ORTHOPTIC ASSOCIATION of AUSTRALIA inc

Australian Orthoptic Journal

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2008 Volume 40 (1)

AUSTRALIAN ORTHOPTIC JOURNAL – 2008 VOLUME 40, NUMBER 1

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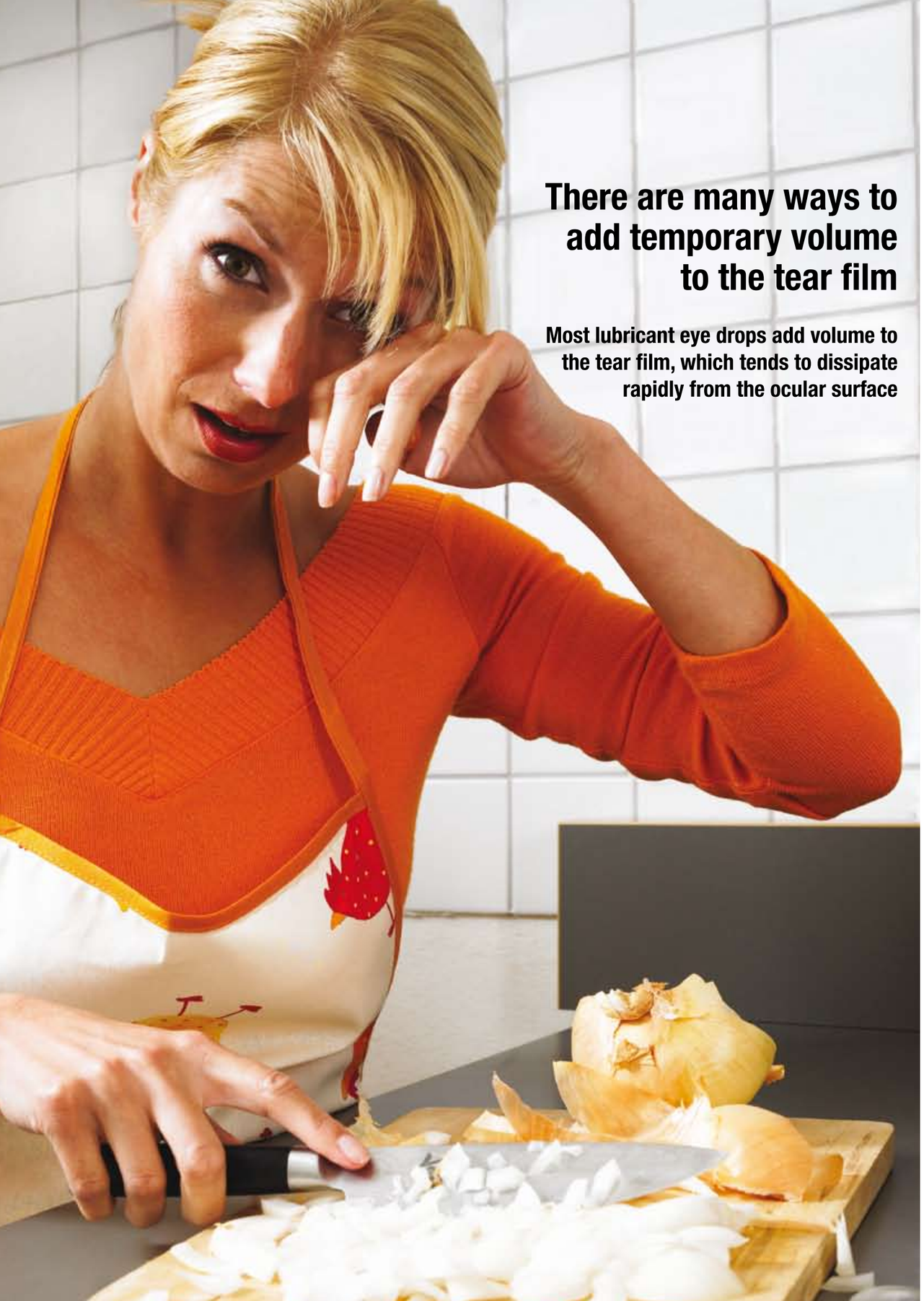

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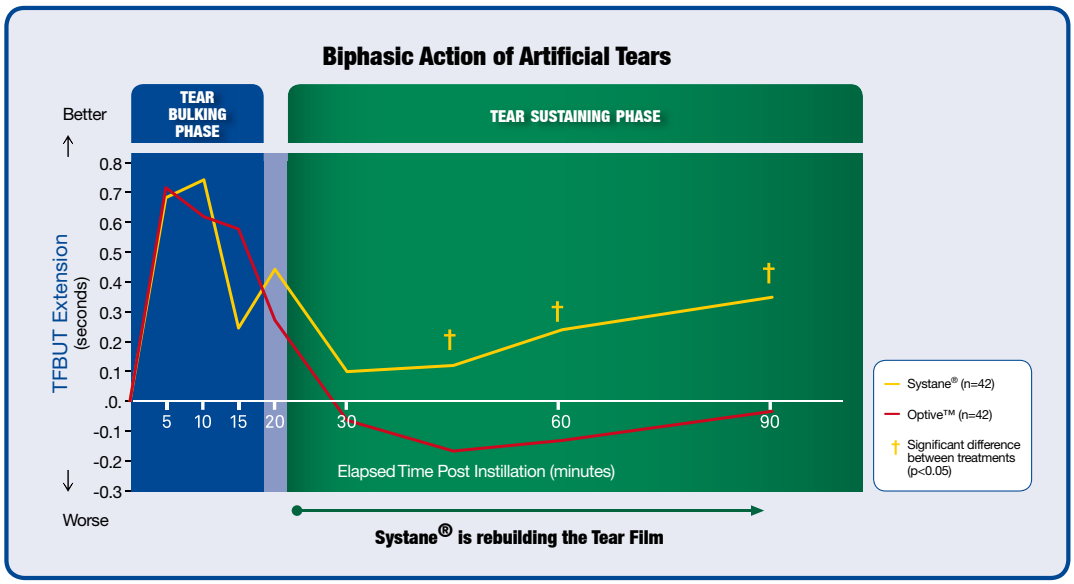

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Australian
Orthoptic Journal
2008 Volume 40 (1)

The official journal of the Orthoptic Association of Australia Inc
ISSN 0814-0936

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Published by the Orthoptic Association of Australia Inc. (Publication date: Aug 2008).

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It is a condition of acceptance of any article for the Australian Orthoptic Journal that original material is submitted. The cover letter must accompany the submission and state that the manuscript has not been published or submitted for consideration for publication elsewhere.

The types of manuscripts accepted are as follows:

- **Editorials (by invitation)**
- **Original Scientific Research Papers**
- **Reviews/Perspectives**
- **Case Studies**
- **Letters to the Editor**
- **Book Reviews**

MANUSCRIPT SUMBMISSION

Submitted manuscripts must include a title page, abstract (including keywords), the paper itself, any acknowledgements, references and tables and/or figures. Each of these sections should begin on a separate page. Pages should be sequentially numbered. The manuscript submission should be electronic, via email to: AOJ@orthoptics.org.au

Title Page: The title page should include the title of the manuscript and each author's name, academic qualifications and institutional affiliation(s). A 'corresponding author' should be designated and their address, telephone number, fax number, and email address listed. The title page should also include the word count for the abstract and text.

Abstract and Keywords: The abstract should not exceed 250 words. It should be a clear and succinct summary of the paper presented and need not be structured into subsections. However, where appropriate, it should relate to the format of the paper, including aim, methods, results and conclusion. Beneath the abstract, include up to 5 keywords or terms suitable for use in an index or search engine.

Text: Manuscripts should not exceed 3000 words. Where appropriate the structure of the text should be as follows: Introduction, Method, Results, Discussion and Conclusion. Authors should also use subheadings for Case Studies, generally as follows: Introduction, Case Report and Discussion (Conclusion is optional). Case Studies should not exceed 1500 words.

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When there are 5 or more authors, only the first three should be listed followed by et al. References to journal articles should conform to abbreviations in Index Medicus. Examples of reference styles are as follows:

Article: Cornell E, Flanagan J, Heard R. Evaluation of compensatory torsion by blind spot mapping. Aust Orthopt J 1996; 32: 13-17.

Book: Kline LB, Bajandas FJ. Neuro-ophthalmology: Review Manual. 5th Ed. Thorofare, NJ: Slack Inc, 2004.

Book Chapter: Murphee AL, Christensen LE. Retinoblastoma and malignant tumors. In: Wright KW, Spiegel PH, editors. Pediatric Ophthalmology and Strabismus. 2nd Ed. New York: Springer, 2003: 584-589.

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THE REVIEW PROCESS

Manuscripts are reviewed by two referees. The referees are masked to the authors and vice versa. Authors will be notified of the decision once the reviews have been received. Where revisions are required, the author must re-submit within twelve weeks or an agreed timeframe. Revised papers received late will be treated as new submissions.

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Australian
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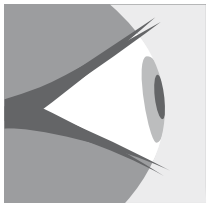
2008 Volume 40 (1)



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CONTENTS

Editorial

Life Begins in the 40's – A Ruby Tribute to this Australian Orthoptic Icon

Whilst not our journal's 40th year, we refer to this Volume 40 as our 'ruby volume' and celebrate the success of the Australian Orthoptic Journal. Opportunities like this are perfect to reflect back on the past, indeed even the beginning, so that we can map our history and see how far we have come.

In the early 1940s Miss Diana Mann and Miss Emmie Russell planned the formation of the Orthoptic Association of Australia, which was inaugurated in 1943. So began the organised effort to develop and promote the profession and the formal exchange of ideas and scientific endeavour at the Annual Scientific Meeting, which was first held in Melbourne from 11-12 October 1944. This was held at the Royal Australasian College of Surgeons, but the first session was held at the Royal Victorian Eye and Ear Hospital where "members undertook to test and initiate treatment on certain cases of squint presented to them"; that is, orthoptists had commenced 'live patients' sessions.

What was considered the first volume (but actually referred to as 'Journal No.1') of the 'Transactions of the Annual Scientific Meeting of the Orthoptic Association of Australia' was first published in 1959, in what seems to be the standard journal size of that time (25.5cm X 20cm, only slightly larger than our old baby blue coloured issues that we remember well). However, the Transactions of each Annual Scientific Meeting, which were simply duplicated typed manuscripts (typed on 34cm X 21cm pages), were available to participants since the very first meeting in 1944. Then, in 1958, the Editor Miss Diana Mann "initiated a new policy" – to "quickly circulate" the Transactions "among those members, and others interested, who were unable to attend". She continues:

> "As the correction by the speakers of errors in the typescript of papers and discussions has invariably resulted in 6 months delay in publication, the Editor[referring to herself] has taken it upon herself to submit only her version of events. She has changed the order of the papers, to bring those on a common subject together. Moreover, in the interests of economy, she has abbreviated papers, rearranged tables, and condensed discussions. She offers sincere apologies to anyone whose ideas or statements she may have misrepresented in doing so."[1]

It would appear that Miss Diana Mann was the first to fully embrace the role of Editor for the 1958 Transactions, which was the immediate precursor to the aforementioned first volume of 1959, and indeed that 1958 issue resembled a journal format with a table of contents included.

The publication of the journal-style Transactions continued until 1966 when the 8th volume and the first entitled the "Australian Orthoptic Journal" was published. Miss Barbara Lewin and Miss Ann Metcalfe were listed as the Honorary Co-Editors of that issue. To preserve history, Miss Jane Russell collected, indexed and photocopied the earlier transactions into two volumes. Three sets were bound and given to the Association's NSW Branch, the library of the Paramedical College and to Miss Patricia Lance's father, Dr Arnold Lance.

In "Volume 10" of the Australian Orthoptic Journal (1969-70), the first editorial committee was put together as "Sub-Editors" to assist the Editor, Miss Neryla Heard (who we are indebted to, since Neryla (now Jolly) has had one of the longest associations with the Journal). One of this editorial committee's first tasks was to develop guidelines for authors wishing to publish in the Journal. This was the consequence of discussions with Dr G. Serpell at a meeting in 1969, who "spoke on the art of editing" and clearly inspired the Association to move the Journal to a new phase.

The longevity and growth of the Australian Orthoptic Journal is a testament to the Editors of the past for their commitment and dedication to disseminating the science of our discipline and maintaining a record of our history. Whilst within each Journal since that first publication we have kept a log of our Association's office bearers and prize winners, we have not so included a page to honour our past Editors. This year, in our ruby volume, we document the editorial history of the Journal to acknowledge these people for their effort and contribution to this essential part of our profession's function. These individuals who have volunteered countless hours are listed here:

Vol 8	1966	Barbara Lewin & Ann Metcalfe
Vol 9	1969	Barbara Dennison & Neryla Heard
Vol 10	1970	Neryla Heard
Vol 11	1971	Neryla Heard & Helen Hawkeswood
Vol 12	1972	Helen Hawkeswood
Vol 13	1973-74	Diana Craig
Vol 14	1975	Diana Craig

Vol 15	1977	Diana Craig
Vol 16	1978	Diana Craig
Vol 17	1979-80	Diana Craig
Vol 18	1980-81	Diana Craig
Vol 19	1982	Diana Craig
Vol 20	1983	Margaret Doyle
Vol 21	1984	Margaret Doyle
Vol 22	1985	Margaret Doyle
Vol 23	1986	Elaine Cornell
Vol 24	1987	Elaine Cornell
Vol 25	1989	Elaine Cornell
Vol 26	1990	Elanie Cornell
Vol 27	1991	Julia Kelly
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Vol 29	1993	Julia Kelly
Vol 30	1994	Alison Pitt
Vol 31	1995	Julie Green
Vol 32	1996	Julie Green
Vol 33	1997-98	Julie Green
Vol 34	1999	Julie Green
Vol 35	2000	Neryla Jolly & Nathan Moss
Vol 36	2001-02	Neryla Jolly & Kathryn Thompson
Vol 37	2003	Neryla Jolly & Kathryn Thompson
Vol 38	2004-05	Neryla Jolly & Kathryn Thompson

However, it would be remiss to not also acknowledge the contribution of those who have published their work in the Journal, with over 400 papers having been published in the last four decades. Without the orthoptic community supporting the Journal by submitting their work, the Journal is not able to survive. In researching the history of the Australian Orthoptic Journal, it was a poignant discovery that in 1976 the Journal was not issued, since there were too few papers for publication. This similarly occurred in 1988 and 2006. Each volume that is published tells a story by mapping events and providing insight into the ideas, vision and indeed challenges of a particular point in time. A missing issue is a gap in the story. As we move into the second year of our role as Editors, we do so conscious of the importance of maintaining the Journal and rallying the support of our colleagues in order to make it happen.

This should not be difficult, however, for the orthoptic discipline in Australia is strong academically, innovative from a clinical standpoint and demonstrates leadership in terms of our professionalism. As usual, we represented well on the international stage at the recent International Orthoptic Congress in Antwerp; the official stats revealing that we were the country with the 5th highest number of presentations and posters and 6th highest number of attendees. Not a bad effort given our distance from Europe and being a relatively small profession in size. So why shouldn't we be able to produce a journal?

Whilst we glance back at our Journal's history, we should also take the time to look forward. In his Patron's Address of 1977, Dr Bill Gillies noted "Although it is fascinating to look back at how far orthoptics has come, it is far more important to look at the way ahead to see where you are going and how you may more effectively get there…."[2] Our sights should be on the continued development of our profession, so that we can continue to provide exemplary patient care, and do this through sharing our clinical experiences, exchanging our ideas and knowledge, and challenging the perceived limits of our current scope. We hope this Journal is utilised by you as one platform to achieve this. Here's to the next 400 or so papers that we anticipate the Australian Orthoptic Journal will one day clock up.

Connie Koklanis & Zoran Georgievski

La Trobe University

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Eye Movements in Vesibular Function and Dysfunction: A Brief Review

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Ian Curthoys, PhD[2]

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ABSTRACT

It is well known that there is a very close relationship between the vestibular system of the inner ear and eye movements, however symptomatic outcomes of this relationship are not common in general eye clinics. Stimulation of the semicircular canals by rotation or caloric testing results in vestibular nystagmus and this can be used clinically to assist in the diagnosis of peripheral and organ vestibular disorders. Testing of otolith dysfunction, however, has been less straightforward. It has recently been shown that eye movements can be elicited by otolithic stimuli, delivered either as air or bone conducted sound. These eye movements are small, but reliable, and can assist in the diagnosis of vestibular disease or dysfunction.

