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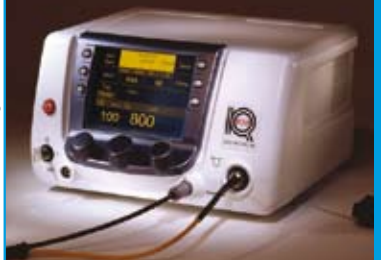

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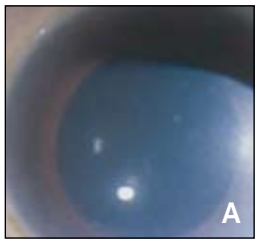
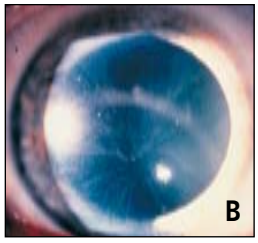


Corneal Clouding[1]

it could be Mucopolysaccharidosis I (MPS I)

Corneal clouding develops in virtually all patients with MPS I and can lead to significant visual disability.



Corneal Opacities[2]

it could be Fabry disease

Distinctive corneal opacity (corneal verticillata or vortex keratopathy) in Fabry disease. Note the whorl-like corneal rays emenating from a single vertex like the spokes of a wheel.

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References: 1. Ashworth JL.*et al.* Survey of ophthalmology. Vol 51; No 1: 2006. 2. Desnick RJ. *et al.* Annal of Int Med. Vol 138; No 4: 2003.

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Photo B. courtesy of RJ Desnick PhD, MD.

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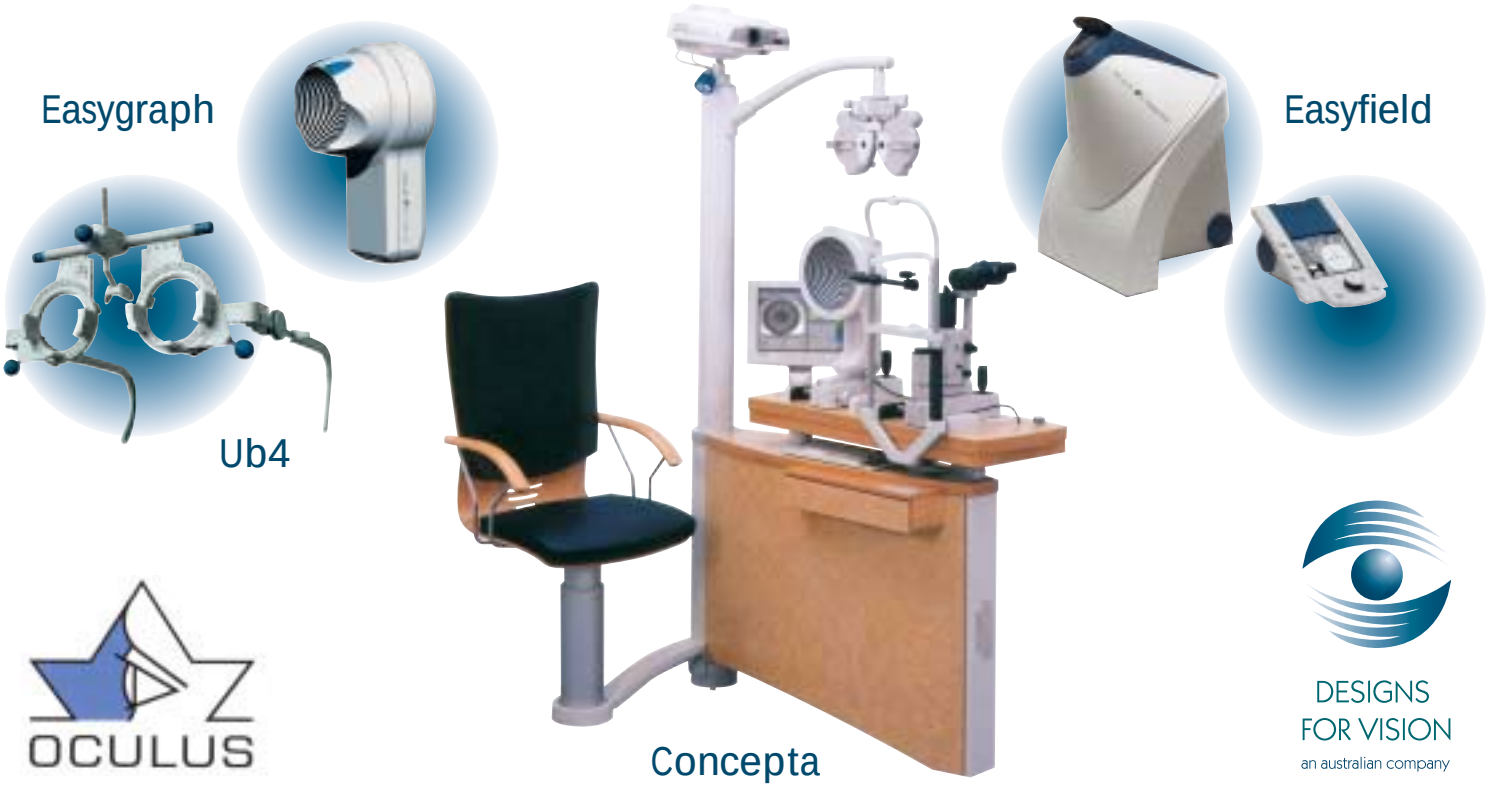
Oculus Style Easygraph



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The Australian Orthoptic Journal is peer-reviewed and the official biannual scientific journal of the Orthoptic Association of Australia Inc. The Australian Orthoptic Journal features original scientific research papers, reviews and perspectives, case studies, invited editorials, letters and book reviews. The Australian Orthoptic Journal covers key areas of orthoptic clinical practice – strabismus, amblyopia, ocular motility and binocular vision anomalies; low vision and rehabilitation; paediatric ophthalmology; neuro-ophthalmology including nystagmus; ophthalmic technology and biometry; and public health agenda.

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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:

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- **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.

References: References must be numbered consecutively in order of appearance in the text. In text references should be designated a superscript number following all punctuation.

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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Conflict of Interest: Authors should declare any financial support or relationships that may pose a conflict of interest or perceived to.

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.

