2011 Meeting, Boston, MA
- Envision New York 2011, Continuing Professional Education Program, New York, NY
- 2011 Convention, Alabama Optometric Association, Birmingham, Alabama
- Schnurmacher Institute for Vision Research (SIVR): The SIVR Colloquium Series & the SIVR Clinical Research Series, SUNY College of Optometry, New York, NY

2012

- British Columbia Association of Optometrists Annual Conference, Vancouver, Canada
- 2012 Behavioral Scholar in Residence, New England College of Optometry, Boston, MA
- Comprehensive Ophthalmology Pearls XV, The Vanderbilt Eye Institute, Vanderbilt University, Nashville, TN
- CPRO 2012 Meeting. Journées Optométriques, Le Centre de Perfectionnement et de Référence en Optométrie, Montreal, Canada
- Indian Health Service Biennial Meeting, Southern California College of Optometry, Fullerton CA
- Essentials in Eye Care Meeting, Pennsylvania Optometric Association, Lancaster, PA
- American Academy of Optometry Meeting, Phoenix, Arizona
- Essentials in Optometry. Illinois College of Optometry Fall 2012 CE Program, Chicago, IL
- Monterey Symposium 2012, California Optometric Association, Monterey, CA

2013

- Gold Coast Educational Retreat, Broward County Optometric Society, Ft. Lauderdale, FL
- Centro de Especialización Optométrica Seminar, Pamplona, Spain

- Keynote lecture at the XIV Biennial Meeting of the Child Vision Research Society, Hospital for Sick Children in Toronto & the University of Waterloo School of Optometry, Waterloo, Canada
- 2013 Optometry's Meeting, San Diego, CA
- Colorado Vision Summit 2013, Denver, CO
- New Mexico Optometric Association Mid-Year Convention Education Program, Taos, NM
- Optical Society of America Fall Vision Meeting, Houston, TX
- American Academy of Optometry Meeting, Seattle, WA

2014

- OPTOM 2014: 23rd International Congress of Optometry, Contact Lenses and Ophthalmic Optics, Madrid, Spain
- Indian Health Service Biennial Eye Care Meeting, Fullerton CA
- American Optometric Association, Optometry's Meeting 2014, Philadelphia, PA
- AAO/AOA Summer Invitational Research Institute, Columbus, OH
- Convergence Insufficiency Treatment Trial - Reading & Attention Trial: Full Investigator Training & Certification Meeting, Columbus, Ohio
- UAB School of Optometry's Alumni Weekend Continuing Education Program, Birmingham, AL
- Interactive International Web Symposium: Continuing medical education course: Case Western Reserve University School of Medicine & American Academy of Pediatric Ophthalmology & Strabismus; with Wallace D, Crouch E, Lee K, Holmes JM, Repka MX
- CAPA's 38th Annual Conference, California Academy of Physician Assistants, Palm Springs, CA
- American Academy of Optometry Meeting, Denver, CO
- Visiting Professor, Zhongshan Ophthalmic Center, Sun Yat-Sen University, Guangzhou, China

2015

- 54th Annual Contact Lens & Primary Care Congress, Kansas City, MO
- 2015 Annual Symposium of the Ontario Association of Optometrists, Toronto, Canada
- 113th Spring Education Conference, Kentucky Optometric Association, Louisville, KY
- California Head Start Association (CHSA) 2015 Health Institute Meeting, Los Angeles, CA
- First Meeting of the Institute of Medicine's Committee on Public Health Approaches to Reduce Vision Impairment and Promote Eye Health, Washington, DC. Presentation: Prevalence & Current Trends in Vision Impairment and Eye Health Across the Lifespan: Epidemiology of Vision Loss and Eye Health in Pediatric Populations
- 118th Annual AOA Congress: Optometry's Meeting, Seattle, WA
- 34th Biennial Canadian Association of Optometrists Congress, Fredericton, New Brunswick, Canada
- American Academy of Optometry Meeting, New Orleans, LA, October 2015, including:
  - Amblyopia and Beyond: Current Evidence-Based Pediatric Eye Care. Inaugural Joint American Academy of Ophthalmology & American Academy of Optometry Symposium
- Missouri Optometric Association Conference, Kansas City, MO, Oct 2015
- USC Eye Institute, Keck Medicine of USC & Marshall B Ketchum University, Joint Educational Program – Clinical Pearls You Shouldn't Practice Without Program, Fullerton, CA
- DAVALOR *Research Center* (DRC), Universitat Politècnica de Catalunya, Terrassa, Spain
- California Optometric Association, Monterey Symposium 2015, Monterey, CA
- American Academy of Ophthalmology Annual Meeting November 2015, Las Vegas, NV
  - Amblyopia and Beyond: Current Evidence-Based Pediatric Eye Care. Inaugural Joint American Academy of Ophthalmology and Academy of Optometry Symposium