Keywords: eye movements, otolith dysfunction, bone conducted sound

INTRODUCTION

The function of vestibular eye movements is to maintain a steady image on the retina despite both angular (rotational) and linear translations of the head[1,2]. These functions are controlled by the short neural pathways from the vestibular system of the inner ear via the brainstem to the extraocular muscles, with close relationships with the cerebellum and other neural areas that control ocular motility.

The peripheral sensory organs for vestibular eye movements are the two membranous labyrinths that lie within the temporal bone of each inner ear. A labyrinth with its neural innervation is shown schematically in Figure 1[3]. Each labyrinth contains three semicircular canals that are more or less orthogonal with respect to each other and sense head rotation; and the maculae of the utricle and saccule (the otoliths) that sense linear motion and static changes in gravitational forces. The labyrinth also contains the cochlea, the primary auditory sensory organ. This short, fast[3] neuronal arc underlies the fast vestibulo-ocular response.[2]

The sensory receptors for rotational acceleration, the cristae, are located at the base of each semicircular canal in an enlarged area, the ampulla. Each ampulla consists of a gelatinous sail like structure (the cupula) in which are embedded in the crista's hair cells. The cupula bends in response to movement of the endolymphatic fluid within the semicircular canals, which in turn exerts force on the cilia of hair cells. These hair cells contain many small processes (stereocilia) and one larger kinocilium. Bending of the cilia towards the kinocilium causes the cell to depolarise, increasing the firing rate of the afferent fibre, whereas bending of the cilia away from the kinocilium causes hyperpolarisation resulting in a decreased firing rate.

The maculae of the otoliths, the sensory receptors for linear acceleration and static changes in gravity with respect to the head, are located in two vestibular sacs, the utricle and saccule. Each macula consists of a gelatinous mass (the otolithic membrane), on the upper surface of which are embedded crystals of calcium carbonate (otoconia) and the cilia of hair cell receptors (stereocilia and a kinocilium) that project into the under surface of the otolithic membrane. When the head is in the upright position, this tissue is located on the floor of the utricle and on the wall of the saccule. The utricle is therefore oriented to respond best to lateral or fore-aft tilts and side to side translations of the head, whilst the saccule responds best to up-down translations of the head[1]. Motion or changes in gravity cause shearing movements of the otoconial layer that bend the hair cells, causing polarization and hyperpolarisation in a manner similar to that in the semicircular canals.

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Afferents from the vestibular apparatus pass to Scarpa's ganglion, located within the internal auditory meatus and then as the vestibular nerve to synapse in the vestibular nuclei. Neurons in the vestibular nuclei project to the cerebellum which project back to the vestibular nuclei, controlling neural transmissions from the receptor in the periphery to the oculomotor nuclei. The organisation of this sensory-motor system is such that neurons from each canal excite and inhibit complementary muscles in each eye (See Table 1).

This tight linkage between semicircular canals and the eye muscles was clearly shown by the pioneering work of Cohen[1] and Suzuki[4] who delivered isolated stimulation of the nerve to each semicircular canal in cats and monkeys and recorded the direction of eye movements that were produced. This linkage can assist in the diagnosis of lesions of the vestibulocochlear complex (Figure 1).

Table 1. Relationship between each semicircular canal and the extraocular muscles[4].

Canal	Excites	Inhibits
Horizontal	ipsilateral medial rectus	ipsilateral lateral rectus
	contralateral lateral rectus	contralateral medial rectus
Posterior	ipsilateral superior oblique	ipsilateral inferior oblique
	contralateral inferior rectus	contralateral superior oblique
Anterior	ipsilateral superior rectus	ipsilateral eye inferior rectus
	contralateral inferior oblique	contralateral superior oblique

CHARACTERISTICS OF VESTIBULAR EYE MOVEMENTS

Vestibulo-Ocular Reflex (VOR)

The function of this reflex is to stabilise the image on the retina during rotations of the head. This reflex depends on the semicircular canals that detect head movements and initiate a rapid compensatory movement in the opposite direction with a latency of less than 16 msec. The VOR is more efficient in yaw (head rotates horizontally) and pitch (head rotates vertically) than in roll movements (ear to shoulder), as in these roll movements the image is not moved off the fovea[1]. Sustained angular rotations of the head produce vestibular

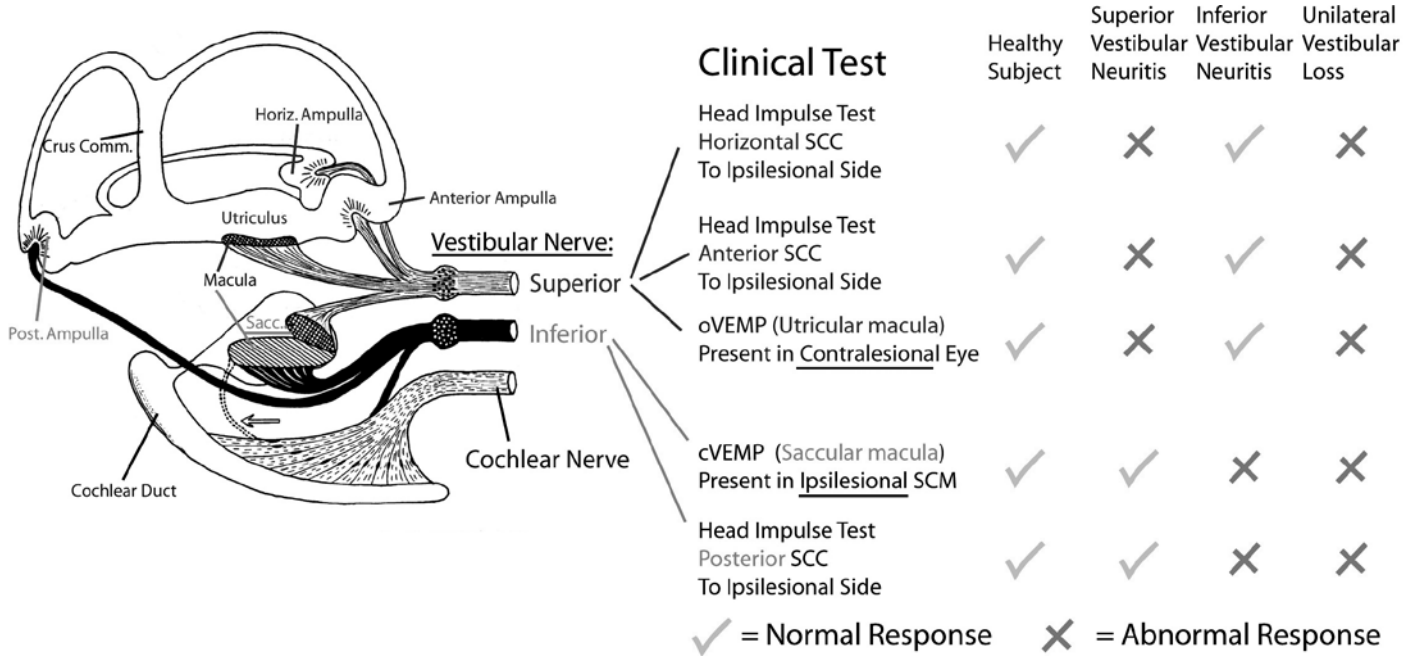

Figure 1. Clinical testing of vestibular and auditory dysfunction can provide identification of specific lesions of the vestibulocochlear complex. Eye movements stimulated by bone conducted sound (identified in this figure as "oVEMP") are absent or abnormal with lesions of the contralateral superior vestibular nerve. (Modified from de Burlet,26).

oVEMP (Vestibular Induced Muscle Potential from the (extra) ocular muscles)

cVEMP (Vestibular Induced Muscle Potential from the cervical muscles)

SCC (Semi Circular Canals)

nystagmus, with the fast phase beating to the same side as the direction of the head.

Translational movements of the head also initiate a compensatory horizontal or vertical eye movement if the object of regard is near to the subject. These movements are initiated by the otolith system (translational, or linear VOR).

Ocular Counter-Roll (OCR)

When the head makes a static tilt to the side, the eyes respond by making a small static conjugate torsional movement with the 12 o'clock meridian of the eye rotating in the opposite direction to the tilt. This reflex is otolith induced. Although this reflex may have originated to maintain a horizontal horizon in vertebrates with laterally placed eyes, in humans it only compensates for approximately 10% of the tilt[5].

Cervico-Ocular Reflex

A rotation of the torso about the vertical (Z) axis, relative to a stationary head produces very small amplitude horizontal nystagmus and a conjugate horizontal eye movement opposite to the movement of the torso. A forward inclination of the torso with respect to the head produces vertical eye movements. Ott[6] considers that a sideways tilt of the torso in the absence of utricular input does not induce eye torsion, although others[7-11] have suggested that there may be some effect of proprioception of the sterno-cleido-mastoid neck muscles on ocular counter-roll when otolith function is reduced or absent.

Skew Deviation

When animals with laterally directed eyes roll tilt the head to one side there is a compensatory movement whereby the lower eye moves up, and the higher eye moves down (skew deviation). In humans a similar response may occur following lesions of the midbrain where the eye on the same side as the head tilt moves up and the contralateral eye moves downward. There is evidence that very small skew deviations can occur on head tilt in normal subjects[12-16]

CLINICAL IMPLICATIONS

This close relationship between the vestibular system and eye movements may be used in assessing the functional status of lateral eye movements in babies (by observing the eyes as the infant is rocked or rotated) or in suspected supranuclear conditions such as Progressive Supranuclear Palsy (where eye movements may only be elicited in response to head movements) but despite the complex and close anatomical relationships between the vestibular and oculomotor systems, clinical manifestations of vestibular disturbance are not commonly recognised in orthoptic practice. However, subtle disturbances of vision that are not explicable by routine testing should be suspected as being possibly of vestibular origin, especially if there is a history of head injury or other neurological signs. A reduction of visual acuity by three lines or more with the head moving at about two to three cycles per second, as opposed to acuity when the head is steady, indicates vestibular disturbance that should be further evaluated[17], possibly by caloric testing or rotational tests that induce vestibular nystagmus.

While most clinical tests for vestibular dysfunction are based on stimulation of the semicircular canals, testing otolith function has been more difficult, especially for ill or bedridden patients. It is now becoming apparent that evaluation of small eye movements in response to otolithic stimuli can also be used to assist in the diagnosis of neurological disease. Suzuki, Tokumasu and Goto[4] showed that electrical stimulation of one utricular nerve in the cat produced eye movements that were mostly rotational (away from the side of stimulation) vertically divergent (with the ipsilateral eye moving upwards) and with small conjugate horizontal movements (towards the contralateral side).

As noted above, the otoliths respond to linear acceleration, and one form of linear acceleration is produced by bone conducted vibration. This stimulus generates many rapid changes in linear acceleration at the mastoid which is an optimal stimulus for one class of primary otolithic neurons. Physiological evidence from guinea pigs shows that irregular primary otolithic stimuli are selectively activated by such vibration, while few semicircular canal neurons are activated by this vibration at physiological levels.

It is now recognised that sound, delivered either through headphones (air conducted, or AC) or through vibration of the skull (bone conducted, or BC) in humans can evoke short latency vestibular induced extraocular muscle potentials (oVEMPs), that peak at approximately 10 ms[7,18-21]. These negative surface potentials are the pre-cursers to the actual rotation of the eye and are probably due to the barrage of neural activity to the inferior rectus and inferior oblique muscles recorded from surface electrodes usually placed beneath each eye. However, there have been fewer reports on the direct measurement of the eye movements themselves. Jombik & Bahyl[20], have recorded sound evoked responses based on electro-oculograms (EOG), although Rosengren[19] has suggested that these may represent synchronous activity of all extraocular muscles. Halmagyi[22] has commented that surface EOG recordings are likely to be "dominated by oVEMP responses and should not be interpreted as eye movements".

Studies using high precision scleral search coils have confirmed the presence of these very small, but predictable eye movements following air and bone conducted sound. Aw et al[23] used search coils to measure eye movements evoked by AC sound in normal healthy subjects. These were primarily upwards, to the side of the stimulated ear and with horizontal rotation away from the side of stimulation. Todd et al[11] also used scleral search coils to demonstrate different eye

movement responses to both AC and BC stimulation. With air conduction (using headphones) these movements were usually upwards and towards the contralateral side, while bone conducted vibrations, delivered to the mastoid process using a clinical bone conductor on the mastoid (Radioear B71), typically produced downward movement towards the ipsilateral side. Torsional rotation was away from the side of stimulation in both conditions. These responses suggest that the ipsilateral superior oblique, and its antagonist, the contralateral inferior rectus, are primarily responsible for these movements. The amplitudes of the vertical eye movements averaged +2.6 mdeg (for AC sound) with a mean latency of 16.6 ms. For bone conducted sound amplitudes ranged from +3.0 to -19.3 mdeg with a mean of -7.4 mdeg.

Our recent studies have used bone conducted vibration at 500Hz by a B71 bone stimulator on the mastoids of a ten of healthy subjects and have recorded eye movements using new very fast fire wire cameras with a high enough resolution to detect very small eye rotations. The results have confirmed that bone conducted stimulation to the mastoid generates predominantly downward eye movements.

Iwasaki et al[21,24-25] delivered bone conduced vibration to the forehead at the hairline (Fz) and recorded short latency surface potentials from beneath both eyes (oVEMPs) in nine normal, healthy subjects and in ten subjects with vestibular or hearing abnormalities. Eight of these patients had had total unilateral vestibular deafferentation (uVD) and hearing loss two or more years after excision of a vestibular schwannoma. One had bilateral vestibular loss but preserved hearing due to gentamicin vestibulotoxicity, and one had profound hearing loss from congenital Rubella but normal vestibular function. Healthy subjects showed symmetric, short latency negative (excitatory) potentials from beneath both eyes, however these potentials were absent from the eye contralateral to the unilateral vestibular deafferentation in all eight uVD subjects. They were bilaterally absent in the patient with gentamicin vestibulotoxicity but were present in the profoundly deaf patient with preserved vestibular function. These findings clearly demonstrate the vestibular origin of these induced eye movements. This has now been replicated in a further 11 UVD subjects[25]. In light of the fact that the stimuli generate linear accelerations (otolithic stimuli) these responses appear to be a new way of using eye movements to measure otolithic vestibular function.

CONCLUSION

It is now evident that eye movements in response to sound, either air or bone conducted, can be used in the diagnosis of vestibular (otolith) dysfunction, and is a growing area of research that has applications in clinical practice in neuro-ophthalmology and vision sciences.

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Vision Rehabilitation and the Development of Eccentric Viewing Training: A Historical Overview

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ABSTRACT

The concept of vision rehabilitation is a comparatively new concept given the long-standing history of medical practice and medical research. This paper provides a historical overview of vision rehabilitation, with an emphasis on the development of eccentric viewing training, from antiquity to the present day.

Keywords: vision rehabilitation; eccentric viewing training.

INTRODUCTION

Healing, caring for the ill and disabled, medical practice and medical research have an extensive history and long standing tradition. However, the concept of rehabilitation and specifically rehabilitation for the vision impaired is a comparatively new concept and has only been adopted within the past fifty years. Rehabilitation is the process whereby a person's function is restored when he or she has been affected by physical disability. Vision rehabilitation therefore enables a person to improve his or her ability to read and perform daily tasks when this has been affected as a result of vision impairment.

The aim of this paper is to outline early healing methods and provide a historical overview of the evolution of vision rehabilitation in addition to identifying some of the influences that may have lead to the development of this form of therapy. In this paper, specific emphasis is placed upon vision rehabilitation for people with macular vision loss. Whilst it is not possible to document every historical event, it is hoped that this paper will provide an interesting and informative insight into this topic area.

HEALING IN ANCIENT CIVILISATION

Vision rehabilitation, as it exists today, was not practiced in prehistoric civilisations. The treatment of illnesses in ancient times was carried out by magicians and medicine men and most healing skills were enveloped in spiritual tradition and cults. As knowledge of human anatomy increased, early civilisations such as the ancient Egyptians, Greeks and Romans advanced the practice of medicine and treatment of illnesses. The ancient Egyptians gained knowledge into human body functions including function of the heart and blood and understanding of the importance of air. As a result of their religious-based embalming techniques, they described various organs of the body, particularly the brain. The ancient Greeks were also influenced by religion and although their lives were dominated by the Gods, evidence exists that Greek physicians like Hippocrates actively treated people that were ill. Another ancient Greek scholar, Alcamaeon of Croton, was one of the first to operate on the eye and discover that there were links between the organs and the brain. The ancient Romans further progressed the study of medicine and disease and whilst they learned from the ideas of the Greeks, their main focus was on public health schemes, improving hygiene and disease control[1-3].