ENQUIRIES

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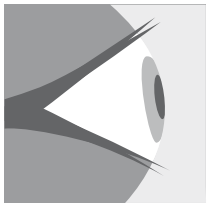

ORTHOPTIC ASSOCIATION of AUSTRALIA inc

CONTENTS

Editorial

On Convergence... On the Strength of Community

In May 2008, orthoptists from around the world will converge on the Belgium city of Antwerp to participate in the XI International Orthoptic Congress. The theme of the Congress is 'Reflections on the Diversity of Current Orthoptics', offering our profession the opportunity to reflect on the evolution of orthoptists' roles in the eye health care team and the diversity of our practices.

The Congress will give us more than just the chance to reflect on our roles, however. Such meetings, including national conferences, also provide us with the opportunity to share ideas and experiences, to 'benchmark', to deliberate on and discuss issues, and to learn new information. These opportunities can be had in and between plenary sessions, during social functions, and well after we have left the venue for our home cities.

Congresses enable us to network, both for professional and scientific or research purposes. Congresses help to strengthen and consolidate our sense of 'orthoptic community'. This is important. Working in relatively small organisations and often separated by significant distance, we can run the risk of becoming isolated and out of touch with our colleagues and profession. Networking and communicating with colleagues who share common interests and passions builds 'orthoptic community' and can bring us home with renewed enthusiasm of our daily work and positive experiences we can share with work colleagues.

Readers may be wondering how this relates to the Australian Orthoptic Journal. Our present publication (few may recall!) actually evolved from our first publication in 1959, the Transactions of the Orthoptic Association of Australia. This was a conference proceedings publication consisting of a record of the presentations at our annual scientific conference. Our Journal has this strong link with our national conference. It is indeed a scientific publication, but it is also a publication for our profession. Orthoptists' core business is patient care, so we encourage the documentation of not only original research papers, but also patient case studies, clinical perspectives and literature reviews – all of these contribute to the continuing education of a professional clinician.

Some two decades after that first publication in 1959, the 1980 issue of the Australian Orthoptic Journal contains an editorial and a story of an international orthoptist who attended various Australian conferences, who shared ideas, broadened our horizons, became a close colleague of and good friend to many. This story will repeat itself many times as orthoptists devoted to their profession pack their cases to converge on Antwerp.

Connie Koklanis & Zoran Georgievski
Department of Clinical Vision Sciences
La Trobe University

Editorial

The Value of Reviews

A review is a body of text which reviews the critical aspects of published knowledge on a particular topic area. It specifically aims to provide up-to-date information on the literature related to the topic area and often provides justification for future research in the area.

This edition of the AOJ contains a number of review papers. Although these reviews do not report new research findings, their benefit is their adherence to the purpose of reviews; that is, the provision of a compilation and analysis of results from past literature which allows the comparison of outcomes, proposals, theories to generate a consensus opinion and highlight controversies plus evidence gaps hence leading to the recommendation for further targeted research.

The review topics in this edition vary considerably in topic which reflects the extended knowledge base of Orthoptists today. The review by Moore and Malesic (Glaucoma and sleep apnoea, is there a link?) considers a causative role: whether sleep apnoea can be considered a risk factor for glaucoma. Whilst, Le, Georgievski and Koklanis (Surgical considerations in the treatment of intermittent exotropia) provide a review that considers a management role: the importance of timing, type and amount of surgery for intermittent exotropia.

Despite the differing topic areas, these reviews show striking similarities in outcome. They prove the difficulty of reaching a definitive conclusion where there are insufficient studies available of appropriate quality and parity. They identify the lack of information on certain aspects of the topic in question thereby highlight knowledge gaps that can target future research prioritisation. They demonstrate the higher frequency of retrospective studies and the need to move towards prospective research with appropriate and justified outcome measures. And, in undertaking prospective research, these reviews demonstrate the importance of strict inclusion/exclusion criteria in promoting validity of studies, the important of robust methodology and representative population sampling and the important of establishing normative data distinct from a population with ocular pathology. The relevance of promoting good quality prospective research is particularly important for those conditions that are known to be increasing in prevalence in certain populations, for example, the ageing population.

It is important for any medical journal that a mix of article types is provided for the reader to offer a breadth of information encompassing new and past knowledge. Reviews are one such important article type and the AOJ succeeds in providing a thorough mix of research information for its readership.

Dr Fiona Rowe
Division of Orthoptics
School of Health Sciences
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United Kingdom

Comparison of the Effect of Enlarged Print VS a Hand Held Visolett Magnifier on Reading Performance in Fully Sighted Children.

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ABSTRACT

Introduction: The aim of this project was to determine if reading performance in terms of reading speed, accuracy and comprehension was affected by use of two low vision aids (LVA) a Hand-Held Visolett Magnifier (HHVM) and enlarged print.

Method: Data was collected from 21 students in year 4, all fully sighted. Their reading performance was assessed whilst reading with a HHVM, with enlarged print and without a LVA. Reading performance was assessed using the Ekwall and Shanker Reading Inventory, which included a measurement of reading speed, accuracy and comprehension.

Results: Students gained maximum reading speed and accuracy with the enlarged print and without a LVA. Reading with the HHVM caused a reduction in reading speed and accuracy, however there was no difference in the comprehension scores between the three conditions.

Discussion: The enlarged print allowed the students to demonstrate a higher level of reading speed and accuracy when compared to reading with the HHVM, primarily due to the influence of the device and the student's inexperience as opposed to a reduction in the reading performance. This influence may be minimised with a period of training and adaptation to the HHVM. Reading comprehension was not affected when either the HHVM or enlarged print was used.

Keywords: Low vision aids, reading performance

INTRODUCTION

Being able to read is seen as one of the most important activities in today's society, and much of the way we learn, work and socialise is literacy bound. The development of reading ability is important in the learning processes of all children. Reading is a complex system of knowledge and activities which may be divided into four interrelated processes[1], including the phonological, meaning, mapping, and orthographic processes. The phonological process refers to the pronunciation of the written word[1]. The meaning and mapping processes contain the knowledge of word meaning and an ongoing understanding of the text[2]. The orthographic process is responsible for perceiving the sequence of letters in the text and is the first to be initiated as reading depends foremost on visual letter recognition[2]. A visual system that is able to resolve written words clearly and correctly is essential for children who are developing their reading skills[2] and the presence of vision impairment may seriously impede the child's progress[3].