2016

- UCLA Stein Eye Institute/Doheny Eye Institute & SCCO at Marshall B. Ketchum University Annual Symposium: Advances in Eye Care, Fullerton, Jan 2016
- Rhode Island Optometric Association, Nose to the Grindstone CE Weekend, March 2016

- 2016 Annual Meeting of the College of Optometrists in Visions Development, St. Louis, MO, April 2016
- Pediatric Optometric Care Conference, The Ophthalmology Department of Children's Mercy Kansas City, Kansas City, MO, May 2016
- Indian Health Service Biennial Eye Care Meeting, Fullerton CA, June 2016

ACADEMIC TEACHING

New England College of Optometry

Center for the International Advancement of Optometry and the Institut Et Centre D'optométrie, Bures-Sur-Yvette, France. 20-hour course titled Strabismus & Amblyopia: Diagnostic Evaluation, 1997

Southern California College of Optometry

Strabismus/Amblyopia Diagnosis (CLS 727), Instructor of record; 1997 – present (97-08 with M. Rouse)
Strabismus/Amblyopia Management (CLS 737), instructor of record 1997 – present (97-08 with M. Rouse)
Clinical Seminars (CLE 809) – lecturer, 1997 – present
Pediatric Optometry – 4 hours on Management of Refractive Error in Childhood, 2010
Management of Non-Strabismic Binocular Vision Conditions (CLS 6371), Laboratory instructor, 2012 - present

Illinois College of Optometry

Clinical Techniques Laboratory (CLE 262.3), instructor, 1984–1985
Strabismus/Amblyopia Diagnosis (CLE 376-1) course (100%), 1984–1997
Strabismus/Amblyopia Laboratory (CLE 376-1), course coordinator & instructor, 1984–1997
Strabismus/Amblyopia Management (CLE 376-2), course (100%), 1985–1995
Developmental Vision Laboratory (CLE 378), instructor, 1986–1987
Clinical Grand Rounds (CLE 462), guest lecturer, 1993–1997
Vision & Learning Laboratory (CLE 378), instructor, 1995–1997
Treatment of Binocular Vision Disorders Laboratory (CLE 375), instructor, 1996–1997

CLINICAL TEACHING

Southern California College of Optometry

Pediatric Optometry Residency Seminar, Optometric Center of Fullerton, 1997 – present
Vision Therapy Service, Optometric Center of Fullerton, 1997 – present
Pediatric Service, Optometric Center of Fullerton, 1997 – present

Illinois College of Optometry

Primary Care Service, 1984–1989
Pediatric / Binocular Vision Service, 1984–1997
Binocular Vision & Pediatric Seminar Conference, 1989–1991, 1993
Binocular Vision & Pediatric Optometry Residency – Seminar & Record Review, 1991–1992

LICENSURE

- National Board of Examiners 1980, 1981, 1982; TMOD 1998
- California #7784 TPA Certified
- Illinois #046-007641, DPA & TPA Certified (inactive)
- Wisconsin #1931 (inactive)

Dr Sue Cotter- Management of Refractive Error in Preschool Children

When do we prescrib-e glasses in preschool children? This should be performed when the refractive error is amblyogenic, causes strabismus, or increases the risk of strabismus. The concept of emmetropization will be reviewed. Prescribing guidelines for specific categories of refractive errors and eye diseases will be detailed. The child's medical and family history influences these prescribing guidelines.

Management of Refractive Error in Preschool Children

Susan Cotter, OD, MS, FAAO
Professor
Southern California College of Optometry
Marshall B Ketchum University

This course presents current evidence in regard to refractive error norms, emmetropization, amblyogenic refractive error, and associations of hyperopic refractive error with esotropia and educational deficits. Clinical guidelines for managing refractive error in preschool children will be discussed with special emphasis on hyperopia.