THE MIDDLE AGES TO THE EIGHTEENTH CENTURY

Medical knowledge in Middle Ages Europe (500-1500 AD) stagnated as scholars concentrated their thoughts on theological issues rather than scientific issues and the Catholic Church dominated medical practice. Diseases were attributed to supernatural causes and common medical illnesses were thought to be punishments from God. In relation to the visual system, anatomists of the time thought that light rays diverged from the eye and the 'nervus opticus' transmitted 'visual spirits' through the lens. One of the only documented practical solutions to vision problems of the time was provided by the explorer Marco Polo who, upon his return from China in 1270, reported that convex lenses were being used by the elderly Chinese, in order to read fine print[4].

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During the Renaissance (1400-1700 AD) performing surgical techniques became more popular and universities were established to provide a scientific basis for teaching medicine. However, due to the delicate nature of the eye it was difficult for surgeons and anatomists to make advances and great discoveries with regards to the structure and optics of the eye. In 1637 French philosopher, scientist and mathematician, Rene Descartes described the use of a magnifying aid that could assist people with vision impairment[5]. This description may possibly be the only documented attempt at vision rehabilitation during this period in history, apart from Marco Polo's documentation of convex lenses[1,6]. There is very little evidence that there was any attempt to provide treatment or education to people who were blind or vision impaired during antiquity, the middle ages or even as late as the seventeenth century.

By the end of the eighteenth century, enlightened humanitarians were convinced that people with disabilities could be assisted and taught new skills, rather than isolated from the rest of society in specially dedicated "asylums". The protection of peoples rights and the rights of the disabled were acknowledged. The prevailing thought was that people who were blind could be taught to adapt to their surroundings and perform normal tasks of daily living. In 1784 Benjamin Franklin invented bifocals and in this same year the first institution for the blind was founded in Paris by Valentin Huay where blind children were taught to read by touch using raised letters embossed on paper. Similar institutions were later founded in England, Germany and various other European countries[2,6].

ADVANCES IN THE NINTEENTH CENTURY

The nineteenth century heralded major advances in general medicine with the study of bacteria and subsequent development of vaccines. It was at this time that a blind teacher by the name of Louis Braille invented the Braille system of raised coded dots that enabled blind people to read. It was also in the late nineteenth century that Helen Keller, a deaf and blind American woman, advocated on behalf of blind people[7]. In Australia, at about this same period in history, Reverend James Miriam founded the 'Victorian Asylum and Schoole for the Blind'. In 1870 the asylum established a vocational training centre for people with vision impairment. This organisation later became known as the Royal Victorian Institute for the Blind. A student of the institute by the name of Tilly Aston formed the Victorian Association of Braille Writers and in 1895 founded the Association for the Advancement of the Blind. This association was an important lobby group for blind people and was able to bring about voting rights for the blind in 1902, established nursing homes and a library (1909 and 1919) and invented blind cricket in 1922[8,9]. Awareness that rehabilitation and special care could be used to benefit people with vision impairment was increasing, although it was still underdeveloped.

Significant progress in terms of recognising the benefits of teaching blind people was made in the early 20th century. Several schools specifically focused on the tuition of blind students and institutions for the blind were founded at this time. Some included the Myope School and the Blind Social Aid and Literary Union in the United Kingdom; the National Society to Prevent Blindness and the Perkins Institute in the United States and the Colne Society in Germany. In addition, the Clear Type Publishing Company published some text books printed in large font[5]. It was also in the early 20th century that Parsons documented various diseases of the eye and described appropriate therapeutic and surgical treatment[10]. However, there was no mention of any forms of rehabilitation for those with poor visual acuity. Most of these schools concentrated on people with total blindness and recognition of those with functional vision impairment was yet to occur.

Over a decade after Parsons, Duke-Elder devoted a small section in his book to "special glasses for optical purposes"[11]. It was at this time that vision impairment, as opposed to total blindness, became more recognised and Duke-Elder describes a new found use for telescopic or Galilean spectacles commonly used by jewellers or those involved with industrial work such as linen grading. The telescopes and Galilean spectacles were reported to be beneficial to patients with a variety of retinal diseases and the American Foundation for the Blind had begun supplying these aids to the vision impaired as early as 1924. The development of vision rehabilitation was now in its infancy and continued to revolve around the use of telescopic lenses.

Although some methods of vision rehabilitation had been described as early as the 1920s, it is difficult to state exactly when modern vision rehabilitation techniques arose. Goodrich reports that vision rehabilitation began in the 1950s with a paper published by New York's Industrial Home for the Blind[12]. The author maintains that this paper defines rehabilitation as a distinctive discipline within a multi-disciplinary vision rehabilitation service and his statements are supported by the fact that this is the first publication outlining vision rehabilitation principles incorporating multi-disciplinary teams. These principles, in addition to the involvement of multi-disciplinary teams in vision rehabilitation, are still considered best practice[13]. In 1947 the United Nations Commission on Human Rights (UNCHR) began drafting a treaty on the principles of human rights. These focused upon respect for all human rights without discrimination[14]. This paper by the Industrial Home for the blind was published soon after the UNCHR draft and may have been directly influenced by the principles of inclusion of all people in society without discrimination based on race, gender or disability.

Telescopic aids increased in popularity during the 1950s and there are reports that people with low vision relied upon telescopic loupes to assist them with close work such as reading. These loupes, which were placed in a spectacle frame, involved mounting a Galilean telescope with a convex lens, enabling the user to focus upon a close object. After 1955, less expensive magnifiers were developed originating from those designed for normally sighted users for tasks such as looking at stamps, coins and fingerprints or used by jewellery makers, as described earlier[11]. The American Foundation for the Blind was instrumental in making these aids commercially available to people with vision impairment. In subsequent decades Louise Sloan published several papers on topics such as using distance low vision aids, optimising illumination, using Closed Circuit Televisions and reading cards[15-19]. In 1970, Duke-Elder also described the use of magnifying devices in the form of aids such as hand magnifiers, stand magnifiers and telescopic spectacles for use in aiding the vision of those with disorders of the retina, optic nerve or visual pathway.

Whilst there were some publications regarding low vision available from the 1940s until the early 1970s, very little literature specific to vision rehabilitation is accessible. The reason for this is not that pioneering work was not being carried out in the field, but rather that most publications at that time were memorandums, internal publications and personal correspondences between low vision clinicians within and between organisations.

EVOLUTION OF VISION REHABILITATION IN THE 1970'S

The disability rights movement which emerged in the United States in the 1970s resulted from the civil rights movement of the 1960s. The civil rights movement intended to eliminate racial discrimination and was the foundation for many minority groups to demand an end to discrimination on the basis of several factors, including disability; hence the Rehabilitation Act 1973 was enacted in the United States.

According to Welch and Palames[20], three important concepts emerged during the 1970s in the United States, these were: "program accessibility, mainstreaming and independent living". These concepts influenced the evolution of vision rehabilitation and one of the first available books in the area of low vision entitled "The Low Vision Patient" was published in 1970[21]. This book evolved from work undertaken at the New York Lighthouse, a support agency for people with vision impairment, established in the early 1950s. This text also introduces a new concept in low vision patient care, that is, the consideration of psychological and social factors. Innovative rehabilitation methods and treatment including both the medical and optical approach to rehabilitation are described. In addition, significant emphasis is placed upon methods of accurate vision testing and prescription of low vision aids. Emphasis was placed upon the use of low vision aids in the 1970s. The most likely reason for this emphasis is that magnifying glasses and telescopes had only become commercially available to patients with vision impairment a decade or two previously. Thus most of the publications of the time were concentrated towards the use and development of these aids, including work by authors such as Sloan[18] and Gerstman and Levene[22]. The use of magnification as a strategy for vision rehabilitation has continued to be extremely popular and as a result, a plethora of information is available for the low vision practitioner. The literature includes an overview of useful magnifiers available to patients with low vision, optimum prescribing methods and complete optical management[23-32].

Despite the fact that the greater part of vision rehabilitation work concentrated on magnification devices, there were some innovative authors of the 1970s who focused on alternative forms of vision rehabilitation. This included perceptual vision rehabilitation based upon their clinical experiences with low vision patients[33-37]. Backman and Inde[33] published a manual describing exercises and vision training for people with a central scotoma, nystagmus, decreased peripheral vision and amblyopia. Based upon the authors' personal and clinical experience rather than through scientific testing, they conclude that the ability to use remaining vision is significantly improved by vision training. In addition the manual offers practical exercises and skills for the person with low vision on how to improve residual vision.

Movement towards alternative methods of vision rehabilitation continued to emerge in the 1970s. At this time, new ideas were developed about how to teach patients with macular vision loss to best utilise their remaining vision, without the use of an optical aid. A multi-disciplinary influence upon vision rehabilitation most likely contributed to the concept that people with low vision still had usable vision. As a consequence, a wider variety of health professionals such as occupational therapists, educators, orientation and mobility instructors, psychologists and other vision scientists became involved in developing the vision rehabilitation concept.

THE EMERGENCE OF ECCENTRIC VIEWING TRAINING

The 1970s and 1980s were a very crucial time in the development of vision rehabilitation with a movement towards other methods of utilising remaining vision, quite distinct from the conventional use of magnification or optical aids. The development of vision rehabilitation at this time was influenced by legislation introduced in the United States and Europe relating to anti-discrimination. In Australia similar laws were also being enacted, such as the Sex Discrimination Act 1975 (SA); Racial Discrimination Act 1976 (SA); Equal Opportunity Act 1977 (Vic) and the Equal

Opportunity Act 1984 (WA, SA, Vic). The Equal Opportunity Act and similar anti-discrimination acts allowed people with disability to be integrated into society and not be discriminated against when attending school or applying for employment. This was especially pertinent for those with vision impairment who required adaptations in educational institutions or the workplace.

As people who had central scotoma caused by macular disease were entering vocational training and the work force a new method of improving remaining sight was introduced and there were several pioneers of this "new method", laying an important foundation for further work in the field over the coming decades. Thus, vision rehabilitation in the form 'eccentric viewing' began. Eccentric viewing is a strategy that assists people with central field loss to utilise their remaining peripheral vision by relocating fixation. It is a skill that the person deliberately uses in order to project an image on to a functioning area of the retina, adjacent to or just beyond the macula scotoma[38-40].

Several papers were published in the 1970s and 1980s describing optimum eccentric viewing training methods. Most of the early publications are based upon anecdotal evidence noted by low vision clinicians. Backman and Inde were among the first authors interested in vision rehabilitation to document and describe the principle of eccentric viewing training[35]. This instruction manual is the foundation upon which many clinicians and researchers base their eccentric viewing methodology. Other clinicians further advanced eccentric viewing training methodology by incorporating various ideas and equipment to facilitate teaching a patient with central scotoma the principles of eccentric viewing training[33,34,41]. Further development of eccentric viewing training methods were reported in the 1980s, including the use of large print materials such as playing cards, followed by the introduction of training materials in various sizes incorporating single letters, words and sentences, dependent upon the patient's progression[42].

Early work in this field was not without some controversy. In 1982, Romayananda and colleagues reported that the use of prisms could be utilised to achieve eccentric viewing[43]. This technique is quite different to that of the other authors at the time, was considered controversial and was soon after refuted by Bailey[44]. More recently, another research team has investigated the effects of prismatic treatment for people with macular vision loss and concluded that using prisms alone is not sufficient for ameliorating macular vision loss[45].

Despite this debate, the groundwork was set for incorporating eccentric viewing as an accepted method of vision rehabilitation. The 1990s heralded further developments in eccentric viewing with many clinicians and researchers cultivating new methods of training. Following the initial reports outlining methods for eccentric viewing strategy, several papers were published that advocated the use of these various strategies and built upon them in order to improve patient outcomes. Whilst, many eccentric viewing methods reported were quite simple, others were more comprehensive training programs. As a result of this early work and of increasing anecdotal and clinical data, eccentric viewing strategy was becoming more widely acknowledged as a vision rehabilitation technique appropriate for people with centre field loss.

Soon the personal computer became an extremely useful tool for both storage of resources and data, and for presenting training techniques. Collins was one of the first to describe the use of a personal computer as a method of teaching eccentric viewing[46] and this was soon followed by other computer generated training methods such as 'EccVUE'[47,48], video display[49,50] and 'Vistra'[51].

CONCLUSION

Now that eccentric viewing training techniques have been developed questions arise as to whether eccentric viewing is an effective rehabilitation method and how does it compare with the use of magnification aids? There has been some attempt at answering this question[39,52-65] however, further questions need to be answered, such as how many training sessions of eccentric viewing are sufficient and does the degree and position of eccentricity influence the outcome of training? Thus, there is much work still left to be done in this emerging area of vision rehabilitation. We can look to the past to assist us with our future direction in terms of vision rehabilitation and ameliorating the impact of vision impairment for people with vision impairment.

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Acknowledgements: This paper is an extract from the corresponding author's PhD thesis. The author was the holder of a La Trobe University Post Graduate Research Scholarship during her PhD candidature and the research was also supported by two Post Graduate Support Grants from the Faculty of Health Sciences, La Trobe University.

Diurnal Variation of Central Corneal Thickness and Intra-Ocular Pressure in Normal and Suspect Glaucomatous Eyes: A Review

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ABSTRACT

Normal physiological variations in central corneal thickness (CCT) are important as they provide a reference parameter for experimental and clinical research particularly in the field of glaucoma prediction and assessment. The literature has established that significant diurnal fluctuations in CCT occur in persons with no ocular pathology when CCT has been assessed over a 12-48 hour period. The consensus in the literature is that CCT is thickest in the morning upon awakening and gradually thins as the day progresses, with the greatest proportion of this variation occurring in the first three hours after awakening. Studies that have attempted to establish whether a diurnal variation in CCT exists in glaucomatous eyes have not been successful. To date, significant developments, although variable, have been made to better understand diurnal variation in CCT in individuals with no ocular pathology. This signifies the importance of monitoring CCT throughout the day in those individuals who may be at risk of developing glaucoma, as opposed to those individuals who already suffer from glaucoma, as it will ensure that the timing of glaucoma treatment will not be overlooked. This review discusses the current opinion on diurnal CCT in those individuals who have no ocular pathology and in those who are glaucoma suspects. It will also focus on the significance of diurnal variability with CCT and its relationship to intra-ocular pressure (IOP) diurnal variation.

Keywords: Central corneal thickness, intra-ocular pressure, diurnal variation, glaucoma

INTRODUCTION

Many of the body's physiological systems, such as blood pressure and glucose regulation[1,] have been found to vary over a 24 hour cycle.[2,3] Important parameters used for assessing the health of the eye, particularly intra-ocular pressure (IOP) and central corneal thickness (CCT) have also been shown to fluctuate over the period of a day. These rhythms may be either circadian (driven by an endogenous clock) or diurnal (driven by the cycle of light and dark).[4] Since the early 1980's a great deal of research[3,5,6,7] has been conducted on individuals with no ocular pathology to assess the diurnal variation of CCT. The mean CCT in the population varies between 535μm and 550μm depending on the race of an individual with African Americans having on average thinner corneas than Caucasians, Asians and Hispanics[8]. Normal physiological variations in CCT are important as they provide a reference parameter for experimental and clinical research particularly in the field of glaucoma prediction and assessment.[2,4,6]

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Glaucoma is an optic neuropathy characterised by cupping of the optic nerve head with corresponding nerve fibre loss and visual field defects.[9,10,11] The relevance of CCT to glaucoma assessment is in its influence on IOP testing. IOP, along with the optic disc and visual field assessment of an individual, are important parameters for glaucoma detection with the "gold" standard IOP evaluation (via a Goldmann tonometer) being set for a mean CCT of 545μm.[2,8,12,13] A deviation in CCT from the set 545μm would therefore produce inaccurate IOP measurements. This suggests that CCT variations are imperative when monitoring those individuals who are at risk of developing glaucoma as a variation in CCT throughout the day would cause a correspondingly different IOP measurement. Hence, the timing of treatment or current topical regimen for an individual may be overlooked if these factors are not considered.[7]

It has been well established throughout the literature that a significant diurnal fluctuation in CCT occurs in subjects with no ocular pathology when CCT has been assessed over a 12-48 hour period.[3,5,4] The consensus in the literature is that CCT is thickest in the morning upon awakening and gradually thins as the day progresses, with the greatest proportion of this variation occurring in the three hours after awakening.[3,4,5] More recent studies on individuals with no

ocular pathology,[5] and those who are glaucoma suspects,[7] which have explored daytime (circadian) variations in CCT and its relationship to the circadian variations in IOP have not been in agreement of the importance of regular CCT examination.[6,7] Furthermore, inconsistent findings in the literature have left many researchers with conflicting views on the status of the relationship between CCT and IOP with some believing that CCT varies independently to IOP[6,7] whilst others believe that there is a dependent relationship between the two.[13,14] It still remains unclear whether overnight changes in CCT are truly representative of the diurnal variation occurring throughout any 24 hour period. Or, whether CCT fluctuates significantly through the day and also if the pattern of corneal thickness is the same on successive days.[5]

This review compares those researchers who have[3,5,7] and have not[6,7] found a statistically significant diurnal variation in CCT in participants with no ocular pathology and those who are glaucoma suspects and reasons as to why the conflicting findings are proposed. This review will further highlight the importance of diurnal CCT testing in the early intervention of glaucoma.