The primary aim of reading is to develop understanding of the written text. Reading performance should therefore be assessed in terms of this understanding, that is, how the reader gains meaning, significance, enjoyment and value from the printed text[4]. When assessing oral reading, that is reading a passage aloud, the student's speed, accuracy and comprehension can all be used as specific measures of reading performance[1]. Reading speed is measured by the number of words read per minute and reading accuracy is measured by the number of individual errors recorded[5]. The assessment of reading accuracy is often termed miscue analysis and can be defined as the actual observed response, which does not match the expected response[6]. The miscue analysis allows insight into the reader's understanding of the text and aids in the evaluation of their reading performance. The aim of testing reading comprehension is to allow the

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student to express what they have learnt from the passage. This is assessed by testing the immediate recall of the main idea of the narrative through oral questioning.

The World Health Organization defines low vision as a permanent vision loss resulting in a visual acuity of less than 6/18 which cannot be medically or optically corrected[7]. The majority of low vision patients will seek support with reading8 and low vision aids (LVA) have been found to provide visual rehabilitation to a very high percentage of low vision adult readers[10]. Low vision children can also be assisted in their reading development by the use of LVAs. The selection of a LVA is usually dependant upon the child's residual vision and personal preference. Two common methods used to assist children with low vision are enlarged print and optical magnifiers.

Previous research has been conducted to compare how LVAs impact on reading performance, but frequently reading speed, in isolation from accuracy and comprehension, has been the only measure used to indicate reading performance. For example, in fully sighted adults who read with a magnifier, it has been shown that initially their reading speed is affected, i.e. speed reduces as the amount of magnification increases, possibly due to a mismatch with saccadic eye movements and the amount of magnification[11]. A decrease in the forward length of the saccade with an increase in the retrace movement has been shown to occur when reading with a magnifier[12]. However, this influence on reading speed has been found to be within 20% of normal reading speed, regardless of the type of LVA used[13]. Studies have shown stand magnifiers to cause maximum reduction in reading speed, with the least reduction caused by microscopes[14].

Similar studies have been conducted on low vision adults, finding that the reading speed may not differ significantly depending on whether large print or a magnifier is used, once the reader becomes experienced in using the LVA[8]. For low vision children the situation is much the same, once adequate training in the use of the LVA has been provided[8].

However, reading is a complex activity that cannot be conclusively assessed using a single measure. Reading speed only measures one aspect of oral reading and does not provide an indication of accuracy and comprehension as reading speed does not always correspond with reading performance[4]. The measurement of reading speed, accuracy and comprehension could provide a better picture of how a LVA affects a child's reading performance. An assessment of reading performance of fully sighted children whilst using a LVA could provide a more accurate indication of the influence of LVAs on these specific aspects of reading performance. This information may then assist clinicians in the prescription of the LVAs which are likely to maximise reading performance.

The present study assessed the reading performance of fully sighted children under three conditions. These conditions were reading with an optical magnifier, enlarged print, and without any aids, (termed standard reading). These two LVAs were selected because previous research[15,16] has shown that the performance of an optical magnifier and enlarged print with respect to reading speed and comprehension were comparable. However a comparison with respect to reading accuracy has not been carried out.

The aim of this study was to assess the effect the three reading conditions had on reading performance. By selecting fully sighted children the impact of reduced vision was controlled for.

METHOD

Participants

A sample of 21 year four students (19 females and 2 males) was taken from an independent primary school in Sydney. Year four students were selected because they have reached a stage at which they can read an extensive range of texts independently, respond to a variety of themes and issues and when reading aloud use appropriate stress, pause and intonation[18].

Before students were selected for the sample, a subject information statement and informed consent form were distributed outlining the aims for the research and what their participation involved. Students were then included in the sample once signed informed consent was gained from either their parents or guardian.

All students selected for the sample underwent vision screening to ensure an equal standard of vision, straight eyes and a normal range of eye movements. This vision screening assessed six aspects of visual function. Visual acuity was measured at 1/3 metre using the Maclure Bar Reading Book and at 6 metres using the Snellens Chart. Students with vision of 6/6 and N5 or better in both eyes were included in the sample as this was considered normal vision.

A cover test was performed at 1/3 metre and 6 metres, assessing the student's ocular posture. Students with an exophoria greater than 8, esophoria greater than 4, or with any vertical or manifest deviation were excluded from the study. These criteria ensured that children with a poorly controlled heterophoria which could potentially disrupt reading were not included in the sample.

Each student's convergence near point was measured using the 'pen to nose' technique. Students who were unable to converge to within 5cm of their nose were excluded from the sample. This criterion ensured that only students with good binocular control of their eyes were included.

Ocular movements were completed for all nine positions of gaze and students with a significant A or V pattern were excluded from the sample; significant A or V pattern was considered as a difference of greater than fifteen dioptres for an exo deviation and ten dioptres for an eso deviation[18]. This criterion ensured that students whose heterophoria increased in depression were not included in the sample.

Lang Stereotest was used to measure the amount of stereoacuity in seconds of arc. Students who did not demonstrate stereoacuity of 200 seconds of arc or better were excluded due to a lack of high quality binocular single vision.

Materials

The Hand Held Visolett Magnifier (HHVM) of 1.8 times was selected for use in this study due to its ease of use, availability and the fact that it is a commonly prescribed LVA by Vision Australia for low vision children[19]. The HHVM consists of a high powered convex lens surrounded by a plastic carrier, causing an increase in print size and a reduction in the field of view available for reading.

Enlarged print refers to any size print that is larger than normal and generally refers to 18 or 24 point type[20]. To obtain the enlarged print, each piece of text was enlarged by 1.8 times so the size of the text was the same size as the text seen through the magnifier. This created approximately 24 point type, which also equated to type seen through the HHVM.

Procedure

The subject's reading performance was assessed under three conditions, reading with the use of the HHVM, enlarged print and reading without a LVA (standard reading). The three test conditions were administered in random order to eliminate a learning effect.

Reading was assessed using the Ekwall and Shanker Reading Inventory[21]. The inventory contains four equivalent reading passages written by Ekwall using the Harris-Jackson Readability Formula[21]. The passages were divided into two sections. Passages A and C were designed for assessing oral reading and B and D were designed for the assessment of silent reading. However in this study, the two silent reading passages were used for the assessment of oral reading, which allowed for four passages, one for practice and the remaining three for testing. The reading passage for each of the reading conditions was randomised. Each passage contained ten sentences, each of which related to a comprehension question, creating a total of ten questions.

Three aspects of reading were analysed during the reading assessment. Each student's reading rate was calculated as the time taken to read the complete passage divided by the number of words in the passage, to provide a word per minute ratio.