1. To review recently published normative data for preschool refractive error based on age and race/ethnicity.
2. To describe what is known about the emmetropization timeline in humans.
3. To discuss what levels of hyperopia, myopia, and anisometropia are considered amblyogenic and what levels of hyperopia place a child at increased risk for esotropia.
4. To review clinical findings other than magnitude of refractive error that should be considered when managing refractive error.
5. To highlight research study results that inform decisions for prescribing for preschool refractive error.

- Reasons to Correct Refractive Error in Preschool Children
- Emmetropization in Humans – BIBs data
- Refractive Error Norms based on Age & Race/ Ethnicity (MEPEDS data)
- Amblyogenic Refractive Error
  - AAAPOS
  - AOA
  - MEPEDS data
- Risk of Esotropia in Hyperopic Children (6-72 months) (MEPEDS/BEPDS data)
- Prescribing for Myopia, Astigmatism, and Anisometropia
- Prescribing for Hyperopia
  - Magnitude of Refractive Error Compared to Norms
  - Amblyogenic or increased risk of esotropia?
  - Other Factors for Consideration
    - Signs & symptoms
    - Academic performance (VIP-HIP data)
    - Visual acuity
    - Phoria direction & magnitude
    - Compensating vergence ability
    - AC/A ratio
    - Accommodation -demand, amplitude, accuracy (dynamic retinoscopy)
    - Potential behavioral & performance effects at near if not corrected
    - Probable follow up
- Case Discussion

Title with a tag

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Your subtitle here

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Joey 3 Years

- Treated for eye infection – Doc recommended eye exam since never had one
- 1 week later: RTO for eye exam; no parental concerns
- VA: UTT (poor cooperation); + F&F
- Cover test: Ortho – no ET (reliable)
- Lang Stereo: 3/3 (550 sec)

- Dry Retinoscopy
  - OD: +1.50
  - OS: +2.00
- Cycloplegic Retinoscopy
  - OD: +4.50 DS
  - OS: +5.00 DS

Determine Refractive Error

Autorefraction?

Eye Health Evaluation

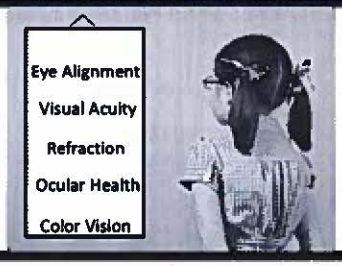
- Pupils
- Anterior Segment
- Posterior Segment
- IOP?

Eye Health Evaluation

Intraocular Pressure - iCare

Routine Eye Examination

- Eye Alignment
- Visual Acuity
- Refraction
- Ocular Health
- Color Vision



Other Testing? As Appropriate.....

- NPC
- Accommodative amplitude
- Accommodative Accuracy (MEM)
- BI & BO vergences
- Pursuits
- Saccades

Reward Time

Management of Refractive Error in Preschool Children

When Should You Prescribe?

And How Much Should You Prescribe?

"Consider" Prescribing When.....

- Magnitude of refractive error:
  - Amblyogenic
  - Increased risk of strabismus development
  - Outside age-norms
- Not prescribing may negatively affect:
  - Binocular vision (eye alignment or stereo) or visual acuity
  - Development
  - Behavior
  - Comfort
  - Function

Course Objectives

- Emmetropization
- Normal refractive error based on age / ethnicity
- Amblyogenic refractive error
- Relationship between refractive error & strabismus
- Factors to consider when prescribing for Preschoolers
- Prescribing "guidelines"?

Refractive Error in Preschool Children

Prescribing Considerations

- Amblyopic or strabismic?
- Type / amount of refractive error
- Refraction normal for age
- Expected to change with age?
- Potentially amblyogenic?
- Risk factor for strabismus?
- Family eye history?