DIURNAL VARIATION OF CCT AND IOP

Harper et al[5] conducted a cross sectional study on eight subjects to elucidate the diurnal variation in human CCT with no ocular pathology over a 48 hour period. They found a mean increase in CCT during sleep of 5.5% with a total mean deviation in CCT of 7.3%. This suggested that overnight changes in CCT were not truly representative of the diurnal variation in CCT as this study revealed a considerable variation during waking hours, and a much greater variation compared to that previously reported of 4%.[11] A study by Kiely et al[3] also found a relatively smaller percentage of CCT thinning throughout the day as compared to Harper et al[5]. However, there were notable differences between the Harper et al[5] and the Kiely et al[3] inclusion and exclusion criteria. Harper et al[5] utilised rigorous criteria such that only subjects free from ocular disease, had adequate tear production and were not contact lens wearers were included. Where applicable, no female participant was included whilst menstruating or ovulating at the time of the study, as increases in oestrogen are associated with an increase in CCT[15]. Furthermore, participants abstained from alcohol consumption and maintained a normal diet throughout the study, as acute alcohol intake has been shown to bring about temporary corneal oedema and a consequence cause an artificial thickening of CCT.[16]In comparison, Kiely et al[3] did not state any inclusion criteria that were adhered to and participants were only excluded on the basis of corneal pathology and contact lens wear. Other factors which could potentially influence CCT, as noted in Harper et al's[5] study, were not considered. In addition, Harper et al[5] utilised an ultrasonic pachymeter, which is a popular clinical method which offers good accuracy and reproducibility.[2,17] Kiely et al[3] on the other hand utilised a less recognised optical pachymeter, the Haag Striet pachymeter, which is not as accurate as ultrasound pachymetry as it has been shown to have a larger range of error.[18,19] Perhaps the most striking factor between the two studies that may help explain the differing results obtained is the sizeable age range of the participants included in the Harper et al[5] study. Harper et al[5] included subjects between the ages of 10 and 63 with a mean age of 38 years compared to that of a mean age of 20 years in the study conducted by Kiely et al[3]. The relevance of this in relation to CCT measurements is that as the human eye ages the corneal dynamics change in such a way that our endothelial cells tend to decrease in number and corneal epithelial cells take longer to regenerate, therefore making the corneas of an older population significantly thinner than those of their younger counterparts.[20,21] Harper et al[5] studied a more representative sample of individuals.

A study by Toit et al[4] on the diurnal variation of corneal sensitivity and thickness found similar results to that of Harper et al[5]. This study was performed on 20 non-contact lens wearers to assess the diurnal variation of corneal sensitivity and thickness over a 24 hour period. A 4% variation in CCT was found over the period of a day which is amid that found by Harper et al[5] (7.3%) and Kiely et al[6] (2.1%). However, a considerable variation of 1.3% to 7.2% suggested that the way in which CCT varies throughout the period of a day is not constant between individuals. Similarly to Harper et al[5], Toit et al[4] showed methodological strengths with a large population sample and a strict inclusion and exclusion criteria. Furthermore, both of these studies withdrew the use of local anaesthetic prior to CCT testing. This is important as local anaesthetic has been shown to have an artificial affect on CCT measurements through inducing lacrimation and resulting in a disruption to corneal epithelial cells.[22]

Limited studies[6,7] have been conducted that have specifically focused on the circadian variations of CCT and their relationship to diurnal IOP measures during daylight hours. As mentioned earlier, the relevance of this relationship is such that a relatively minor change in CCT may produce a clinically significant change in IOP measurements, as a thick cornea will lead to an overestimation of IOP and a thin cornea will lead to an underestimation.[7,8,13] Laiquzzaman et al[6] performed a study on 42 normal eyes and found the difference between the CCT values for any time period was not significant suggesting that IOP varies independently of the variation in CCT.

Like Laiquzzaman et al[6], Shah et al[7] also assessed the daily circadian fluctuations in CCT and IOP, however they studied 28 glaucoma suspects. Similar results were found showing no significant correlation between IOP and CCT in any patient, nor were there any significant correlations between

the mean diurnal variations of CCT and IOP. The reported average of CCT variation was less than 1%. Shah et al[7] should be acknowledged for their choice of equipment to measure CCT (ultrasonic pachymeter) and IOP (Goldmann tonometer), however a major failing of this study is that IOP was measured prior to CCT. CCT measurements can be affected following applanation tonometry due to the probe of the Goldmann tonometer damaging and possibly removing corneal epithelial cells as it takes an IOP measurement.[2] This may cause an artificial thinning of the CCT.

The times at which CCT is measured has varied considerably between researchers and may be a potential reason for the minimal diurnal variations found in CCT by Laiquzzaman et al[6] and Shah et al[7]. Harper et al[5] and Toit et al[4] performed CCT measurements over a 24 and 48 hour period. Even though the study by Harper et al[5] was conducted over a 48 hour period there was little difference in the total diurnal variation of CCT after the 24 hour mark. The mean CCT diurnal variation on day one was 7.1% compared to that of 7.4% on day two. A confounding feature of the study by Harper et al[5] that may explain the much higher percentage of fluctuation in CCT was the fact that corneal thickness was measured immediately before sleep when the cornea is theoretically at its thinnest then immediately upon awakening when the cornea is theoretically at its thickest. Consecutive measurements were then made at 15 minute intervals for the first hour followed by 30 minute intervals for the next 2 hours, followed by 2 hour intervals for the remainder of the day. It appears that Harper et al[5] administered this intense testing schedule to highlight the times in which CCT is assumed to vary the most, which is during the three hours after awakening.[3,4,5] Testing schedules for Toit et al[4] and Kiely et al[3] were not as involved as Harper et al[5]. They measured CCT at 1 hour intervals throughout the day with the only difference being that Toit et al[4] like Harper et al[5] measured CCT immediately prior to sleep. The pre-sleep CCT measurement was the lowest value obtained and was used as a baseline which could also explain the difference in the magnitude of the CCT diurnal variations seen in these studies.[28] Laiquzzaman et al[6] who performed CCT measurements during normal clinical consulting hours (8am, 11am, 2pm and 5pm) and Shah et al[7] who performed CCT measurements during extended clinical consulting hours (8am, 12pm, 4pm and 8pm) found no significant circadian fluctuations in CCT. These findings may be explained by the fact that CCT was only measured at 4 different times during this time frame and missed those times when CCT is at its thinnest and thickest. This is compared to a total of 16 CCT readings performed by Harper et al[5] and 13 conducted by Toit et al[4]. However, Laiquzzaman et al[6] and Shah et al[7] methodological design cannot be criticised as ophthalmological measurements such as CCT and IOP are generally carried out on patients during normal hospital or clinical consulting hours, this being between 8am and 5pm.[6]

It should also be noted that the number of pachymetry measurements taken at each time interval and the standard deviation of these measurements differed between studies. For example, in the study conducted by Harper et al[5] a total of 10 measurements were taken with a maximum standard deviation of 2μm. By doing this the reliability of recordings was strengthened given that if the standard deviation rose above 5μm, reliability would have decreased considerably.[5,23] However, this variable was at no point discussed by Laiquzzaman et al[6] making it difficult to assess whether this could have influenced the reported diurnal CCT variation.

Overall, results from the Laiquzzaman et al[6] and Shah et al[7] studies suggest that a single measurement of CCT is sufficient when assessing both individuals with no ocular pathology and those with suspected glaucoma. That is, a change in CCT would not predict a rise or fall in IOP. These results support the notion that IOP varies independently of CCT. However, the findings from these studies should be considered with caution as subjects were not age and sex-matched and local anaesthetic was instilled prior to the CCT measurements. Furthermore, the validity of their conclusions are uncertain as these studies both have methodological limitations and oversights. As the participants in the Shah et al[7] study exhibited either disc cupping or visual field loss the use of a control group that consisted of individuals with no ocular pathology for comparison would have been useful. Moreover, due to the fact that early glaucoma can show variable peaks in IOP, the finding by Shah et al[7] is unexpected as their population sample was one that had suspect glaucoma and one would therefore anticipate variable CCT measures through the day.[7,24] Therefore any generalizations drawn from this study could be considered unreliable. Unlike those studies conducted on individuals with no ocular pathology that have established a definite diurnal variation in CCT exists,[3,4,5] those that have attempted to investigate this trend in glaucomatous subjects have not been successful.[2,7] This can be seen in a study by Fogagnolo et al[2] who performed a cross-sectional study on 30 individuals with primary open angle glaucoma (POAG) and found minimal circadian variations in CCT (1.2%) that did not seem to interfere with circadian IOP assessment. This highlights that future research should focus on individuals with no ocular pathology rather than those with glaucoma. There is strong support that a diurnal variation in CCT does exist in individuals with no ocular pathology, however due to insufficient research6 the relationship between diurnal CCT and IOP in these individuals remains uncertain.

CONCLUSION

To date significant developments, although variable, have been made to better understand diurnal variation in CCT.[3,4,5,6] Harper et al[5] discovered a new revelation which opened the way for a better insight into diurnal CCT. They found that in addition to a significant increase in CCT during sleep a significant variation occurred during waking hours. Toit et al[4] and Kiely et al[3] further highlighted that

significant fluctuations in CCT do occur in subjects with no ocular pathology. The studies that have focussed on subjects with no ocular pathology[3,4,5] have been important in establishing that significant fluctuations in CCT do exist, with the consensus in the literature supporting that on average diurnal variation in CCT is 4% over a 24 hour period.[3] However, a major limitation of these studies is that they neglected to test the relationship between diurnal CCT and IOP. Furthermore, any generalisations drawn from the only study that did assess this relationship in subjects with no ocular abnormalities[6] are questionable due to methodological flaws. Future research would need to address these limitations in the methodological design in order to establish a better understanding of diurnal CCT and IOP in individuals without ocular pathology. A way of overcoming these short fallings are to ensure that future studies perform pachymetry prior to tonometry and a slit lamp examination should also be conducted before each CCT measurement to confirm the absence of corneal epithelial defects. This practice should be applied for reasons related to the effect of applanation tonometry on CCT measurements.[2] Furthermore, a sufficient sample size and the use of a single examiner with adequate expertise to minimise operator bias when taking measurements should also be adopted.[6]

Despite the differences reported by various researchers there is support in the literature that a diurnal variation in CCT does exist in the normal population. This signifies the importance of monitoring CCT throughout the day in those individuals who may be at risk of developing glaucoma as it will ensure that the timing of glaucoma treatment will not be overlooked through errors in the evaluation of IOP measurements. The relationship between the diurnal variation of CCT and its effect on IOP measurements is still an area that requires future research as there is disagreement in the literature as to whether the relationship between the two is dependant or not.

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Surgical Management of Essential Infantile Esotropia

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ABSTRACT

There is universal agreement that surgical intervention is necessary to treat infantile ET, however debate regarding the timing of surgery and the type of procedure necessary to produce the best postoperative outcome continues. This paper highlights the issues regarding the management of infantile esotropia and briefly reviews a cross section of the literature.

Keywords: infantile esotropia, surgery

INTRODUCTION

Infantile esotropia (ET), or essential infantile ET (and previously commonly referred to as congenital ET), is a large-angle deviation with an onset usually in the first 6 months of life. It is characterised by a stable deviation of at least 30 prism dioptres (pd). Infantile ET is the most common type of childhood strabismus, affecting 1 – 2% of the population[1]. The aims of treatment of infantile ET are to align the visual axis and optimise the potential for binocular vision. Successful treatment will result in a small-angle ET (less than 10pd), preferably with subnormal stereopsis and peripheral fusion. There is universal agreement that surgical intervention is necessary to treat infantile ET, however, there is controversy as to the type of surgical procedure and the optimal age at which to operate.

TYPE OF SURGERY

Surgery to correct infantile ET involves adjusting the horizontally acting extraocular muscles. Surgery can be unilateral, consisting of a medial rectus recession and lateral rectus resection; bilateral, consisting of a bilateral medial or 'bimedial' rectus recession; and can include a three muscle procedure, consisting of a bimedial rectus recession with a lateral rectus resection on one side. There has been strong debate as to whether unilateral recess-resect or bimedial recession surgery is most favourable. Further, there is also controversy as to whether three-muscle surgery is optimum for treating very large angles or whether larger or augmented bimedial rectus recessions suffice.

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Bimedial Recession Vs Unilateral Recess-Resect

Arnoult, Yeshurun and Mazow[2], Miles and Burian[3], Bartley, Dyer, & Ilstrup[4] and Simonz, et al[5] have compared bimedial recession with unilateral recess-resect surgery and reported variable findings. Arnoult et al[2] found that the initial operations in both groups were equally effective in terms of ocular alignment. When reoperation was required, however, the recess-resect group had significantly better results. In this study the bimedial recession group had bilateral lateral rectus resection at reoperation and the recess-resect group a recess-resect procedure of the other eye.. The authors therefore concluded that the most effective surgical approach is a recess-resect procedure, followed by the same procedure on the fellow eye if required.

Bartley et al[4], on the other hand, reported that patients undergoing recess-resect surgery achieved not only better reoperation prospects, but also better results in terms of inital ocular alignment. Similarly, Miles and Burian[3] found that the recess-resect procedure gave better results after the initial operation. However, as compared to Arnoult, this study had a larger series of patients with a relatively shorter follow-up period. In addition, a preoperative difference in visual acuity between the two groups was present which may have affected the results; patients in the recess-resect group having poorer average visual acuity (amblyopia) in the deviating eye to begin with.

More recently, Simonz et al[5] conducted a multicentre randomised study that included 120 patients. Patients were randomly assigned to receive either bimedial recession or recess-resect surgery. This study failed to find a difference

between the results of patients who received unilateral or bilateral surgery three months postopertively. However, a smaller preoperative angle was correlated with less effect.

Three-muscle Surgery Vs Large Bimedial Rectus Recessions

Proponents of large bimedial rectus recessions (of greater than 6 millimetres) argue that this procedure is simpler and less traumatic than three-muscle surgery[6], whilst those against are concerned about producing adduction deficits and subsequently a consecutive exotropia[7]. Szmyd, Nelson, Calhoun and Spratt[8], however, reported that large bimedial recessions do not significantly alter adduction, and advocated this procedure on the basis that re-operation options were significantly improved when this was performed initailly. They reported a 91% success rate with 6mm and 7mm bimedial recession surgery in deviations of ≥50pd. However, alignment was only measured 6 weeks postoperatively, which is far too short a follow-up for any conclusive remarks.

In agreement are Vroman, Hutchinson, Saunders and Wilson[9], Damanakis et al[7] and Altintas, Yilmaz, & Duman[10]. Vroman et al[9] looked at the rate of reoperation in 56 patients with small versus large angles of deviation. The success rate for alignment in patients receiving bimedial recession did not appear to diminish when applied to deviations ≥50pd or greater compared with smaller deviations. The follow-up period was 2 years, though it is possible that with a longer term follow-up a greater number of patients may have developed consecutive exotropia due to underaction of the medial recti. The authors failed to assess adduction and could not comment on the effect of large recessions on the action of the medial recti.