The reading accuracy errors were divided into six different categories. Omissions occurred when the student failed to read a word in the passage. Insertions occurred when another word was added into the text. Substitution occurred when a similar word to that printed on the page was spoken and repetition occurred when a word or phrase was repeated by the student. Mispronunciation and words which were pronounced for the student when they were unable to decode the word in less than five seconds were also included as errors[21].

To obtain a reading accuracy score the total number of errors for each passage was counted and recorded. Words which were self-corrected, a disregard for punctuation and pauses of less than five seconds were not counted as errors. The counting of repetitions followed the suggested guidelines[21]. A high accuracy score indicated poor reading accuracy and a low score indicated an excellent reading accuracy. To enable a reliable measure of reading accuracy, the student's reading was tape-recorded and the miscue analysis was conducted once the testing was completed. The students were required to respond to questions verbally, assessing reading comprehension. This created a comprehension score out of ten. The students' answers were not required to be identical to the model answers on the scoring sheet to be judged as correct. A reasonable answer which meant the same as the written answer (such as Dad or Father) was judged as correct. When the student gave an answer which was unclear, the researcher prompted the student with a neutral question, such as 'Can you tell me more?', thus allowing the student to clarify their answer and ensure scoring accuracy; this method also followed the suggested guidelines[21].

The reading assessment occurred within the school grounds with only the student and researcher present in the testing room. The student was seated at a writing desk on an adjustable seat which could be moved to a height at which the student felt most comfortable.

The testing order of the three reading conditions was randomised. For each reading condition the student was instructed to read each passage as they would normally read aloud in class.

When reading with the HHVM, each student was given instruction on how to use the HHVM and allowed time to practice. The aim of the practice time was to familiarise the student and improve the student's manual dexterity while using the HHVM. However this practice time was only short, hence the student's lack of experience with the use of the HHVM could not be completely eliminated. When reading with the HHVM the student was instructed to maintain a constant distance between themselves and the HHVM to control for distance. This was monitored by the researcher. As with the HHVM, the student was allowed a period of time in which to familiarise themselves with the enlarged print and given a brief practice time.

Design and Analysis

A repeated measure design was used to analyse the results of the study. The independent variable was the type of LVA used and the dependant variable was reading performance, which was divided into reading speed, accuracy and comprehension. The data was analysed by a series of planned contrasts for each of the dependant variables; this is the most powerful form of analysis. A supplementary analysis using the Spearman rank order correlation was conducted to determine any relationship present between the dependant variables. Prior to the analysis the assumption that all three passages would be read at the same average speed was checked with an analysis of variance, followed by post hoc Scheffe tests to determine if all three test passages were read at the same speed.

RESULTS

Assumptions checks

A multiple comparison Scheffe test was used to test all four of the reading passages used for the testing procedure. This preliminary analysis was performed to determine if there was any difference between each reading passage in terms of speed, accuracy or comprehension. Passage B had significantly lower reading speeds when compared to passage C and D when the passage was used for standard reading (Table 1). There was no difference in reading speed between passage A and B. However, the average overall reading speed was the same whether passage B was included or not, hence to correct for passage B in the reading analysis was unnecessary. No other statistical differences were found when the other reading passages were compared.

Planned Contrast Results

Reading performance data was collected from twenty one year four students (2 males and 19 females) over a three month period from May 2002 to July 2002.

Descriptive statistics and within subjects' planned contrasts were performed to compare the results between standard reading, enlarged print and HHVM. Standard reading was used as the control condition.

Maximum reading speed was obtained by either reading with enlarged print or standard reading (Table 2). The standard reading speed was significantly higher than the enlarged print and HHVM combined ($F_{1,20} = 5.37$, $p = 0.031$). This difference appeared to be due to the lower score for the HHVM, which was significantly lower than the enlarged print reading speed ($F_{1,20} = 25.56$, $p<0.001$).

The HHVM had the highest mean of accuracy errors (Table 3). The HHVM accuracy score was significantly higher than the enlarged print and standard reading combined ($F_{1,20} = 9.184$, $p = 0.007$). However there was no difference in accuracy score between the enlarged print and standard reading ($F_{1,20} = 0.329$, $p = 0.573$).

Reading comprehension scores were compared across the three test scenarios. The mean comprehension score (out of ten) was equal for standard reading and enlarged print (Table 4). Although the comprehension scores for the HHVM appeared to be lower than the enlarged print and standard reading, this showed no statistical significance ($F_{1,20} = 1.191$, $p = 0.288$).

Supplementary Analysis

A Spearman rank order correlation was conducted to determine whether any relationship between speed, accuracy and comprehension was present. A Spearman correlation was selected to minimise the effect of significant outliers impacting the correlation.

There was a significant correlation between reading speed and accuracy for both standard reading and enlarged print. There was a negative correlation between standard reading speed and accuracy ($r = -0.520$ $p = 0.016$) indicating that as reading speed increased the accuracy scores improved. This relationship was also present for the reading speed and accuracy scores achieved with the enlarged print ($r = -0.606$ $p = 0.005$). This relationship did not occur whilst reading with the HHVM indicating that some other factor was causing the reduction in reading accuracy. The comprehension scores showed no correlation with reading speed or accuracy.

Table 1. Results of multiple comparison Scheffe test for reading without a LVA.

Dependant Variable	Passage (I)	Passage (J)	Mean Difference (I-J)	Sig.
Reading speed	B B	C D	-61.6389 -51.2295	0.005 0.017

Table 2. Descriptive statistics for reading speeds obtained for standard reading, enlarged print and HHVM (N=21).

	Mean	Std. Deviation
Standard	132.4829	32.8912
Enlarged Print	133.8183	28.1705
HHVM	108.6769	23.5614

Table 3. Descriptive statistics for accuracy scores obtained for standard reading, enlarged print and HHVM (N=20).

	Mean	Std. Deviation
Standard	6.9000	5.2806
Enlarged Print	6.3500	4.5105
HHVM	11.1500	9.7185

Table 4. Descriptive statistics for comprehension scores obtained for standard reading, enlarged print and HHVM (N=21).

	Mean	Std. Deviation
Standard	7.8095	1.6006
Enlarged Print	7.8095	1.1670
HHVM	7.4762	1.9396

DISCUSSION

The aim of this study was to determine whether reading performance was influenced by using a HHVM or enlarged print. The use of fully sighted subjects eliminated the confounding variable of low vision, thus allowing the comparison of reading performance between each of the reading conditions to be made more clearly.