Prescribing Considerations

- Signs or symptoms?
- Visual acuity
- Stereopsis
- Accommodation
- Phoria, AC/A, vergence ranges
- Academic performance
- Visual demands

Strabismus +/or Amblyopia Present

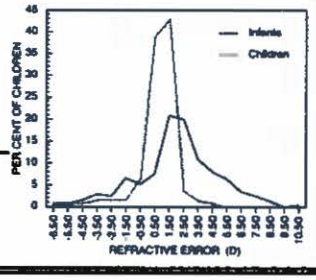
Prescribing Guidelines

Goal: provide equally clear retinal images & improve eye alignment

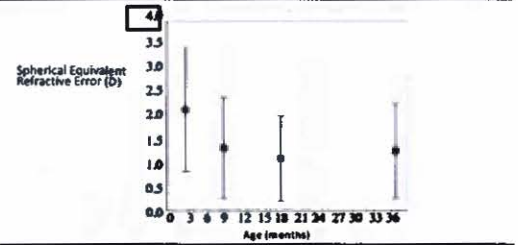
- Full anisometropia / astigmatism / myopia
- Full (or close to full) plus for ET's
- (Typically) least plus for XT's
- If reduce hyperopia, cut symmetrically

Will Refractive Error Change With Age?

Emmetropization Concept

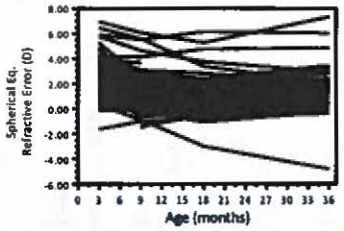


Emmetropization: Time Course



Mutti et al., OVS 2007;84:97-102; OVS, 2004;81:753-61

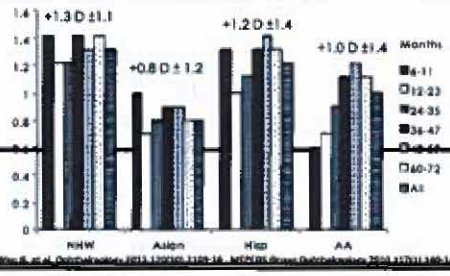
BIBS: SEQ Refractive Error by Age



Mutti, DO. To emmetropize or not to emmetropize? Optom Vis Sci 2007;84:97–102

What is "normal" refractive error for infants / young kids?

Mean SE Refractive Error (D)



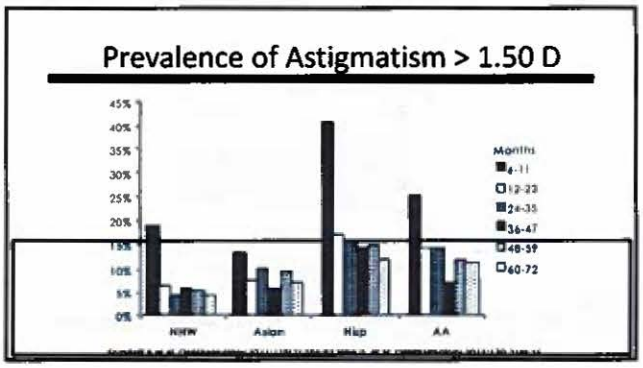
Mean Mean SE Refractive Error (D)Refractive

Race/Ethnicity 6 - 72 months (n)	Mean SE Refraction Diopters (SD)
African American (2992)	+1.0 (1.4)
Hispanic (3000)	+1.2 (1.4)
NHW* (1486)	+1.3 (1.1)
Asian* (1507)	+0.8 (1.2)

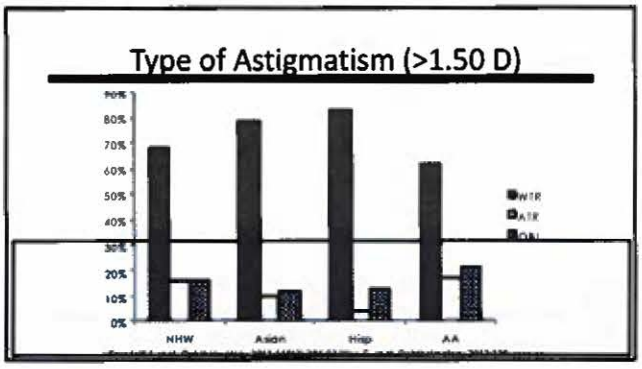
MEPEDS. Ophthalmology 2010;117(1):140-147; * Wen G. et al. Ophthalmology 2013;120(10):2109-16

Astigmatism?

Prevalence of Astigmatism > 1.50 D



Type of Astigmatism (>1.50 D)



Magnitude of Refractive Error that Places Child at Risk for Amblyopia?