Damanakis et al[7] investigated bimedial recessions of 8mm in patients with infantile ET and angles of 80–90pd. With a follow-up of at least 18 months, successful alignment to within 10pd was achieved in 75% of patients; the remaining 25% were under-corrected by 15-40pd. In addition, no postoperative limitation of adduction was observed. The authors concluded that 8mm bimedial recession surgery is an effective procedure for the correction of infantile ET of 80-90pd. On a similar note, Altintas et al[10] reported that augmented (greater than 6mm) bimedial recession for larger angles is an effective procedure and produces similar results to those achieved with a standard bimedial recession surgery for smaller deviations.

Some studies investigating the effectiveness of three-muscle surgery have also suggested that augmented recessions may be a preferred option to three muscle surgery. For instance, Minkoff and Donahue[6] reported that bimedial recessions combined with one lateral rectus resection resulted in a satisfactory horizontal alignment in only 30% of patients; 60% were over-corrected and 10% remained under-corrected. However, other studies have shown that three muscle surgery can be successful. Contrary to Minkoff and Donahue[6], Forrest, Finnigan, Finnigan, & Gole[11] found their success rate of three-muscle surgery to be 78%. Their results showed that 10% of patients had residual ET and 12% had consecutive exotropia. The authors concluded that operating in a graded fashion on both medial recti and one lateral rectus in children with very large angle infantile ET has a high success rate, even over longer follow-up.

SURGICAL TIMING

There has been much controversy as to the ideal age and timing for patients to undergo infantile ET surgery; though there is general consensus that it is more advantageous to perform early surgery before the age of 2 years[12]. Despite this, the question of "how early, is early enough?" remains and there are still some proponents of late surgery. Very early surgery refers to surgery performed between 3-6 months of age, early surgery describes surgery performed before 2 years, and late surgery refers to after 2 years. Early surgical alignment minimises the duration of misalignment, therefore possibly resulting in better stereopsis[13]. Von Noorden[14] argued that early surgery provides a better chance for functional improvement, is desirable for psychological reasons, and that secondary changes occur in the extraocular muscles, the conjunctiva, and Tenon's capsule – all of which make correction at a later age more difficult and less predictable. Proponents of late surgery argue that the correction of the angle of strabismus can be more precise after 2 years of age because it can be measured more accurately, and therefore result in fewer operations[16]. There is also a chance of spontaneous remission of the ET with age[17].

Simonsz, Kolling and Unnebrink[17] recently conducted a prospective, non-randomised, multicenter trial comparing early and late surgery. They used a large number of patients from 58 clinics across Europe, and employed a range of surgical procedures. They included children with angles between 10 and 60pd. Children in the early surgery group were operated on before the age of 2 years, while those in the late surgery group were operated on after the age of 2. Children operated on before 2 had significantly better gross stereopsis at age 6 years compared to children operated on after 2. Interestingly, there was no significant difference in the angle of strabismus between the two groups at the final examination; however, the number of surgeries was higher in the early surgery group. It was concluded that early surgery for infantile ET, before the age of 2, appears warranted.

Many other studies have also suggested that early surgery is beneficial. Trikalinos, Andreadis and Asproudis[18], for instance, found that more children will experience stereopsis by the age of 8 years if they are operated on very early (at 6 months of age) and early (at 2 years of age)

than late (at 4 years of age). In addition Zak and Morin[19] showed that fusion was most frequent in the children whose eyes were successfully aligned to within 10pd by 9 months of age and least frequent when it was achieved after 18 months. Inferior oblique over-action was also less frequent when the initial operation was performed before 1 year of age.

Others have also advocated that surgery prior to 6 months of age is optimal. A recent prospective study by Birch and Stager[20] compared surgery at 6 months to surgery between 7 and 12 months in a cohort of 397 infants diagnosed with infantile ET. Postoperative ocular alignment was similar in both groups, but more children in the early surgery group demonstrated peripheral fusion, central fusion and random dot stereopsis than in the later surgery group. It was concluded that early surgery was associated with a higher prevalence of fusion and stereopsis, without adverse motor outcomes. These results are further supported by Autrata, Hromadkova and Rehurek[15] who also found that surgical outcomes improved when surgery was performed by 6 months.

Contrary to these findings, Ing[21] found no significant difference between the patients that underwent surgical alignment before 6 months compared to those who underwent alignment at 6 months of age. Ing therefore suggested that it remains controversial to recommend surgery before 6 months of age. Similarly, in another study Ing and Okimo[13] found that, the proportion of patients with stereopsis was identical for patients aligned before 6 months of age and patients aligned between 7 and 12 months of age. However, patients aligned between 1 and 2 years of age demonstrated a lower percentage of stereopsis.

One of the issues when studying the timing of surgical intervention for infantile ET is that often the duration of the deviation is neglected and only the age at surgery is considered. It is probable that conflicting finding regarding timing may be influenced by the onset and duration of the strabismus. Birch, Fawcett and Stager[22] conducted a study focusing on the duration of misalignment prior to surgery rather than the patient age at surgery. The age of onset was calculated to the nearest month according to an average of the parents' and paediatrician reports and the age at initial visit, minus the average delay between referral and scheduling of an office visit. Significantly more patients achieved random dot stereopsis when the duration of misalignment was 3 months compared to 1 year. The results suggested that early surgical alignment is associated with better stereopsis in patients who were treated before 2 years of age, as early surgery may minimise the duration of misalignment, not because alignment is achieved during a critical period of visual development. On a similar note, when Ing[23] looked at the age at which initial adequate alignment was achieved rather than age at initial surgery, he found that patients who were adequately aligned by the age of 6 months did not statistically differ from those aligned by 1 year of age. However, significantly fewer patients aligned after 2 years of age demonstrated binocular vision.

CONCLUSION

There is a large body of literature on the treatment of infantile ET, this review only providing a snapshot; however, the majority of the literature consists of retrospective and cohort studies. Due to the lack of sufficient randomised controlled trials, it is difficult to resolve the controversies concerning the ideal surgery and timing of surgery. Some authors advocate unilateral recess-resect procedures, while others prefer the bimedial recession. In cases of very large deviations, high success rates have been reported with three-muscle surgery, as well as with augmented bimedial recessions. Prospective cohort studies have found that surgical alignment is associated with better stereopsis in patients who receive surgery within the first 2 years of life, and most authors agree that surgery should be performed before the age of 2 years. Some authors have gone further and recommend surgery as early as 6 months of age. Whilst numerous studies have addressed these various issues, many aspects remain controversial and will only be resolved with higher quality evidence.

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Suitability of Monovision Laser Correction in Patients With Ocular Motility Disorders

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ABSTRACT

This paper presents two cases which illustrate the importance of a pre-operative orthoptic examination in patients with ocular motility disorders considering monovision laser correction. The relative influence of the pre-operative orthoptic examination on the advice given to patients seeking monovision is discussed.

Keywords: monovision, laser refractive surgery, ocular motility disorder

INTRODUCTION

Laser refractive surgery is a commonly performed procedure for people seeking independence from their glasses or contact lenses. With the onset of presbyopia, there are a significant number of patients considering monovision after the age of 40. Monovision is aimed at correcting presbyopia, where the dominant eye is usually focused for distance and the non-dominant eye is corrected for near [1-3]. This largely increases patients' independence from reading glasses. In this paper two case studies are presented to highlight the importance of performing a pre-operative orthoptic examination to assess binocular function of patients considering monovision laser vision correction.

CASE STUDY

Case 1

A 63-year-old male accountant presented expressing interest in determining his suitability for laser refractive surgery so that he could be without his glasses for distance and near work. On examination his unaided distance vision was right and left eye count fingers and unaided near vision were right and left less than N18. His best corrected vision was right eye 6/6 part and left eye 6/6-1. A dry and wet refraction were performed using tropicamide 1% and showed similar results: right eye -8.25/-0.50 x 85° and left eye -4.25/-1.00 x 132°.

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An ocular history revealed that he had strabismus surgery as a child, however, the patient was unable to provide any further information regarding the type of surgery. On cover test near and distance a large right exotropia of greater than 45 prism dioptres was found with the ability to freely alternate fixation. No diplopia was reported.

Ocular dominance was assessed using the 'hole-in-card'. The patient firstly holds a card with a central hole and is asked to binocularly align an object within the hole. When the patient alternately occludes either eye, only the dominant eye sees the object[1,3] . This test revealed he preferred left dominance as predicted.

Retinal and corneal examinations were unremarkable. Corneal topography was performed using the Orbscan and corneal thickness measured 509 microns right eye and 516 microns left eye.

After the initial assessment, a monovision contact lens trial was performed. Taking into consideration the patient's age and the type and amount of near work he performed, the target refraction of right eye was -2.00DS (with a contact lens script of -6.50DS), and left eye was plano (with contact lens script of -4.25/-1.00 x 132°). With monovision contact lenses the patient achieved right near vision of N5 and left distance vision of 6/6. Binocularly the patient was seeing 6/6 and N5. A cover test performed during the monovision trial showed no change to the deviation and no diplopia.

The patient wished to continue the monovision contact lens trial outside of the clinical setting, so extended wear contact lenses were prescribed. Monovision contact lenses were successful and worn for a period of 7 years. During this time the patient did not experience any diplopia or symptoms of imbalance and the visual acuity remained stable.

Seven years after the initial contact lens trial, the patient underwent bilateral LASIK. At 4 months post-surgery he achieved unaided 6/24 and 6/12 vision of the right and left eye respectively and bilateral unaided near vision of N5. A subjective refraction showed 6/6-2 vision of either eye with a correction of -1.50/-0.50 x 14° and +0.75/-0.25 x 47° of the right and left eyes respectively. The patient reported that the distance vision was "not so good" without glasses. His deviation remained similar; a large right exotropia of greater than 45 prism dioptres with the ability to freely alternate. The patient underwent a left LASIK enhancement procedure. At 6 months post-enhancement laser vision correction surgery the patient achieved distance vision of 6/6 unaided left eye and maintained near vision of N5 with both eyes open. The patient reported to be very happy with the results.

Case 2

A 52-year-old lady presented for a refractive consultation. Unaided visual acuities were right eye 6/15 and left eye 6/7.5. Wet refraction using tropicamide 1% revealed right eye +1.75/-1.00 x 176° and left eye +0.75/-0.75 x 21°, with best corrected vision of 6/6 right and left. The patient did not have any distance glasses. Corneal topography was performed and results were normal with central corneal pachymetry of right eye 574 microns and left eye 564 microns.

A cover test at near with glasses (right eye +3.75/-1.00x67 and left eye +3.75/-0.50x27) showed a large exophoria of 25 prism dioptres with good recovery, while a cover test in the distance without glasses revealed an intermittent right exotropia of 14 prism diopters. Due to the patient's refraction and age the prism cover test was not performed at near without glasses as the patient was having difficulty focusing on the near target. Ocular movements were full. The patient was found to be left eye dominant using the hole-in-card method.

A monovision contact lens trial was performed with a -1.50DS refraction target for the right eye (with contact lens +3.25DS) aiming for N6 near vision. The target refraction of the left eye was plano (with contact lens +0.75DS) with an aim for distance vision of 6/6. During the monovision contact lens trial a cover test was performed. There was no change to the deviation at near. However, a cover test in the distance revealed a constant right exotropia with intermittent diplopia. With the monovision contact lenses in place the deviation increased to 20 prism dioptres. The patient achieved distance vision of 6/6 and near vision of N5 with both eyes open during the monovision contact lens trial. Despite good potential distance and near vision it was advised that the patient should not proceed with monovision refractive surgery given the increased deviation size and appreciation of diplopia.

DISCUSSION

Monovision compromises binocular visual function due to a decrease in vision in one eye causing anisometropia. This can lead to an interruption of fusion, therefore a pre-operative orthoptic examination is essential[4]. Orthoptists perform a variety of tests to assist in deciding whether a patient is an ideal candidate for monovision. Orthoptists also provide pre-operative counseling to potential monovision candidates. Standard testing includes patient history, unaided and best corrected vision for distance and near, a dry and wet refraction, pupil reactions, ocular dominance testing, corneal topography, measurement of intraocular pressure, ocular motility assessment, and a monovision contact lens trial. An extended orthoptic examination includes measurement of the deviation using a prism cover test and the assessment of stereopsis. Stereopsis is also performed before and during the monovision contact lenses trial if patients complain of imbalance, disorientation, hazy or blurred vision with monovision contact lenses despite achieving good distance and near vision uniocularly.

The length and level of the monovision contact lens trial can vary amongst patients, depending on their visual plasticity and their ability to adapt. Table 1 shows a guideline for the amount of anisometropia given to specific age groups, which can be modified depending on the patient's visual expectations, lifestyle or occupational needs. During the monovision contact lens trial we counsel the patients to ensure they understand that monovision compromises their binocular visual acuity, stereoacuity, contrast sensitivity and binocular function[5]. A questionnaire is also given to patients prior to the monovision trial to provide an overview of their visual expectation following surgery. This alerts the patient that monovision will not necessarily mean they will be free of glasses for all activities and that they may still need mild magnifying glasses for close work some of the time. It also alerts the clinician of the patients' expectations of surgical outcomes.

Warning signs that may indicate a patient is not suitable for monovision correction include: a large latent deviation with poor recovery, a decompensating latent deviation

Table 1. Guideline for monovision corrections

Age	Monovision Target Refraction
40-43	-0.50
44-45	-0.75
46-47	-1.00
48-50	-1.25
51-53	-1.50
54-57	-1.50 to -1.75
>57	-1.50 to -2.00.

or diplopia at any time during the monovision trial, or an increase in the deviation size with monovision. In addition, if after a monovision contact lens trial the patient lacks comprehension of the surgical endpoint, or appears unable or unwilling to accept a binocular compromise, it is advised that they do not proceed with monovision refractive surgery.

Reduced stereoacuity with monovision can also affect the success of monovision laser correction. Dimitri et al[5] has noted that successful monovision patients show less of a difference in stereoacuity before and during their monovision contact lens trial. Unsuccessful monovision patients, however, showed a greater reduction of stereoacuity during their monovision contact lens trial compared to successful monovision patients[6]. Anecdotally, we have found that if stereopsis (using a TNO) decreases by more than 30 seconds of arc during the monovision trial, the patient is less likely to become a successful monovision candidate.

Returning to the case studies, it is clear the effect of monovision on the patients' deviation influenced the surgical recommendation. In Case 2 monovision correction was not recommended due to her right exotropia becoming more marked during the monovision contact lens trial and the recognition of intermittent diplopia[6]. It was also expected over time that the patient's exotropia may become more marked and possibly require strabismus surgery. The patient in Case 1, on the other hand, was suitable for monovision as he had a monovision contact lens trial for many years without symptoms. He also clearly illustrates that monovision can be performed on patients with a manifest strabismus provided they have a thorough orthoptic examination and an appropriate monovision contact lens trial[7].

In conclusion, it is important for all patients considering monovision refractive surgery to have a pre-operative orthoptic examination to investigate their binocular functions in order to achieve an optimal post-operative outcome. A patient is an ideal candidate for monovision laser vision correction and likely to achieve a positive post-operative outcome if they: understand monovision, have reasonable post-operative expectations, if during the monovision contact lens trial the ocular motility examination is favorable and if the patient experiences comfortable vision during the trial.

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Orthoptic Association of Australia Inc

65th Annual Scientific Conference

23–26 November 2008

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Selected Abstracts from the OAA 64th Annual Scientific Conference, held in Perth, 25 - 28 November 2007

PERSON CENTRED CARE AND ORTHOPTICS PRACTICE

Catherine Devereux
Council of Ageing

The Enhancing Practice Program is funded by the Department of Human Services, Victoria and delivered to a wide range of staff in 10 health services around Victoria. In a multidisciplinary environment the teaching in this "change management" program is conducted over 4 two-hour interactive sessions. The program encourages health workers to strengthen their practice and increase awareness of ageing, ageist attitudes and person centred care. In this presentation the key messages of the Enhancing Practice Program will be outlined and applied to Orthoptic Practice

WHERE ARE WE NOW IN GENETIC EYE DISEASE?

Lisa S Kearns, AW Hewitt, JB Ruddle, S Staffieri, C H Wilkinson, LW Scotter, CR Swanson, DA Mackey
Clinical Genetics Research Unit, Centre for Eye Research Australia

New gene discoveries and improvements in laboratory techniques have led to significant advances in the genetics of all diseases (and traits) including those affecting the visual system. With the availability of highly co-ordinated genealogical and genetic information from research studies we are now able to provide many individuals with information on the specific genetic mutation running in the family. Genetic testing is becoming more available and with laboratories offering a large bank of gene tests for hereditary eye diseases many patients choose to pursue this service. Recent developments in genetic eye disease will be discussed and how genetics is increasingly becoming part of clinical practice and affecting how eye care professionals understand, diagnose and manage diseases.