The results of this study indicated that standard reading and enlarged print allowed students to demonstrate a higher level of reading performance over a short period of time, when compared to the reading performance achieved with the HHVM. This was due to the HHVM causing a reduction in reading speed and accuracy. It has been shown that for adult readers and users of LVAs there is no significant difference in reading speed with enlarged print and optical magnifiers[8]. The reduction of reading speed in this study may have been due to the reader's inexperience with the HHVM and the reduced field of view caused by the device. When reading with the HHVM, students were required to concentrate on moving the HHVM smoothly and fluently across the page whilst maintaining comprehension. The task of using the HHVM, along with the students' lack of familiarity with the device may have been a contributing factor to the reduction in reading speed. The HHVM also caused a reduction in the field of view available for reading due to the optical magnification, although this was quite low in this study, at 1.8 times magnification. Other studies have reported a similar effect, although a much increased magnification was used[22]. The same phenomenon has been found in low vision readers who lacked experience in using magnifiers. Once experience was gained and the low vision readers adapted to the LVA, their reading speed was found to catch up[8].

When reading with standard or enlarged print the results showed that as reading speed increased, reading accuracy also improved. However, this relationship did not occur whilst reading with the HHVM, indicating that reading accuracy is not dependant upon how fast the passage is read but dependant upon some other factor. When reading with the HHVM, three students had reading accuracy scores in excess of 24, primarily due to a high number of word omissions. The high number of word omissions was caused by the students experiencing problems finding the beginning of a new line or loosing their place whilst reading across the line, resulting in a reduced accuracy score. The reduction in reading accuracy whilst reading with the HHVM may also be due to difficulties the students experienced adapting to the use of the HHVM as opposed to a reduction in their reading performance.

The reading comprehension scores were consistent across each of the three test conditions. A correlation analysis showed comprehension ability was not dependant upon reading speed or accuracy. This result supports other findings that reading speeds are not predictive of comprehension ability in low vision adults[23]. It has also been shown that when the presentation of reading material is intentionally slowed, reading comprehension is not affected[24]. Therefore, it should not be assumed that a reduction in reading speed and accuracy will cause a reduction in reading comprehension.

Enlarged print allowed the students in this study to demonstrate a high level of reading performance, however enlarged print is not readily available to all low vision students in activities of daily living. Therefore it is important that low vision students learn to use an optical magnifier, both within and outside the school environment. Proficient use of an optical magnifier will ensure the low vision student can read letters, labels whilst shopping and other reading tasks that are required for activities of daily living.

Thus, when assessing a low vision child's reading performance prior to prescription of LVA, it could be recommended that reading speed, accuracy and comprehension be considered. Conclusions can be drawn from this research for the cohort studied, i.e. a small group of fully sighted year 4 students. It was demonstrated that aspects of the child's reading performance will be influenced by the introduction of the LVA, however, this effect is temporary, and with training in the use of the LVA, will be minimised. Most importantly, during this training period, the child's comprehension of the text should not suffer, despite a reduction in reading speed and accuracy. Further research needs to be undertaken to determine whether a similar effect would be found on a cohort of children who are older and thus are involved with reading which has increased academic demands.

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Surgical Considerations in the Treatment of Intermittent Exotropia: A Review

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ABSTRACT

The surgical management of intermittent exotropia has been subject to wide discussion and debate in the literature. In general, recommendations for best practice guidelines for the surgical management of this condition are not possible due to the conflicting finding of various studies and a lack of high quality evidence. The main issues concerning surgical intervention relate to the timing, type and amount of surgery. This paper presents a review of the current literature with a particular focus on these three issues.

Keywords: intermittent exotropia, divergence excess, surgery, treatment

INTRODUCTION

Exotropia (XT) is a manifest deviation with a temporal or outward misalignment of the visual axes. Intermittent XT has a manifest phase at which time the deviated eye is said to be suppressed or the individual experiences diplopia; whilst during the 'controlled' phase, the eyes are straight with binocular single vision (BSV) being present.[1] Although intermittent XT can be used to describe any XT that is not constant, it commonly refers to one that is manifest at distance fixation with or without a manifest phase for near.[2] Intermittent XT is the most prevalent exodeviation[3-6] with a higher rate in females.[4, 7]

Management of intermittent XT can be surgical and or non-surgical. Various non-surgical management options include minus lens therapy, prisms, fusion exercises, alternate patching and observation.[8, 9] The surgical options include bilateral lateral rectus recessions or unilateral medial rectus resection and lateral rectus recession. Management of intermittent XT is aimed at reducing the manifest deviation whilst aiding sensory fusion so that normal binocular alignment and BSV can be achieved.[10]

Although the natural history of intermittent XT is relatively unclear[3] and with few reports of patients with smaller angle deviations benefiting from non-surgical management,[3, 8, 9, 11] many view it as primarily a surgical condition when treatment is required. Chia, Seenyen and Long[8] recently reported that half of those who present with intermittent XT eventually have surgery. However, the indications for surgery are not well defined or generally agreed upon. Despite this, surgical intervention is usually or perhaps often warranted when the deviation is manifest for over 50% of the time or an increase in size is noted with concerns that this may lead to the disruption of binocularity[2]. Parental concerns regarding the cosmetic appearance also play an important role in the decision leading to surgery.[12]

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SURGICAL TREATMENT

There is widespread opinion as to the most appropriate surgical intervention for intermittent XT, with the literature reflecting various conflicting findings. The three main issues concerning surgical intervention are: (i) the age at which surgery should take place, (ii) the type of surgical procedure and (iii) the amount of correction.

A significant shortcoming in the literature is the inconsistent definition of a successful outcome between studies. A successful outcome can range from a result within 10 prism dioptres (pd) of the ortho-position, or within 8 pd of ortho to merely no manifest deviation. Some studies also include post-operative sensory status in determining the success of surgery. Adding to this are the different lengths of follow up.

This is of particular concern given that intermittent XT often has a tendency to recur with time.[13, 14] Further, some studies have also included patients with a constant XT[15, 16] or patients with A/V patterns[14, 15, 17] and lateral incomitance[12]. Constant XT, although similar to intermittent XT, is a different type of exodeviation as there is a total loss of BSV. In addition, the effects of A/V patterns and lateral incomitance on final horizontal alignment are not well established[18] with some studies suggesting that small vertical imbalances decrease chances of a successful result.[17]

EARLY VERSUS LATE SURGERY

The age at which surgery should be performed remains controversial. Whilst there are studies demonstrating the advantages of operating at a younger age,[15, 17] there are those in favour of delaying surgery till later.[1, 12] Conversely, other studies suggest that age has no effect on final outcomes.[13, 14, 19-23] Further adding to the uncertainty is that there is no agreement on the age range that qualifies as early or late surgery.