Potentially Amblyogenic Refractive Error

Ametropia Type	Anisometropia (D)	Isoametropia (D)
Hyperopia	≥ 1.00*	≥ 4.00*
Myopia	≥ 3.00	≥ 6.00
Astigmatism	≥ 1.50	≥ 2.00*

Combined values from: AOA Clinical Practice Guideline on Amblyopia
Preferred Practice Pattern on Amblyopia. Am Acad Ophthalmology
Tarczy-Hornoch et al. MEPEDS/BPEDS *Ophthalmology* 2011;118(11):2262-73*

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Risk of **Bilateral** Decreased VA Associated with Hyperopia

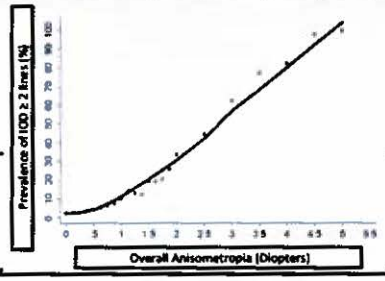
MEPEDS/BPEDS: 5704 AA, Hispanic, White Children 30-72 months

Bilateral SE Hyperopia	Odds Ratio*	95% CI
<0.0 D	1.37	0.63 – 2.99
0.0 to <+1.0 D (reference)	1.0	----------
+1.0 to <+2.0 D	0.37	0.13 – 1.02
+2.0 to <+3.0 D	1.02	0.36 – 2.85
+3.0 to <+4.0 D	1.64	0.51 – 5.24
≥+4.0 D	11.45	5.01 – 26.18

Adjusted for age, astigmatism, gestational age.
*Significant Odds Ratio's in bold. Level of hyperopia defined by least hyperopic eye.

Tarczy-Hornoch et al. MEPEDS/BPEDS *Ophthalmology* 2011;118(11):2262-73

Prevalence of Amblyopia (%)



Magnitude Hyperopia That Places Preschool Child at Risk for Strabismus?

Risk of Esotropia Associated with Bilateral Hyperopia

MEPEDS/BPEDS: 9970 Children 6-72 months

Bilateral SE Hyperopia	Odds Ratio*	95% CI
0.0 to <+1.00 D	reference	------
<0.00 (myopia)	2.48	0.89 – 6.91
+1.00 to <+2.00 D	1.81	0.71 – 4.62
+2.00 to <+3.00 D	6.38	2.56 – 15.93
+3.00 to <+4.00 D	23.06	9.65 – 55.61
+4.00 to <+5.00 D	59.81	23.61 – 151.52
≥ +5.00 D	122.24	49.86 – 299.70

† Multivariate stepwise logistic regression model; adjusted for age, ..., maternal smoking, gestational age. *Significant Odds Ratio's (OR) in bold. * Level of hyperopia defined by less hyperopic eye

Cotter et al. Ophthalmology 2011;118(11):2251+

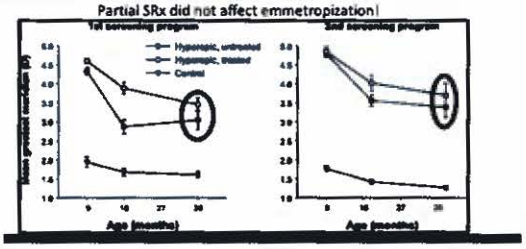
Will Correcting Hyperopia Prevent Strabismus?

Spectacle correction versus no spectacles for prevention of strabismus in hyperopic children (Review)

THE COCHRANE COLLABORATION®

Adverse Effect on Emmetropization if Correct Hyperopia at an Early Age?

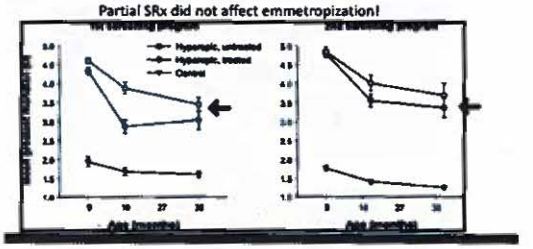
Partial SRx did not affect emmetropization!



Atkinson et al. Optom Vis Sci. 2007;84(2):84-86.

Emmetropization Effected if Correct Hyperopia at Early Age?

Partial SRx did not affect emmetropization!



Atkinson et al. Optom Vis Sci. 2007;84(2):84-86.

Bottom Line?