DOES TRUMPET PLAYING CONTRIBUTE TO GLAUCOMA: CASE REPORT

Fleur O'Hare, Jonathan Crowston, Angus Turner
Glaucoma Investigation and Research Unit, Centre for Eye Research Australia

A 79 year old gentleman was referred to our private clinic for an opinion regarding future management. Despite responding well to topical medication his glaucoma was progressing. His identified risk factors for glaucoma included treated hypertension, a history of migraine and transient ischaemic attacks.

It was noted that this patient was a keen trumpet player and had been playing regularly for 50 or more years. Increased IOP and visual field defects, in high resistance wind instrument playing, has been reported in the literature.

Serial IOP and HRT measurements were recorded in this patient whilst he was playing his trumpet. Peak IOP was noted at 36mmHg. Full clinical findings will be presented. In addition the mechanism behind the transient elevation in IOP will be discussed. This case report supports the finding that long term trumpet playing may be a risk factor for glaucomatous damage.

ARE CLINICAL MEASURES GOOD INDICATORS OF PERFORMANCE OF DAILY ACTIVITIES?

Natalia Dawson, Kerry Fitzmaurice
Department of Clinical Vision Sciences, La Trobe University

Purpose: The aim of the study was to identify whether clinical measures of visual acuity and contrast sensitivity were good indicators of performance of daily tasks in vision-impaired school aged children.

Methods: 22 participants, (11 fully sighted and 11 vision-impaired children), aged 5 to 15 years. Clinical measures were distance acuity assessed by LogMAR chart and contrast sensitivity measured by Vistech grating contrast sensitivity. Colour vision was also assessed using Ishihara plates as a control. Performance of visual function was assessed by completion of one of two modified Visual Acuity Questionnaires (VAQ) Sloan 1992. This questionnaire measures self-perceived level of difficulty in undertaking specified activities graded on a five-point Likert scale. Results of clinical measures were correlated against VAQ scores.

Results: Vision impaired participants reported greater difficulty performing VAQ visual functions than sighted participants. There was an overall trend of a weak to moderate positive correlation between visual acuity and difficulty in performing daily activities measured on the VAQ and a weak to moderate negative correlation between contrast sensitivity and performing daily activities measured on the VAQ.

Conclusion: Data from this study indicated that visual acuity and contrast sensitivity were weak indicators of general performance of visual function. Whilst this represents pilot data the trends demonstrated were similar to others reported in the literature. Further investigation should be undertaken in this domain of low vision, as many intervention programs are directed by clinical measures.

FACTORS ASSOCIATED WITH THE POST-OP RECURRENCE OF ESOTROPIA

Connie Koklanis, Zoran Georgievski, Nicole Mocnay
Department of Clinical Vision Sciences, La Trobe University

Aims: To investigate the effect of various factors on the outcome of esotropia surgery in both infantile esotropia and early acquired esotropia.

Methods: The medical records of 450 patients who underwent surgery for esotropia at the Royal Children's Hospital from June 1998 to September 2001were reviewed. Of these, 231 patients met the inclusion criteria. Data concerning the patient's angle, age of onset and surgery, refraction, presence of associated findings or conditions, and type of surgery were recorded from the medical records.

Results: The success rate for esotropia surgery was found to be 32.4%.The age of onset of the esotropia, age at first surgery, angle at presentation and the presence of inferior oblique overaction significantly affected the surgical outcome. Furthermore, the presence of DVD, convergence excess, and astigmatism were all approaching significance. All other factors were found to have no effect on surgical outcome.

Conclusion: Based on the results of this study, one surgery is often insufficient in fully correcting an esotropia. Our study has found that various factors appear to influence the surgical outcome. A prospective trial is required to further investigate these findings.

INTERPRETATION OF FUNDUS FLUOROSCEIN ANGIOGRAPHY

Manisha Ghai
Vision Group

Fundus fluorescein angiography is the gold standard imaging technique in routine clinical practice. This presentation will review the principles of fundus fluorescein angiography. Fluoroscein angiography interpretation will be discussed. Clinical cases requiring fluorescein angiography assessment are presented. Moreover, ocular disease treatment and management based upon fluorescein angiography clinical findings will be discussed.

SYDNEY PAEDIATRIC EYE DISEASE STUDY (SPEDS): PRELIMINARY DATA

Shahrimawati Sharbini, Kathryn Rose
Discipline of Orthoptics, Faculty of Health Science, University of Sydney.

Purpose: To determine the prevalence of eye disease in children aged from 6 months to 6 years in Sydney, Australia.

Methods: The Sydney Paediatric Eye Disease Study is a cross-sectional population-based sample from two geographically separated postcodes in the greater metropolitan area of Sydney. Based on Australian Bureau of Statistics data (2001 Census), postcodes identified for inclusion had a population of more than 1500 children less than 6 years of age and the percentage of children was greater than 8%. The first postcode chosen is 2763 for the suburbs of Quakers Hill and Acacia Gardens in the North West of Sydney and the study commenced in late 2006. All households in the postcode received leaflets by post informing them of the study's purpose. This was followed by a visit from a study interviewer. All households were enumerated and details of eligible children's ages and contact information was obtained. Families were progressively invited to participate in the study by means of an information and consent letter sent to them by post, followed by a phone call to confirm their participation and allocate them an appointment time. A house within the postcode has been converted in to a clinic where all the testing is done.

Results: All children undergo a comprehensive eye examination. This includes: age appropriate vision tests, with and without optical correction if any. Cover test, prism cover test, ocular movements and convergence are performed A 15Δ test and stereoacuity tests (Langs II, Randot Pre-school and/or Stereo Smile) are used to assess binocular function. Colour vision (Waggoner) is only recorded for the children more than 30 months old. Pupils are assessed for RAPD, Bruckner's reflex and iris colour. Blood pressure and anthropometry are also obtained. Cycloplegic retinoscopy is performed using either the Canon autorefractor, Retinomax or by streak retinoscopy. Ocular biometry is measured by IOL Master in children aged more than 30 months. Slit lamp examination or loupe and a fundus examination ensues. Retinal photography is attempted on all children aged 3 years and older.

Conclusions: At present 800 children have been assessed and the study is aiming to test approximately 3000 children from two chosen postcodes. Preliminary analysis of data indicates a range of eye diseases being detected in the study population and that the rate of eye disease is higher than has been found in previous school-based studies.

AN OVERVIEW OF CONTACT LENS USE IN INFANTS AND YOUNG BABIES. OUR EXPERIENCES AT THE CHILDREN'S HOSPITAL AT WESTMEAD EYE CLINIC

Stephanie Sendelbeck
The Children's Hospital Westmead

A retrospective review of patients attending the Children's Hospital at Westmead Eye Clinic who required contact lens correction for aphakia or high refractive errors. Patients included had aphakia secondary to congenital cataracts and PHPV, and both high myopia and high hypermetropia were included in the review. Methods for fitting of the contact lens, teaching insertion, compliance with wear and visual outcomes are discussed.

PUPILLOGRAPHIC MULTIFOCAL VISUAL FIELD ASSESSMENT FOR GLAUCOMA

Maria Kolic, T. Maddess, A.C. James.
ARC Vision Science Centre of Excellence, Australian National University

Purpose: To investigate the sensitivity and specificity of 10 variants of multifocal pupillographic perimetry in glaucoma.

Methods: Ten stimulus protocols were examined in two blocks of experiments. Block one contained 22 normal and 23 glaucoma subjects; block two: 20 normal and 20 glaucoma subjects. All subjects were examined with HFA achromatic, SWAP and Matrix 24-2 perimetry, Stratus OCT, slit lamp and tonometry. Informed written consent was obtained from all subjects under ANU ethics approval 238/04. In all protocols multifocal stimuli were presented concurrently to both eyes with a dartboard layout, having 24 independent test regions/eye extending to 30 deg eccentricity. The test recording duration for each of the 10 protocols was 4 minutes, divided into 8 segments. Stimuli in each protocol could differ in the presentation rate per dartboard region (0.25, 1, 4 presentations/s), stimulus duration/presentation (66, 133 or 266 ms), flicker rate on each presentation (0, 15, or 30 Hz) or luminosity (80, 150 and 290 cd/m^2). Background luminance was 10 cd/m^2. 48 responses/eye were obtained giving 96 contraction amplitude and 96 delays.

Results: The mean simultaneously highest sensitivity and specificity, 95.5%, was obtained with a linear discriminant models containing amplitude and delay for the stimulus 290 cd/m^2, 66 ms, and 30 Hz flicker.

Conclusions: This study indicates higher presentation and flicker rates combined with higher luminance stimuli can yield sensitivities and specificities around 95% for test durations equivalent to 2 min/eye.

CAN MYOPIA BE PREVENTED

Kathryn Rose
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Purpose: In the last thirty years the primary aim of myopia research has been to find a method of preventing myopia and its progression. This endeavor was give impetus by the rapid rise in the prevalence of myopia in urban centres in East Asia. While this rapid rise posed a significant health problem for the countries affected, it also implicated changes in environment in having a significant role in the development of myopia. The Sydney Myopia Study aimed to assess the relationship of range of lifestyle factors, with the prevalence of myopia in school-aged children.

Methods: The Sydney Myopia Study is a cross-sectional study of two age samples from 55 Sydney schools, selected using a random cluster design. A total of 4,132 children from either Year 1or Year 7 of school, participated from 2003-2005 (participation rate 78.9% and 75.3% respectively). Children had a comprehensive eye examination, including cycloplegic

refraction and measures of ocular biometry using the IOLMaster (Ziess). Parents and students completed separate questionnaires on activities outside school hours. Myopia was defined as spherical equivalent ≤ -0.5D in at least one eye.

Results: The mean refractive error at mean age 6.7 years (n= 1740) was + 1.26D (95% CI, 1.19-1.33) and at mean age 12.7 years (n = 2367) it had become less hyperopic (+0.49D; CI, 0.27-0.71). Myopia prevalence in Year 1 students was 1.5% and in Year 7 12.8%. In the Year 7 students higher levels of outdoor activity (including sport and leisure activities) were associated with more hyperopic refractions and lower myopia prevalence. Students who combined high levels of near-work with low levels of outdoor activity had the most myopic mean refraction (+0.27D; CI, 0.02-0.52), while students who combined low levels of near-work with high levels of outdoor activity had the most hyperopic mean refraction (+0.56D; CI 0.38-0.75). After adjusting for near-work, parental myopia and ethnicity, the lowest odds ratios for myopia were found in groups reporting the highest levels of outdoor activity. There were no associations between indoor sport and myopia.

Conclusions: The prevalence of myopia in Sydney was lower than in age-matched peers in urban East Asia and other countries. Outdoor activity was negatively associated with myopia and may be protective for the development of myopia. The benefit of this protective effect may only be relevant for children who are still within the hyperopic phase of refractive development.

WE KNOW ABOUT SKIN - HOW ABOUT EYES? MINIMIZATION OF SUN RELATED DAMAGE TO AUSTRALIAN CHILDRENS' EYES.

Sue Silveira
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It is well recognised that a link exists between sunlight exposure and disease. Public campaigns have been in existence for many years in Australia aimed at encouraging people to protect themselves from the sun. However, this has mainly focussed on skin protection, with little emphasis on the importance of also protecting the eyes. A dilemma exists in reaching a balance between preventing disease related to sun exposure versus preventing disease relating to lack of sun exposure. Recently the need to minimise sunlight exposure in children's eyes has been highlighted, as technology has begun to foster an understanding of the presence of sun damage in the eyes of Australian children. Other research has shown a negative relationship between outdoor activity and the incidence of myopia, i.e. there is a suggestion that outdoor activity may offer some protection from myopia in children. Lack of sun exposure poses a further potential health hazard, with a link to vitamin D deficiency disorders such as rickets.

So how do we best protect children's eyes to prevent disease linked to lifelong sun exposure without compromising their outdoor activities and placing them at risk of disease related to sun avoidance? This presentation will outline briefly the nature of vision impairment in our ageing population; the link between sunlight exposure and eye disease and possible preventative strategies that can be implemented to offer increased protection to Australian children's eyes. The need for research in this area will also be highlighted.

PREVALENCE OF HETEROPHORIA IN AUSTRALIAN SCHOOL CHILDREN

Jody Leone, Kathryn Rose
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Purpose: Establish the prevalence of heterophoria and its relationship with refractive error in school children.

Methods: The Sydney Myopia Study is a population-based stratified random cluster sample of 4107 students from 55 primary and secondary schools. Of these, 1692 Year 1 students (mean age 6.7 years) and 2289 Year 7 (mean age 12.7 years) who had no strabismus or vertical heterophoria were included in this analysis. As part of a comprehensive eye examination, cycloplegic auto-refraction, cover/uncover, alternate cover test and prism bar cover tests at near (33cm) and distance (6m) fixation were performed.

Results: For near fixation, exophoria was highly prevalent (Year 1: 58.3%, Year 7: 52.2%). For distance fixation, orthophoria predominated (Year 1: 85.4%; Year 7: 90.9%). There was a significant association between near heterophoria and refractive error in both the Year 1 ($p=0.0296$) and Year 7 students ($p<0.0001$). Children with hypermetropia >+2.00D were more likely to be esophoric at near (Year 1: OR 1.7, CI 1.1-2.8; Year 7: OR 2.9, CI 1.7-4.8), and in Year 7 those with myopia were more likely to be exophoric (near: OR 2.1, CI 1.5-2.7; distance: OR 3.1, CI 2.1-4.4) than children without significant refractive error. Myopia and esophoria were rarely associated at near (Year 1: 0.06%; Year 7: 0.6%).

Conclusions: While orthophoria for near has been more commonly reported in studies of children of comparable age, we found a high prevalence of exophoria at near. Consistent with other studies, we found that esophoria was rare. The predominance of orthophoria for distance fixation for both age groups indicates a possible biological process of orthophorization, that is, an active mechanism for guiding heterophoria for distance fixation towards orthophoria.

REFRACTIVE OUTCOMES OF TORIC INTRAOCULAR LENSES

Amanda Marini, Stephanie Goodwin
Sydney Eye Specialist Centre

A study of over 100 eyes implanted with Toric IOL's was conducted earlier this year. The criteria for IOL and patient selection, along with the pre and post operative results of these implants will be discussed. Several case studies will also be high lighted illustrating the refractive outcomes of using such lenses.

CATARACT SURGERY. A CURE FOR AMBLYOPIA? A CASE STUDY.

Sally Turner
Sydney Eye Specialist Centre

Conventional visual solutions for patients with extreme anisometropia are limited. Orthoptics and patching in childhood, and intolerable glasses as a teenager, left a patient who had been seeking visual improvement her whole life, virtually without hope. Until at age 44 she developed a cataract. This case and the resulting benefits will be discussed.

IMPROVEMENT IN VISUAL FUNCTION FOLLOWING CATARACT SURGERY

Meri Vukicevic, Lara Freijah
Department of Clinical Vision Sciences, La Trobe University

Visual acuity is the traditional method of determining the success of cataract surgery and good outcome is defined as vision of 6/12 or better.Most patients are able to achieve this (Desai, 1993). However, the definition of a "good visual outcome" is relative, especially when patients present for surgery with VA of 6/12 or better (Haynes et al. 1999). In addition, the limitation of visual acuity measures for determining visual function are widely acknowledged (Bernth-Petersen, 1981; Abrahamsson et al, 1996; Elliot et al, 1990; Lundstrom et al, 1994). Consequently, several tools have been developed to assess visual function of patients after cataract surgery. All of these tools are questionnaires and the VF-14 (Steinberg et al, 1994) appears to be most widely used. As with all questionnaires, the patient is asked to rate their performance on a scale and an answer is always required. Patient's ability to always correctly rate their ability may not be accurate and is subjective.

The Melbourne Low Vision Activities of Daily Living Index (MLVAI) (Haymes et al, 1999) was developed in Australia to assess visual function in terms of ability to perform daily living tasks. It comprises an objective measure of visual performance where a patient is observed performing a task, in addition to a questionnaire.

The aim of this study was to measure visual function pre and post cataract surgery using the clinical measures in addition to tests of visual function. A comparison of both the MLVAI and VF-14 were conducted to determine if one is more sensitive than the other to changes after cataract surgery and results will be presented.