Advocates of early surgery believe it is important to 'break the habit of the deviation' so it is not reinforced over a longer period of time and to prevent intractable sensory anomalies (i.e. temporal hemi-retinal suppression).[1, 15] However, as stated earlier, the cut-off age distinguishing between early and late surgery differs between studies making it difficult to draw direct comparisons.

In a retrospective study, Pratt-Johnson, Barlow and Tillson[17] reported that individuals who underwent surgery before 4 years of age had a better chance of a successful outcome after a 1 year follow up. Abroms, Mohney, Rush, Parks and Tong[15] also advocated early surgery reporting better sensory outcomes in individuals who received surgery before 7 years of age and before 5 years onset of the intermittent XT. Though often ignored, onset may also be an important factor to consider when investigating differences between early and late surgery. Age alone does not relate to the duration of the XT and the deterioration of control over time.

Asjes-Tydeman, Groenwoud and van der Wilt[16] similarly found that patients who received surgery before the age of 7 had a better chance of a successful result in terms of ocular alignment and sensory outcome. However, in this study patients operated on after 7 years demonstrated constant deviations and on average larger deviations. In addition, the majority of patients in the older group received unilateral surgery, whilst the majority of those in the younger group received bilateral surgery.

The relative risk of operating on a younger child is namely the possibility of developing amblyopia and monofixation syndrome owing to sensory adaptations through cortical plasticity.[1, 17] Pratt-Johnson et al,[17] for instance, reported that individuals who underwent surgery prior to 4 years of age were more likely to develop monofixation and amblyopia. Edelman, Brown, Murphee and Wright[24] followed patients with consecutive esotropia and also found that those under 6 years of age were more likely to lose stereopsis and develop amblyopia. This has often been considered a reasonable argument for delaying surgery.

On the other hand, Richardson[12] found that individuals receiving surgery after the age of 6 had a better chance for a successful outcome with BSV at near and distance. Richardson[12] believed that this was owing to the more precise measurements possible in older children, which subsequently reduced the risk of consecutive esotropia. In support of this rationale, Chia et al[8] reported that children under 5 years of age were much more variable in their measurements between visits.

Pre-operative orthoptic treatment[8, 10] is also better utilised in older patients[12] and is viewed as another reason to delay surgery.[1, 12] For instance, Figueira and Hing[10] reported that patients in their study who had orthoptic treatment combined with surgery had a better chance of a successful outcome compared to those who received surgery alone.

Adding to the conflicting findings of these studies are the several papers that have suggested that age is not a factor for a successful outcome.[13, 14, 19-23] Theses studies have reported that there is no correlation between age at surgery and final outcome. It is also noteworthy that Stoller et al[13] found age at surgery is not predictive of success when using a retrospective 'survival analysis' where 'survival time' was considered to be the time from surgery to recurrence.

Although this paper has focused age at surgery, it is worth noting that many have suggested that control rather than age may play a greater role in success.[13, 15, 25, 26] In most studies, loss of control is defined as deterioration in magnitude or frequency as perceived or observed by the parents or the examiners. Stoller et al[13] and Abroms et al[15] found better outcomes when patients were operated on whilst their deviation was partially controlled. Similarly Jeoung, Lee and Hwang[25] reported that all cases of overcorrection had poor pre-operative stereopsis; stereopsis being the measure of control.[26] Indeed in all of the studies, surgery was only indicated on the basis of either the parents' or examiners' concern of the deterioration of the intermittent XT in either deviation size or frequency.

Current studies investigating the effect of age on surgical outcome are based on retrospective studies which have inherent bias or flaws. As indicated by Stoller[13], a major draw back of using a retrospective analysis is the inclusion of cases that are lost to follow up. Outcome is judged by the last visit and therefore late failures could be counted as successes and vice versa. In addition, no study has yet randomised the age of surgery. However, a randomised controlled trial (RCT) for early versus late surgery may be difficult given that ethical issues play a large role in the decision on when

Table 1. Studies using bilateral lateral rectus recession surgery

Study	Study Size	Follow Up	Success
Pratt-Johnson et al 1977	100	1 year	81% good cosmetic result,
			41% good sensory result
Stoller et al 1994	57	At least 1 year	58% good cosmetic result,
			no sensory criteria
Ruttum 1997	60	6 months	63% good cosmetic result
			no sensory criteria
Ing et al 1999	52	6 months	61.5% good cosmetic result
			no sensory criteria
Abroms et al 2001	76	6 weeks	67% good sensory result

to operate. As an example, an examiner may not be able to justify delaying surgery in a 2 year old patient who has a large and frequently manifesting intermittent XT and is at threat of losing BSV. Overall, the evidence for the influence of age on surgical outcomes is, at best, still inconclusive. With conflicting findings from retrospective studies and the lack of RCTs, no recommendations as to the most appropriate age for surgery can be safely made at the present time.

TYPE OF SURGERY

Several studies have compared the effectiveness of different types of surgery for intermittent XT. In many studies bilateral lateral rectus recessions (BLRR) has been the procedure of choice for intermittent XT.[13, 15, 17, 18, 20, 22, 27] However, this procedure has produced varying success rates, as detailed in Table 1. There is also the suggestion that the type of intermittent XT[1, 28] should influence the chosen surgical procedure. For example, some authors believe that true distance intermittent XT (distance angle is largest) should receive BLRR whilst a simulated distance XT (distance angle largest due to a high AC/A ratio) or a basic XT (deviation same for all distances) should receive unilateral surgery.[1]

Chia, Seenyen and Long[29] found a higher success rate for unilateral surgery compared to bilateral surgery at 1 year follow up. Their study group contained a large proportion of divergence excess intermittent XT patients where the type of surgery received was not determined by the type of intermittent XT. However, at the 3 year follow up, a greater proportion of patients with a successful outcome in the unilateral surgery group demonstrated an exotropic drift at distance as compared to those who received bilateral surgery. Despite this, the unilateral group still had a slightly higher success rate at 3 year follow up. The few prospective randomised control trials in this area[25, 30] have also reported greater success with unilateral surgery. Kushner[30] for instance compared bilateral and unilateral surgery in a group of patients who demonstrated a basic intermittent XT and found that the unilateral surgery group had a higher success rate. Similarly, Jeoung et al[25] found a significantly higher success rate with unilateral surgery for basic intermittent XT.