- We KNOW that moderate hyperopia (as low as +2.00D) is associated with ET
- We do NOT know if Rxing for moderate hyperopia reduces the incidence of ET
- NO good evidence in humans that prescribing for moderate hyperopia adversely affects emmetropization

Hyperopia in Preschool Children

Prescribing Considerations

- Family eye history?
- Signs or symptoms?
- Visual Acuity
- Stereopsis
- Accommodation
- Phoria, AC/A ratio, vergences
- Academic performance
- Probable follow-up

Prescribing for Hyperopia: Other Considerations

- History — No ET or amblyopia
  - Signs & symptoms, academic performance
  - Family history, patient ocular/medical hx, meds
- Visual acuity
- Accommodation
- Stereopsis at near
- Phoria direction & magnitude, AC/A ratio, compensating vergence
- Potential behavioral & performance effects
- Probable follow up

Symptoms / Signs

Symptoms / Signs

History

- Symptoms / signs
- Medical history (e.g., CP or Down syndrome)
  - Poor accommodation – Down syndrome
- Medication
- Family history (hyperopia, aniso, strab, ambly)
- Previous SRx & compliance
- Academic performance

Decreased Visual Acuity or Stereoacuity?

Normal Presenting Monocular VA

Age	Threshold Visual Acuity (Snellen equivalent)	% Children with Worse VA
2.5 years	20/63 or better	4.2%
3 years	20/50 or better	2.9%
4 years	20/40 better	1.1%
5 years	20/32 or better	0.5%

Pan et al. MEPEDS. Optom Vis Sci 2009;86(6):607-12.

Other Pertinent Clinical Findings for Hyperopic Children?

How About Accommodation?

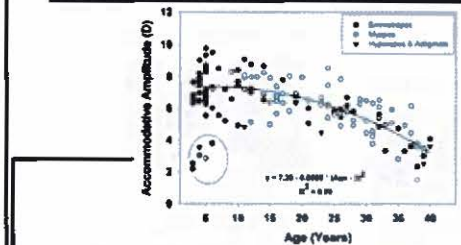
- Demand
- Amplitude
- Accuracy (dynamic retinoscopy)

Accommodation in Young Children

- Normal accommodative abilities
  - Southall (1937); 4000 children
  - Mean amplitude = 14 D for 8-year-old (range 12-16 D)
- So why would kids with 4 or 5D of hyperopia not accommodate well?

It's not the accommodation...
...it's getting the accommodation without getting the convergence

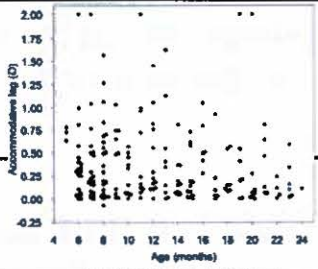
Accommodative Amplitude as Function of Age



Anderson et al. *Invest Ophthalmol Vis Sci.* 2008;49:2919–2926

Accommodative Accuracy: MEM

Accommodative Lag & Age: 5-24 months



Other Clinical Findings

- Phoria direction & magnitude, compensating vergence
- AC/A ratio
- Stereopsis

VIP-HIP Study

- Uncorrected 4-& 5-yr olds with ≥ +3.00 to ≤ +6.00 D & no strabismus / amblyopia vs. emmetropes?
- Statistically significant difference in:
  - Visual acuity (distance & near)
  - Stereoacuity
  - Accommodative response (accuracy)

Ciner et al. ARVO May 2015

Academic Performance / School Readiness?

- Potential behavioral effects on performance at near if not corrected
- Academic performance

Hyperopia & Academics

- Uncorrected 4-& 5-yr olds with +3.00 to +6.00 D & no strabismus / amblyopia vs. emmetropes
- Statistically significant difference in:
  - Test of Preschool Early Literacy (TOPEL)

Kulp et al. VIP-HIP ARVO Meeting May 2015

Effect of Spectacle Correction on Preschoolers' Cognitive Abilities

- 3-5 yrs low income
- Previously uncorrected (n=35)
  - Bilateral hyperopia of ≥ +4.00D
  - Astigmatism ≥2D if 3yrs, ≥1.50 if 4-5 yrs
- Emmetropia (n=35)
  - Bilateral hyperopia <2D; <1D cyl OU
- VMI & WPPSI-R
  - Baseline
  - 6 wks post-SRx (full cyl; cut hyperopia 1.50-2.00D)

Roch-Levecq et al. Archives of Ophthalmology 2008;126;252-8

Effect of Spectacle Correction on Preschoolers' Cognitive Abilities

- **Baseline**: Significantly reduced in hyperopes (vs. emmetropes)
  - VMI
  - Most WPPSI-R subtests requiring H-E coordination
  - Comparable to children with nutritional deficiencies, high blood lead concentration, LBW, prematurity
- **Post-spectacle wear:**
  - VMI scores improved = to emmetropic controls
  - WPPSI-R also improved but not stat significant

Roch-Levecq et al. Archives of Ophthalmology 2008;126;252-8

Goals of Refractive Correction?