HE SEES, SHE SEES: AN ANALYSIS OF GENDER DIFFERENCES IN VISUAL SCANNING TO EMOTIONAL FACIAL EXPRESSIONS

Suzane Vassallo[1], Sian Cooper[1], Jacinta Douglas[2]

1 Department of Clinical Vision Sciences, La Trobe University

2 School of Human Communication Sciences, La Trobe University

The ability to interpret facial expressions is a fundamental form of non-verbal communication. It has been shown that when interpretation of facial affect is poor, social integration is diminished as is the forming of interpersonal relationships with others (e.g., Knox & Douglas, in press; Watts & Douglas, 2006). The literature suggests that females outperform males in judging emotional facial expressions, at least for certain emotions, however the visual scan path employed in the viewing of facial expressions has not been explored for gender differences. The visual scan path is a direct measure of visual attention (see Noton & Stark, 1972). It describes the 'path' taken by the eyes to extract visual information from the stimulus being viewed. It is made up of a series of saccades which are interspersed by periods of fixations during which time detailed visual information is acquired via the fovea. The normal scan path to human faces encompasses fixations directed to the eyes, nose and mouth, with little (if any) viewing time spent on other facial areas (e.g., the chin). In order to determine whether the visual scan path employed by males and females differ, normal healthy males and females aged between 18 – 44 years were recruited for this study. Subjects were shown a series of evoked static facial expressions on a computer monitor – these were happy, sad, surprised, angry, anxious and disgusted faces taken from the Matsumoto & Ekman (2004) facial set. While viewing each face, participants' eye movements were recorded using the Tobii 1750 infrared eye tracker. The groups were compared with respect to accuracy in naming the facial expression, reaction time (time taken to view each face), number of fixations and duration of fixation to a given area of interest. The findings will be discussed.

WHAT ARE THE VISION-BASED DRIVING HABITS OF SENIOR DRIVERS WHO MEET THE LICENSING VISION STANDARD?

Nathan Clunas, Neryla Jolley
Discipline of Orthoptics, Faculty of Health Sciences, The University of Sydney

Driver licensing is constantly under review with the role of the medical practitioner having an ever-increasing responsibility. Recent problems in New South Wales have focussed on accidents involving senior drivers and previous research has shown that ageing is accompanied by significant declines in visual function. This paper aims to report on the visual responses and driving behaviours of 80 drivers between the ages of 60 & 85 who meet the Austroads criteria to address the question – are drivers who meet the vision criteria visually safe when driving?

The paper addresses the characteristic responses of 80 senior drivers (30 females, 50 males) who held a full driver's license and met vision-based criteria. Each participant undertook an off and on-road assessment by a multi-disciplinary team. Participants were shown to have a range of binocular visual acuity at 6m between 6/4 and 6/9 part. Binocular visual fields in 38% of cases showed a response that was decreased but within licensing standards. More in-depth tests of sensory function (contrast sensitivity and stereopsis) showed a decreased response. Drivers reported decreased comfort when driving at night and were observed to have habits when driving that impacted on safety.

Vision behaviours whilst driving demonstrated a range of responses, indicating poor use of the driving environment. Of particular note is the minimal blind spot checking to both right and left sides, and decreased emphasis on looking to the left. This would suggest a need to educate senior drivers about appropriate vision behaviours to ensure their safety and support their continued assessment.

WHY THE WORLD NEED ORTHOPTICS - TWO CASES THAT HIGHLIGHT ORTHOPTIC EXPERTISE AND THE DIFFERENCE IT CAN MAKE TO PATIENT OUTCOMES

Sue Silveira
Discipline of Orthoptics, Faculty of Health Sciences, University of Sydney

Numerous eyecare professionals investigate and manage patients with strabismus and ocular motility conditions. Orthoptists are traditionally the experts in this area, providing knowledge and skills which positively influence the outcome for the patient. Two unusual strabismic patients who had improved outcomes from orthoptic advice and management will be presented to highlight the continuing need for this expertise.

SNORING... IS IT JUST AN IRRITANT TO THE EARS?

Shandell Moore, Linda Malesic
Department of Clinical Vision Sciences, La Trobe University

Purpose: The main aim was to collect pilot data (IOP, CCT, automated perimetry & retinal vasculature) in individuals who snore and to determine if these measures differ when compared to an age and gender-matched control group of non-snorers. The affect of gender on these measures was also investigated. A second aim was to determine if there was a greater variability in the diurnal variation of IOP and CCT in the group of snorers and investigate whether the relationship between IOP and CCT is a dependant one.

Methods: The snoring group consisted of 12 participants (6 males & 6 females, mean age=53.8 years ±4.2) and the non-snoring group comprised 10 participants (6 males and 4 females, mean age=55.2 years ±4.3). Allocation of participants into each group (experimental or control) was determined by the Snoring Systems Inventory (SSI) questionnaire. Testing including IOP, CCT, fundus photography and automated visual field measurements with both white-on-white and blue-on-yellow programs on all participants. Participants were tested at two different times on a given day (8am & 4pm). Repeated testing allowed for diurnal variation assessment of IOP and CCT. Fundus photographs were analysed by a trained retinal grader who determined arteriolar and venular diameters for both groups.

Results: The mean IOP at 8am for the snoring (14.8mmHg ±1.3) and control (15.2mmHg ±1.4) groups were not statistically different ($p = 0.53$). There was a statistically significant difference between the IOP measurements taken at 4pm in the snoring group (14.0mmHg ±0.7) when compared to the control group (12.5mmHg ±1.9) ($p= 0.04$). There was no significant difference between morning (snorers = 568.5μm ±11.6 & control = 561.2μm ±31.6) and afternoon (564.6μm ±15.4 & 557.6μm ±26.6) CCT measurement in either group (AM $p= 0.46$ and PM $p=0.45$). Vascular thickness, both central retinal arteriolar equivalent (CRAE) and central retinal venular equivalent (CRVE), were thinner on average in snorers when compared to the control group (snorers CRAE = 124.5 ± 41.9 & control =144.7 ± 14.3; snorers CRVE=183.9 ± 63.4 & control=211.9 ± 28.7).

However, this was not statistically significant in either group ($p = 0.14$ & 0.20 respectively). Visual field results were categorized via the Glaucoma Staging System to compare if white-on-white results differed to that of the blue-on-yellow program. This was not significant in either group; both programs were equally sensitive in identifying early field changes.

Conclusion: Snorers demonstrated higher IOP measurements in the afternoon when compared to the control group and less diurnal variation between the AM and PM measures; however these were not alarmingly suspicious. The non-significant diurnal variation between CCT in both groups is suggestive of IOP varying independently to CCT as well as implying that a single CCT measurement would suffice in a clinical setting. As the CRAE and CRVE were found to be thinner in the snoring group a study involving a larger co-hort of snores (severe, moderate & mild categories) is required to better determine if this sleep breathing disorder is a potential risk factor in the development of low-tension glaucoma.

BAD EYE GENES. EXTREME MYOPIA AND THE REST

Ana Alexandratos
Sydney Eye Specialist Centre

Solving extreme myopia in ageing patients who are becoming HCL's intolerable and can be a challenge. A series of ocular problems and declining vision are discussed in this case history. Implantation of the Human Optics Lens was a solution for this patient.

HISTORY TAKING AND PRE-OPERATIVE ASSESSMENT IN VITREO-RETINAL SURGERY

Manisha Ghai
Vision Group

Orthoptists these days in retinal clinical setting are dealing with sophisticated technology such as OCT, fundus photography but good and precise history is very crucial in the diagnosis and management of patients with vitreo-retinal disorders. The presentation will discuss various aspects of history taking and pre-operative assessment in retinal disorders. This presentation will provide a brief overview of how to obtain precise and useful information while conversing with the patients.

Discussion will include - asking the right questions, indications for Vitreo-Retinal surgery, history taking (General, Ocular, Family, Systemic), assessment (Adnexa, Anterior Segment, Fundus assessment) and the role of the Orthoptist.

EYE MOVEMENTS FOLLOWING BONE CONDUCTED SOUND - A DIAGNOSTIC TEST FOR VESTIBULAR DYSFUNCTION?

Elaine Cornell
Discipline of Orthoptics, Faculty of Health Sciences, University of Sydney

Bone conducted vibration (BCV) of the head activates vestibular as well as auditory receptors and also results in small but reliable eye movement responses and evoked muscle potentials in guinea pigs and in human observers.

In a previous study it was shown that the evoked potentials were present in healthy subjects and in a subject who was profoundly deaf but had preserved vestibular function, but they were bilaterally absent in a subject with gentamicin vestibulotoxicity, confirming that they are primarily vestibular, and probably otolith induced.

There has been limited research on the characteristics of the eye movements involved in these responses. The purpose of this study was to compare the responses of each eye to BCV delivered at the mastoid and the effect of gaze position on these responses, and possibly to identify the extraocular muscles involved. The outcomes of this research may provide a simple test for vestibular dysfunction as well as add to our knowledge of the neural pathways for vestibular induced eye movements.

THE VERBAL COMMUNICATION OF ORTHOPTISTS

Irina Sim, N. Jolly, I. Sim, K. Pepper, R. Heard.
Discipline of Orthoptics, Faculty of Health Sciences, The University of Sydney

Purpose: Verbal communication is an essential part of the medical consultation and defines, reflects and distinguishes the roles of professional bodies in the health care industry. The study aimed to provide a preliminary comparison between the verbal skills of orthoptists with other health practitioners and investigate the effects of patient qualities and experience of orthoptists on the verbal interaction during a consultation.

Methods: 12 orthoptists and 49 patients were recruited from 3 private ophthalmic practices in metropolitan New South Wales. The duration of orthoptic tasks and verbal skills were coded into 13 categories in real time and analysed

Results: Orthoptists were found to use high levels of explanation, information and rapport that increased with experience. Patient qualities such as their cultural background and if visiting the clinic for initial or return visits did not demonstrate an effect on the duration of individual tests performed or verbal skills recorded.

Conclusion: This study has shown that orthoptists have demonstrated verbal skills that reflect the role of a primary health care practitioner as an allied health professional. The level of experience has more impact on the verbal skills used by the orthoptist than patient. More in depth research into the dynamics of the orthoptist-patient relationship should be carried for quality improvement purposes and its effects on patient compliance and patient adherence to ocular treatment and therapy.

PHOTOTOXIC MACULOPATHY ASSOCIATED WITH WELDING: A CASE STUDY

Meri Vukicevic
Department of Clinical Vision Sciences, La Trobe University

Phototoxic maculopathy can result from overexposure to light from several sources including: the sun, halogen lamp filaments, operation microscopes and also from welding arcs. A welding arc emits ultra violet and infra red wavelengths of light and the ultra violet emissions can cause phototoxic maculopathy when prolonged light exposure damages the photoreceptors and retinal layers. It has been reported that young apprentice welders are most at risk of retinal injury caused by an arc welder due to their vocational inexperience combined with clear ocular media. The case of a 21 year old male with phototoxic maculopathy directly resulting from arc welding will be presented. His residual symptoms almost 4 years after the date of his injury will be reported, including results of tests relating to visual acuity, stereopsis, colour vision, visual fields and contrast sensitivity.

WHAT IS THE DIFFERENCE BETWEEN THE DIFFERENT TYPES OF DIVERGENCE EXCESS INTERMITTENT EXOTROPIA

Thong Le, Z Georgievski, C Koklanis
Department of Clinical Vision Sciences, La Trobe University

The classification and management of intermittent XT relies on an accurate measurement of the accommodative convergence to accommodation (AC/A) ratio. However, an accurate measurement also relies on the patient

exerting or relaxing an appropriate amount of accommodation during the AC/A ratio measurement. It is well known that the detail of a target can influence the level of a patient's accommodation and subsequently the size of their deviation. Despite this, to date no study has investigated the effect of different fixation targets on the AC/A measurement in patients with intermittent exotropia. This study aimed to investigate the effect of different fixation targets on the near angle of deviation measurement and AC/A ratio in patients with intermittent exotropia of the divergence excess type. The incidence of a high AC/A ratio was also investigated.

Twenty-eight participants identified as having intermittent XT were included in this study. The size of each participant's deviation was measured with a prism cover test at three distances before and after occlusion. After occlusion, the deviation at near was also re-measured through plus lenses using two different targets, that of a butterfly and a N5 print target. The gradient method was employed to measure the AC/A ratio of each participant. A t- test was used to investigate the difference, between firstly the deviation measured through plus lenses at near with the different targets and secondly, if this resulted in a significant difference in the AC/A ratio measurement.

This study found there was a statistically significant difference between the two targets used when measuring the deviation, $t(54.00)=2.91$, $p=0.005$. On average, the deviation measured was 8.8Δ larger with the with the N5 print. This also resulted in a statistically significant difference between the two targets when measuring the AC/A ratio ($t(54.00) = -5.139$, $p<0.001$). The mean AC/A ratio was 3.4Δ:1D with the butterfly target as compared to 6.4Δ:1D with N5 print. A large majority of participants (71.4%) were discovered to have a high AC/A ratio. However, 10 participants were reclassified (e.g. from normal to high) and 4 participants were re-diagnosed from having a true to a simulated intermittent XT of the divergence excess type. The results of this study illustrate how the choice of fixation target can result in incorrect AC/A ratio measurement leading to incorrect diagnoses which can have negative implications on patient management.

ORTHOPTIC WORKFORCE SURVEY 2006 - RESULTS

Sue Heathcote Wendy Holland, Val Tosswill
Orthoptic Association of Australia

The 'Orthoptic Workforce Survey 2006' was distributed to Orthoptists throughout Australia and overseas to obtain up-to-date information on Orthoptists' demographics, qualifications, association memberships, current work status, workplace practices and continuing professional education. There was a total of 234 respondents who have provided valuable information for both the Orthoptic profession and the OAA Inc. Results will be presented along with comparisons with previous surveys and discussion of key areas that can be acted on to further our profession and association.

AN OPPORTUNE TIME FOR PROGRESS: THE IMPACT OF LEGISLATIVE CHANGE ON MODELS OF EYE CARE

Zoran Georgievski
Department of Clinical Vision Sciences, La Trobe University
Northern Health

The legislative changes in Victoria that saw orthoptists be allowed to prescribe glasses this year have created opportunity for our profession. As service frameworks for the delivery of eye care continue to change, our profession is required to respond to the challenge of fitting within new models of care, with the possibility of providing leadership in eye healthcare structures.

A profession must change or evolve if it is to remain relevant to the community, and indeed, in order to be efficient and be able to compete for the health care dollar. Governments and hospitals, like businesses, are seeking increasing efficiency (more for their money!), better / smarter ways of practice (more for their money!), as well as high standards of health care (more for their money!) as expected by the public.

In this presentation, new models of care in an ophthalmology / orthoptic hospital outpatient setting (Northern Health) will be presented, with some opportunity for discussion.

EYE HEALTH CARE PROVISION AT THE ROYAL CHILDREN'S HOSPITAL

Connie Koklanis
Department of Clinical Vision Sciences, La Trobe University
Department of Ophthalmology, Royal Children's Hospital, Melbourne

Eye health care services are predominately ambulatory with a large proportion of eye disease being managed on an outpatient basis. Hospitals are facing increasing demands on their clinical service which is translating into long waiting list for outpatient appointments. Over several years the Royal Children's Hospital in Melbourne, as the key provider of public specialist paediatric ophthalmology services in Victoria, has had a dramatic increase in the number of referrals it receives and the numbers of patients it reviews per year. To assist in managing this increase in demand, a new orthoptist led model of care was recently introduced at the Royal Children's Hospital. The model of care and preliminary outcomes will be discussed in this presentation.

STUDENTS, GRADUATES AND OCULAR MOTILITY SKILLS

Sue Silveira[1] **, Zoran Georgievski**[2] **, Connie Koklanis**[2]
1 Discipline of Orthoptics, Faculty of Health Sciences, The University of Sydney
2 Department of Clinical Vision Sciences, La Trobe University

For many years the clinical education of orthoptic students has been strongly supported by a group of highly committed orthoptists working in the field. Curriculum requirements dictate that orthoptic students gain clinical experience and competency in a broad range of specialised practice areas, to prepare them for a workforce that expects a highly skilled practitioner.

Academics are continually challenged with increasing student numbers and static or diminishing clinical locations which can provide specialised practice experience. Also, the availability of clinical in these areas is often determined by professional trends. One such area is the investigation and management of strabismus patients.