In contrast, Lee and Lee[31] reported no significant difference between the two surgical procedures for either basic or simulated distance intermittent XT. Similarly Maruo et al[14] found no difference in success rates between bilateral and unilateral surgery at 1 month. However, in concordance with Chia, Seenyen and Long[29], at 4 years, Maruo et al found that the success rate of the in the unilateral surgery group dropped considerably more than that of the bilateral surgical group.

While the majority of studies have compared BLLR with unilateral surgery, there have also been reports of unilateral lateral rectus recession or single muscle surgery being effective in a small number of patients with moderate size intermittent XT with no reports of post operative lateral incomitance.[32-34]

Agreement for best practice recommendations for the surgical correction of intermittent XT is still lacking. Many retrospective studies investigating the effectiveness of bilateral rectus recessions on intermittent XT have produced varying success rates[13, 15, 18, 20, 22, 27, 35] and the prospective studies[25, 30] have focused primarily on basic intermittent XT. A trial randomising surgical procedure for all types of intermittent XT is needed to further investigate this issue.

FULL CORRECTION VERSUS OVERCORRECTION

The postoperative outcome of surgery with regards to the amount of planned correction has also been widely debated. Many have suggested that overcorrection is necessary because of the postoperative exotropic shift that patients with intermittent XT display.[21-23, 27, 36-38] Even though these studies agree that initial overcorrection is needed, they vary in the amount they recommend. This is highlighted and summarised in Table 2.

There have been a number of retrospective studies investigating the effect of the initial postoperative correction

Table 2. Studies recommending overcorrection

Study	Study Size	Follow Up	Amount of overcorrection	Success rate
Clarke and Noel 1981	78	No minimum	10 to 15 pd	42%
Beneish and Flanders 1994	67	6 months	Any amount of esodeviation	60%
Ruttum 1997	60	6 months	Less than 10pd	63%
Kim et al 2005	68	6 months	20pd	71%
Oh et al 2006	365	No minimum	Over 10 pd	60.3%
Koo et al 2006	199	1 year	Success group had larger overcorrection	60%

on long term alignment. Beneish and Flanders[36] reported that patients with a consecutive esodeviation at 1 week or 1 month had better final outcomes, similar to Lee and Lee's[30] who also reported that initial overcorrection produces better long term outcomes. Likewise, Koo et al[21] found that a greater proportion of patients in their successful group had an initial overcorrection – 86% of patients in the success group showed initial esodeviations compared to 62% in the fail group.

Souza-Dias and Uesgui[38] also reported that an esodeviation of 10pd was the most desirable postoperative immediate outcome. Any lesser overcorrection would increase the chances of recurrence and any more would increase the chances of a longstanding consecutive esotropia. Clarke and Noel[37], also in favour of overcorrection, found that individuals who were overcorrected by 10–15pd had better results than those who demonstrated orthophoria, exophoria or small angle esophoria immediately after surgery. Similarly, Oh and Hwang[23] found that those with the highest chance for success were those who were initially overcorrected by over 10pd. Ruttum[22] reported that those initially corrected from orthophoria to 9pd of esotropia had the best success rates. In contrast Kim, Kim and Hwang[27] reported that 71% of patients with an immediate post-operative overcorrection of at least 20pd demonstrated successful results of within 10pd of orthophoria on follow-up visits.

In the aforementioned studies it is not clear whether the overcorrections were planned. Exact correlations between the immediate post-operative alignment and final long term alignment have also yet to be established, even in the studies that recommend initial overcorrection.[21-23, 27, 36, 37] The other consideration is the risk of monofixation syndrome and amblyopia[17, 24] which can result from persistent consecutive esotropia. This issue was raised by Kim et al[27] and by Edelman et al[24] who had a re-operation rates for consecutive esotropia of 5.9% and 11% respectively.

Another issue concerning the amount of planned correction relates to the variable size of the exodeviation during different testing conditions. As suggested by some, a testing distance of beyond 6 metres or measurement after monocular occlusion may reveal a greater angle of deviation in patients with X(T).[1, 18, 35] In an RCT, Kushner[18] found that many patients exhibit larger deviations when they fixate beyond 6 metres or after 1 hour of monocular occlusion. In this study he randomised patients to either receive surgery for the traditional 6 metre distance or the larger angle found. The group receiving the surgery for the larger angle had a success rate of 86% compared to the 6 metre group of 62.5%. Similarly, Kim and Hwang[35] found this approach to be effective and safe with only 9% of patients who had a surgical correction for their 'largest angle' requiring a postoperative re-operation. These findings may explain the exotropic drift seen when surgery is planned for the smaller 6 metre angle. According to Kim and Hwang[35] and Kushner's[18] findings an undercorrection is potentially achieved when aiming for full correction of the XT as measured at the 6 metre distance.

No randomised trials comparing full correction and overcorrection are yet available. With little still known about the nature of exotropic shift, it is difficult to suggest the amount of overcorrection necessary, if indeed necessary at all. Until there is stronger evidence available overcorrection or persistent consecutive esotropia are still an issue.

CONCLUSION

With conflicting reports and the majority of evidence based on retrospective studies, the most appropriate surgical management for intermittent XT remains somewhat elusive. Lacking at present are prospective RCTs that would provide the stronger evidence required. Agreement on the definition of early surgery and of a successful outcome is also needed, so that future studies can have a common aim and be comparable. Further, these future studies need to include appropriate follow up periods to effectively analyse long term postoperative stability. With reports of increasing numbers of intermittent XT in certain populations[4] and the possible consequence of monofixation syndrome and amblyopia with unsuccessful treatment, it is important that more investigation on surgical treatment take place so that the best practice guidelines can be developed for the management of intermittent XT.

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Glaucoma and Sleep Apnoea: Is there a Link? A Review

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ABSTRACT

Glaucoma is one of leading causes of vision loss in Australia. There are well documented and accepted risk factors associated with glaucoma such as family history, high myopia, diabetes and if an individual is of black decent. It is only since the turn of the 21st century that researchers have attempted to establish if there is a link between glaucoma and sleep apnoea and whether this too could be a risk factor in the pathogenesis of glaucoma. The cause of glaucoma and damage to the optic nerve head due to sleep apnoea remains unclear, however, it has been postulated that a decrease in optic nerve head blood flow occurs during the prolonged apneic episodes leading to ischemia, just as occurs in low tension glaucoma. This review will discuss key studies that have researched the prevalence of sleep apnoea in individuals who have glaucoma and discuss whether sleep apnoea should be considered a risk factor in the pathogenesis of glaucoma.