- Improve visual acuity
- Prevent amblyopia and/or strabismus
- Treat amblyopia or strabismus
- Improve binocular function
- Eye alignment
- Stereopsis
- Manage accommodative or vergence demands
- Reduce signs and symptoms

Prescribing Guidelines

- Strabismic or amblyopic?

If not:

- Normal for age?
- Is it amblyogenic?
- Risk of strabismus?
- Other clinical findings.....?

Prescribing Guidelines Strabismus +/or Amblyopia

- Tend toward full SRx of:
  - Myopia
  - Astigmatism
  - Anisometropia
  - Hyperopia – full plus only for esotropia ≈ ≤6 years
- Cut hyperopia (symmetrically) for:
  - Anisometropic amblyopia
  - Exotropia
  - Esotropic patients who will have distance blur

Guidelines for Non-strabismic Children

Correcting Hyperopia in Preschool Children

Prescribing Considerations

- Amblyopic or strabismic?
- Type / amount of refractive error
- Refraction normal for age
- Expected to change with age?
- Potentially amblyogenic?
- Risk factor for strabismus?
- Family eye history?

Prescribing Considerations

- Signs or symptoms?
- Visual acuity
- Stereopsis
- Accommodation
- Phoria, AC/A, vergence ranges
- Academic performance
- Visual demands

Hyperopia: Amount to Prescribe When No Esotropia Present

- Cut plus symmetrically
- Leave uncorrected by amount you consider negligible / normal for child's age

4.5-Year-Old Child

- Dr. Cotter, I had a 4.5 yr old Hispanic female
- VA sc 20/30+ OD, OS
- Unremarkable health
- Ret: OD: +1.25 -0.75 x 180 20/30+
  OS: +1.25 -0.75 x 180 20/30+
- Should I prescribe lenses for her or repeat refraction in 6 months or ....?

Should I Prescribe?

OD: +1.25 -0.75 x 180
OS: +1.25 -0.75 x 180
VA: 20/30 OD/OS

- Amblyogenic?
- Increased risk of ET?
- Other clinical findings?
- Symptoms?

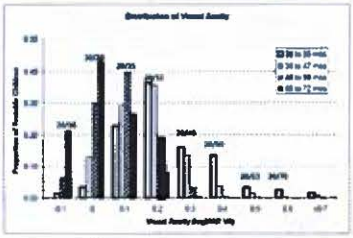
Hispanic Months of Age	Spherical Equivalent Mean Diopters (SD)	
	Right Eye	Left Eye
6 to 11	1.3 (1.4)	1.3 (1.5)
12 to 23	1.0 (1.5)	1.3 (1.5)
24 to 35	1.3 (1.4)	1.3 (1.5)
36 to 47	1.3 (1.4)	1.4 (1.4)
48 to 59	1.4 (1.3)	1.4 (1.4)
60 to 72	1.3 (1.2)	1.4 (1.3)
Total (3000)	1.2 (1.4)	1.3 (1.4)

Should I Prescribe?

- First eye exam; no complaints
- VA sc 20/30+ OD/OS (D/N)
- Eye health unremarkable
- Dry Ret: OD: PL -0.50 x 180
  OS: -0.25 -0.25 x 180
- Cyclo Ret: OD: +4.00 -1.00 x 180
  OS: +3.50 -0.75 x 180

Should you prescribe?
IF "Yes", how much do you prescribe?

Defining Normal Visual Acuity
Distribution of logMAR VA by Age



Pan et al, MEPEDS, Optometry and Vision Science 2009;86(6):707-715

Mean Refractive Error: MEPEDS

OD: +4.00 -1.00 x180

OS: +3.50 -0.75 x180

Hispanic Age Months	Spherical Equivalent Mean Diopters	
	Right Eye	Left Eye
6 to 11	1.3 (1.4)	1.3 (1.5)
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Total (3000)	1.2 (1.4)	1.3 (1.4)

Is the Hyperopia Potentially Amblyogenic?