A questionnaire that will aim to determine current practitioner's level of confidence and experience in strabismus will be discussed. This questionnaire will be used to facilitate discussion regarding the orthoptist's role in this area and to develop strategies for continuing clinical education of orthoptic students in strabismus.

EDUCATIONAL FRAMEWORKS: IS HOSPITAL BASED TRAINING BETTER THAN UNIVERSITY?

Kerry Fitzmaurice
Department of Clinical Vision Sciences, La Trobe University

Whilst innovation in teaching has been a commonplace phenomenon in the primary and secondary education domains for some 50 years the tertiary education sector has been much slower to consider pedagogy and the impact on student learning. This paper will present a discussion of the change in focus from teaching to learning and the impact of this on teaching methodology. The implication of appropriate selection of learning paradigms to developing good practioners will also be discussed.

NEW LA TROBE COURSE TO COMMENCE IN 2009

Zoran Georgievski, Linda Malesic
Department of Clinical Vision Sciences, La Trobe University

In line with a complete over haul of Health Sciences teaching and learning at La Trobe University, the current undergraduate qualification degree in orthoptics is being reviewed. As of 2009, we will commence an undergraduate Bachelor of Health Sciences / Masters of Orthoptics double degree program. This course will have a 'common' first year that will involve all students enrolled in the allied health science programs, with the introduction of ophthalmic and orthoptic sciences along with more advanced human biosciences from the second year. The new program will adopt the most current and relevant teaching strategies (e.g. enquiry based learning), including the use of IT / media technology. The clinical teaching will be undertaken in the latter part of the course once the theory and practical skills have been introduced. The style of clinical teaching will be similar to an intern year - students will be placed in clinical schools linked to large public hospitals or private ophthalmology practices that will have strong support from the University. With the commencement of a Masters level qualification, we anticipate and will strive for a high calibre graduate that will be well equipped to deal with the challenges that face the orthoptic profession presently and in the future.

MASTER OF HEALTH SCIENCE AT SYDNEY UNIVERSITY FOR PRACTICING ORTHOPTISTS

Nathan Clunas, Neryla Jolly
Discipline of Orthoptics, Faculty of Health Sciences, The University of Sydney

In 2008 Post Graduate studies will be available for Orthoptists who are eligible to register with the Australian Orthoptic Board. The course is in the field of Health Sciences and is offered in 2 forms:

1. Graduate Certificate of Health Sciences which has four units of study (6 credit points each unit)

2. Masters of Health Sciences which has 8 units of study (6 credit points each unit)

Each course can be studied on a part time or full time basis and each unit of study will involve a range of teaching methods including distance web based sessions, block mode sessions for intensive theory and on site practical sessions.

Students will be required to study 2 core units such as Health Care Systems and Research & Inquiry in Health Professions. The remaining units can be Orthoptic specific units or from other discipline areas eg Gerontology.

The units of study in the discipline area of Orthoptics are: a, refraction practice, b. peri operative practice, c. vision and driving,d. advanced ocular motility, e. vision impairment, f. current issues in ophthalmology

This paper will present detailed information about the proposed courses and seek discussion about the implementation.

DIABETIC RETINOPATHY SCREENING IN WESTERN AUSTRALIA

Chris Barry
Lions Eye Institute

Diabetes and Diabetic Retinopathy screening has been a feature of ophthalmology in rural and remote Western Australia since 1978. With the introduction of the non-mydriatic retinal camera in the mid 1980s, Aboriginal Medical Workers were trained to use the Polaroid retinal cameras and results sent to Perth for analysis with treatment arranged in Regional centres. This paper will outline Western Australian Aboriginal screening programmes as reviewed in 2007 and some results presented.

Digital systems are currently being installed in some centres with the attendant technical and practical problems. Fast, high resolution, digital image transfer is now a reality from remote communities. However, other problems have emerged including the lack of anonymity and confidentiality of patient information, a process that is currently overlooked by many software packages.

WHEN IS IT GLAUCOMA? HANDY HINTS WHEN EVALUATING THE OPTIC NERVE HEAD FOR GLAUCOMATOUS DAMAGE

Linda Malesic
Department of Clinical Vision Sciences, La Trobe University
Glaucoma Monitoring Clinic, Royal Victorian Eye and Ear Hospital

This presentation will outline the strategies adopted by clinicians on the Glaucoma Monitoring Clinic at the Royal Victorian Eye and Ear Hospital when evaluating the optic nerve head (via indirect ophthalmoscopy) for detection or progression of glaucomatous damage. The "4-step" approach in evaluating the optic nerve head will be discussed and examples will be used to illustrate the characteristic changes that occur during early to late stage glaucoma. The ways in which to document these observations will also be highlighted.

ACRONYMS AHOY! - TECHNOLOGICAL ADVANCES IN GLAUCOMA DIAGNOSIS AND PROGRESSION

Nathan Clunas
Discipline of Orthoptics, Faculty of Health Sciences, The University of Sydney

Recent developments in ophthalmic equipment have changed the way in which clinicians diagnose and measure the progression of glaucoma. This talk will focus on the latest technologies including HRT, OCT, FDT, GDx, Humphrey Matrix, updated versions of HFA and the measurement of CCT. An emphasis will be placed on the orthoptist's role with the use and interpretation of this equipment.

AMD - A REVIEW

Mara Giribaldi
Marsden Eye Specialists

This review on Age Related Macular Degeneration will explain aspects of the disease and show how Ocular Coherence Tomography (OCT), photography and Fluorescein Angiography (FFA) is used in it's diagnosis at Marsden Eye Specialists.

CURRENT MANAGEMENT OPTIONS FOR AMD: AN OVERVIEW

Meri Vukicevic[1,2] **Stavroula Stylianou**[2]
1 Department of Clinical Vision Sciences, La Trobe University
2 Eye Surgery Associates

This presentation will provide an overview on current management options for age-related macular degeneration (AMD). These management options include visudyne, lucentis and avastin therapy. Information in relation to the following themes will be provided: The purpose of each treatment, common method of use, conditions each treatment is suitable for, and typical improvement seen as a result of treatment.

RETINAL ASSESSMENT USING OCT: AN ORTHOPTIST'S COMPILATION OF TIPS

Suzane Vassallo[1] **Maria Kolic**[2]
1 Victoria Parade Eye Consultants, St Vincent's Medical Centre, Fitzroy Vic 3065
2 ARC Vision Science Centre of Excellence, Australian National University, Canberra, Australia.

When the device first arrived in the clinic, it seemed problematic from the start. Firstly, we had to find a position where it should go. Then, we had to learn how to use it – my patience with learning yet another piece of technology was waning. In an attempt to obtain some practical tips on how to tackle the OCT (and avoid reading the manual) I contacted Maria who became my mentor in the process of acquiring this new skill. This talk will highlight the novice's journey in understanding how to get the most out of this imaging device, and how a skilled and patient mentor, even when interstate, can make all the difference.

EVIDENCE BASED MEDICINE - APPLICABILITY TO ORTHOPTICS AND OPTHALMOLOGY

Rachel McIntosh
Retinal Vascular Imaging Centre, Centre for Eye Research Australia

The practice of Evidence Based Medicine is increasingly being utilised to develop and assess many diagnostic and treatment options for patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external evidence from systematic research. (Centre for Evidence Based Medicine, 2007). It is also about integrating clinical expertise and best research evidence with patient values. Evidence based medicine involves tracking down the best evidence to answer our clinical questions. To determine the accuracy of a diagnostic test, to determine the safety and efficacy of an intervention and to answer questions regarding prognosis we need to find research findings that have employed the most applicable study designs, eliminated as much bias as possible and have sufficient sample size to answer our questions.

This presentation will present a brief background on the development and use of Evidence Based Medicine in Orthoptics and Ophthalmology. In addition to this a description of the methods used to critique the evidence available and a brief overview of how to conduct a systematic review will be provided.

TREATMENT OF MACULA OEDEMA WITH AVASTIN: CASE STUDY

Vivien Lee
The Eye Institute

A 66 year old male presented with a 10 day history of left blurred vision. He had never had the need to wear glasses for distance vision. Investigation showed macula oedema and a retinal vein occlusion. OCT showed thickening of the macula. Avastin treatment was indicated which resulted in a visual improvement from 6/12 to 6/7.5 within 2 months.

DIABETIC MACULAR OEDEMA - CURRENT AND FUTURE TREATMENT OPTIONS

Julie Ewing
Retinal Vascular Imaging Centre, Centre for Eye Research Australia

Diabetic Retinopathy (DR) is the leading cause of blindness in the working population of Australia and other developed countries. The most common cause of vision loss from DR is diabetic macular oedema (DME). All patients with diabetes are at risk of developing DME with risk factors including duration of disease, poor blood sugar control and hypertension. Good control of these factors is known to reduce the risk of DME developing and progressing. The current standard of treatment for DME is focal or grid laser photocoagulation. Although this has been shown to be effective in reducing the risk of vision loss, only a small number of patients experience an improvement in visual acuity. Some patients may not be suitable for laser due to the central area of swelling.

A number of new treatments are currently being investigated to treat DME and in some cases are already being used clinically. These include intravitreal triamcinolone and other longer release steroids as well as Macugen, Lucentis and Avastin. The current research on these treatments will be discussed.

ORTHOPTISTS ROLE IN SELECTING PATIENT SUITABILITY FOR MONOVISION LASER CORRECTION WHO HAVE OCULAR MOTILITY DISORDERS

Shih Shih Ta
The Eye Institute

Patients with ocular motility disorders often present to ophthalmology clinics for laser vision correction. However, several issues need to be considered when treating these patients. The role of the Orthoptist in assessing ocular motility patients, their likelihood of gaining a positive outcome post laser corrective surgery and the strategies employed by the Orthoptists at The Eye Institute will be discussed.

Named Lectures, Prizes and Awards of the Orthoptic Association of Australia Inc.

THE PATRICIA LANCE LECTURE

1988	Elaine Cornell	(Inaugral)
1989	Alison Pitt	Accommodation deficits in a group of young offenders
1990	Anne Fitzgerald	Five years of tinted lenses for reading disability
1992	Carolyn Calcutt	Untreated early onset esotropia in the visual adult
1993	Judy Seaber	The next fifty years in orthoptics and ocular motility
1995	David Mackey	
1997	Robin Wilkinson	Heredity and Strabismus
1998	Kerry Fitzmaurice	Research: A journey of innovation or rediscovery
1999	Pierre Elmurr	
2005	Kathryn Rose	The Sydney Myopia Study: implications for evidence based practice and public health
2006	Frank Martin	

THE EMMIE RUSSELL PRIZE

1957	Margaret Kirkland	Aspects of vertical deviation
1959	Marion Carroll	Monocular stimulation in the treatment of amblyopia exanosia
1960	Ann Macfarlane	A study of patients at the Children's Hospital
1961	Ann Macfarlane	A Case history "V' Syndrome
1962	Adrienne Rona	A survey of patients at the Far West Children's Health Scheme, Manly
1963	Madeleine McNess	Case history: right convergence strabismus
1965	Margaret Doyle	Diagnostic pleoptic methods and problems encountered
1966	Gwen Wood	Miotics in practice
1967	Sandra Hudson Shaw	Orthoptics in Genoa
1968	Leslie Stock	Divergent squints with abnormal retinal correspondence
1969	Sandra Kelly	The prognosis in the treatment of eccentric fixation
1970	Barbara Denison	A summary of pleoptic treatment and results
1971	Elaine Cornell	Paradoxical innervation
1972	Neryla Jolly	Reading difficulties
1973	Shayne Brown	Uses of fresnel prisms
1974	Francis Merrick	The use of concave lenses in the management of intermittent divergent squint
1975	Vicki Elliott	Orthoptics and cerebral palsy
1976	Shayne Brown	The challenge of the present
1977	Melinda Binovec	Orthoptic management of the cerebral palsied child
1978	Anne Pettigrew	
1979	Susan Coil	Nystagmus blocking syndrome
1980	Sandra Tait	Foveal abnormalities in ametropic amblyopia
1981	Anne Fitzgerald	Assessment of visual field anomalies using the visually evoked response.
1982	Anne Fitzgerald	Evidence of abnormal optic nerve fibre projection in patients with Dissociated Vertical Deviation: A preliminary report
1983	Cathie Searle	Acquired Brown's syndrome: A case report
	Susan Horne	Acquired Brown's syndrome: A case report
1984	Helen Goodacre	Minus overcorrection: Conservative treatment of intermittent exotropia in the young child
1985	Cathie Searle	The newborn follow up clinic: A preliminary report of ocular anomalies
1988	Katrina Bourne	Current concepts in restrictive eye movements: Duane's retraction syndrome and Brown's syndrome
1989	Lee Adams	An update in genetics for the orthoptist: a brief review of gene mapping
1990	Michelle Galaher	Dynamic Visual Acuity versus Static Visual Acuity: compensatory effect of the VOR
1991	Robert Sparkes	Retinal photographic grading: the orthoptic picture
1992	Rosa Cingiloglu	Visual agnosia: An update on disorders of visual recognition
1993	Zoran Georgievski	The effects of central and peripheral binocular visual field masking on fusional disparity vergence
1994	Rebecca Duyshart	Visual acuity: Area of retinal stimulation
1995-7	Not awarded	
1998	Nathan Clunas	Quantitive analysis of the inner nuclear layer in the retina of the common marmoset callithrix
1999	Anthony Sullivan	The effects of age on saccadis mode to visual, auditory and tactile stimuli

2001	Monica Wright	The complicated diagnosis of cortical vision impairment in children with multiple disabilities
2005	Lisa Jones	Eye Movement Control During the Visual Scanning of Objects
2006	Josie Leone	The prognostic value of the cyclo-swap test in the treatment of amblyopia using atropine
2007	Thong Le	What is the difference between the different types of divergence excess intermittent exotropia

PAEDIATRIC ORTHOPTIC AWARD

1999	Valerie Tosswill	Vision impairment in children
2000	Melinda Symniak	
2001	Monica Wright	
2005	Kate Brassington	Amblyopia and reading difficulties
2006	Lindley Leonard	Intermittent exotropia in children and the role of non-surgical therapies
2007	Jodie Leone	Prevelance of heterophoria in Australian school children

THE MARY WESSON AWARD

1983	Diana Craig (Inaugral)
1986	Neryla Jolly
1989	Not awarded
1991	Kerry Fitzmaurice
1994	Margaret Doyle
1997	Not Awarded
2000	Heather Pettigrew
2004	Ann Macfarlane

PAST PRESIDENTS OF THE ORTHOPTIC ASSOCIATION OF AUSTRALIA INC

1945-7	Emmie Russell	1964-5	Lucy Retalic	1981-82	Marion River
1947-8	Lucy Willoughby	1965-6	Beverly Balfour	1982-3	Jill Stewart
1948-9	Diana Mann	1966-7	Helen Hawkeswood	1983-5	Neryla Jolly
1949-50	E D'Ombrain	1967-8	Patricia Dunlop	1985-6	Geraldine McConaghy
1950-1	Emmie Russell	1968-9	Diana Craig	1986-7	Alison Terrell
1951-2	R Gluckman	1969-70	Jess Kirby	1987-9	Margaret Doyle
1952-4	Patricia Lance	1970-1	Neryla Heard	1989-91	Leonie Collins
1954-5	Diana Mann	1971-2	Jill Taylor	1991-3	Anne Fitzgerald
1955-6	Jess Kirby	1972-3	Patricia Lance	1993-5	Barbara Walsh
1956-7	Mary Carter	1973-4	Jill Taylor	1995-7	Jan Wulff
1957-8	Lucille Retalic	1974-5	Patricia Lance	1997-00	Kerry Fitzmaurice
1958-9	Mary Peoples	1975-6	Megan Lewis	2000-2	Kerry Martin
1959-60	Patricia Lance	1976-7	Vivienne Gordon	2002-4	Val Tosswill
1960-1	Helen Hawkeswood	1977-8	Helen Hawkeswood	2004-6	Julie Barbour
1961-2	Jess Kirby	1978-9	Patricia Dunlop	2007-8	Heather Pettigrew
1962-3	Patricia Lance	1979-80	Mary Carter		
1963-4	Leonie Collins	1980-1	Karen Edwards		

OAA Office Bearers, State Branches & University Training Programs

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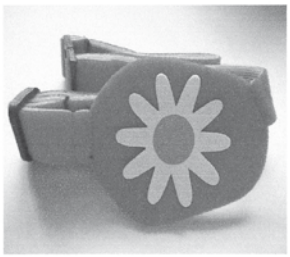

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