Hyperopia	CPG*	PPP**	MEPEDS Data
Isoametropia	≥5.00 D	≥4.50 – 6.00 D	≥4.00 D

*AOA Clinical Practice Guideline on Amblyopia
**AAOphthalmology Preferred Practice Pattern: age dependent, lower value at ≥ 2 years

Consensus opinion & not address if age dependent

Increased Risk for ET?

OD: +4.00 -1.00 x 180

OS: +3.50 -0.75 x 180

Other Considerations

- OD: +4.00 -1.00 x 180 20/30+
- OS: +3.50 -0.75 x 180 20/30+

- History including medical & family eye?
- Signs or symptoms?
- Other clinical examination findings?
  - VA and stereopsis
  - phoria direction & magnitude; compensating vergence
  - AC/A, accommodative amplitude & lag
- Academic performance?
- Probable follow-up

3-year-old Max

- Sibling of patient in for examination
- No concerns; mom notes that sits close to TV
- DVA unaided 20/50 OD/OS (Lea symbols)
- Cover testing: Dist OP; near 6Δ XP
- MEM: +3.00 D OD/OS

Dry Retinoscopy	Cycloplegic Ret
RE +1.50 DS	+6.00 -3.00 x 180
LE +2.50 DS	+7.00 -3.00 x 180

Diane 6.5 yrs: Grade 1

- Visual acuity: 20/25, 20/25
- Cycloplegic
  - +3.75 -0.50 x 180
  - +4.00 -0.50 x 180
- Eye Health: WNL
- Management?

Diane 6.5 yrs: Grade 1

✓Difficulty completing assignments in class
✓Short attention span when reading/copying
- Reversals
- Visual acuity (distance): 20/25, 20/25
- Eye alignment: orthop (D) & 4Δ XP (N)
- Stereopsis: 30"
- Cycloplegic
  - +3.75 -0.50 x 180
  - +4.00 -0.50 x 180

Management???

4-year-old boy

- Failed vision screen at pediatrician's office (Toronto)
- Uncorrected VA: OD: 20/100 OS: 20/100
- Cycloplegic refraction:
  - OD: +6.00 -4.00 x 020 (20/60)
  - OS: +6.00 -4.00 x 165 (20/60)
- No evidence of esotropia
- Mum reports no eye or head turn
- Ocular health exam within normal limits

Amblyogenic Isoametropia

Refractive Error	CPG*	PPP**
Astigmatism	>2.50 D	≥2.00 – 3.00 D
Hyperopia	>5.00 D	≥4.50 – 6.00 D
Myopia	>8.00 D	≥3.00 – 5.00 D

*AOA Clinical Practice Guideline on Amblyopia; *not address age*
**Preferred Practice Pattern on Amblyopia. AmAcadOphthalmology

Consensus opinion only; PPP lower magnitude ≥2 years

Questions?

Thank You!

scotter@ketchum.edu

Determine Refractive Error

How Often Are Spectacles Prescribed for "Normal" Preschool Children?

Study: Not all kids with glasses need them

Many will outgrow mild farsightedness

By Liz Szabo
USA TODAY

A study released today finds that up to 25% of children with normal eyes who have comprehensive vision exams may be prescribed glasses they don't need.

... the Journal of the American Association of Pediatric Ophthalmology and ...

... tometrists and ophthalmologists who usually treat adults may not have as much expertise with children. Many youngsters are slightly farsighted, he says, although most will grow out of the condition without glasses.

Though many doctors recommend that preschoolers should be screened for vision problems, experts disagree about the best approach. Kentucky requires that youngsters undergo comprehensive eye exams before beginning school.

35%(OD) vs. 6%(MD)*
For kids without amblyogenic factors or pathology
*Peds OMD>2%

Donahue S. How Often Are Spectacles Prescribed to "Normal" Preschool Children? J AAPOS 2004;8:224-229

AAOphthalmology Preferred Practice Pattern on Rxing

TABLE 3 [illegible]

[illegible]	[illegible]	[illegible]	[illegible]
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http://www.aao.org/education/library/ppp/