Keywords: glaucoma, sleep apnoea, low tension glaucoma, risk factor, retinal vasculature

GLAUCOMA AND ITS PATHOGENESIS

Glaucoma is a group of eye diseases which result in characteristic damage to the optic nerve and associated visual field loss that may be caused by a number of pathological processes[1]. Glaucoma is a major eye health problem throughout the world and is said to be the second leading cause of vision loss, affecting over 160,000 Australians[2].

Two potential theories into the pathogenesis of glaucoma have been described; a mechanical and a vascular theory[3]. The mechanical theory proposes that a rise in intraocular pressure (IOP) results in compression of the optic nerve and damage to the retinal cells[3]. This theory supports a number of glaucomatous conditions such as pseudoexfoliation syndrome (PXF), pigmentary dispersion syndrome (PDS), neovascular glaucoma and primary-open angle glaucoma[4]. There is resistance to aqueous outflow through the trabecular meshwork which causes a rise in intraocular pressure, it is this that leads to the development of glaucoma and damage to the optic nerve through compression[5]. However, not all elements of glaucoma can be explained through the rise in IOP. Low tension glaucoma (LTG) can be described as the glaucoma that develops despite no rise in IOP due to a decrease in the vascular supply to the optic nerve causing damage[3]. This type of glaucomatous damage can be described by the vascular theory, where there is a lack of blood supply to the optic nerve head causing death to the retinal nerve fibres due to an increase in vascular resistance which decreases blood flow to the smaller capillary fibres that supply the optic nerve[6].

GLAUCOMA RISK FACTORS

There are well documented and accepted risk factors associated with glaucoma. It is important to recognise these risk factors in individuals to promote early detection and treatment to prevent irreversible blindness, as well as to increase awareness so that individuals understand which risk factors leave them susceptible to the development of glaucoma. An individual with a family history of glaucoma increases their risk of development by up to 9 times, and up to 6 times if they are over the age of 60[7]. Other risk factors include high myopia, diabetes, hypertension, migraines and if they are of a black decent[8]. Like diabetes and hypertension, sleep apnoea also affects blood flow to and around the optic nerve[6], secondary to the apneic episodes which occur whilst an individual sleeps[9]. It is only since the turn of the twenty-first century that researchers[10-16] have tried to establish if there is a link between glaucoma and sleep apnoea and

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whether this too could be a risk factor in the pathogenesis of glaucoma.

SLEEP APNOEA AND ITS EARLY ASSOCIATION WITH GLAUCOMA

It is estimated that 2% of women and 4% of male adults suffer sleep apnoea in America[17] and up to 80-95% of adults have undiagnosed sleep apnoea in Western countries[17]. Sleep apnoea is characterized by repeated episodes, in which a sufferer ceases breathing during sleep for periods of up to 2 minutes due to upper airway obstruction, which are terminated only after awakening from sleep[17]. An individual may not be aware of their sleep apnoea despite these apneic episodes which can occur hundreds of times throughout one night[18]. This disrupts the individual's quality of sleep which leads to excessive daytime sleepiness, insomnia and fatigue due to this non-restorative sleep[18].

The early work of Walsh and Monplaisir[19] sparked interest into sleep apnoea and the development of glaucoma. Walsh and Montplaisir conducted a study that looked at sleep apnoea combined with glaucoma in two generations of a family, and found that 5 members of this family in fact had this combination. However, it could be said the risk factor of family history may have played a more influential role in the development of glaucoma in this sample of participants than the sleep apnoea. Despite this, it was hypothesised that a change in venous pressure during apneic episodes of sleep apnoea causes intraocular pressure to rise causing the glaucoma[20]. Since this novel study Walsh & Montplaisir, it has taken almost 20 years for other researchers[10-16] to re-visit the link between glaucoma and sleep apnoea. The cause of glaucoma and damage to the optic nerve due to sleep apnoea remains unclear, however, it has been postulated[11-13] that a decrease in optic nerve head blood flow occurs during the prolonged apneic episodes leading to ischemia, just as occurs in LTG.

Recent review articles in this area[9, 21], are either written in a foreign language[21] or do not focus specifically on to the effect of sleep apnoea and the development of glaucoma but rather the effects on the eye in general[9]. This paper appears to be the first to review a number of selected key articles on sleep apnoea and whether it's a risk factor in the pathogenesis of glaucoma.

SLEEP APNOEA AS A GLAUCOMA RISK FACTOR

Marcus et al.[15] aimed to determine the prevalence of sleep breathing disorders and whether this could be a risk factor in patients with LTG. Marcus et al., recruited 23 participants with LTG, 14 were LTG suspects and 30 participants who had no ocular pathology served as the control group. All participants were over the age of 60. A series of questions based on sleeping habits were administered to all participants to ascertain sleep history, in terms of being a snorer or possibility of having sleep apnoea. A physician then graded the participants as having a positive or negative sleep history based on their answers. Those with a positive sleep history were offered an overnight polysomnography. Nine of the LTG participants and 4 of the LTG suspects chose to undergo the overnight polysomnography. The results from the polysomnography diagnosed 5 of the 9 participants with LTG and 2 of the LTG suspects with sleep apnoea. Marcus et al, concluded that sleep breathing disorders may be a risk factor in the pathogenesis of glaucoma. The researchers used the title of sleep breathing disorders, however focused on the prevalence of sleep apnoea in their participants, therefore not being clear to the reader what they were actually investigating, sleep breathing disorders or solely sleep apnoea. Throughout their conclusion they referred to their findings and higher prevalence to be attributable to the sleep breathing disorders as a group of problems; however their results appeared to concentrate on the diagnosis of sleep apnoea. In addition, not all participants who were diagnosed with a positive sleep history underwent the polysomnography which questions the validity of their findings. Nonetheless, the frequency of positive sleep histories was higher in the LTG groups (diagnosed or suspects) when compared to the control group. However, this high rate of positive sleep histories may have resulted from the interview questions used in this study. The test may not have been sensitive enough to detect sleeping problems which would lead to a positive sleep history and possibly sleep apnoea.

Sergi et al,[16] attempted to determine the prevalence of LTG in recently diagnosed sleep apnoea sufferers. The methodology of Sergi et al, built on Marcus et al,[15] by recruiting participants who had been diagnosed with sleep apnoea and which of those had undiagnosed LTG, rather than the reverse which was used in Marcus et al.'s study. This strengthened the findings of this study with respect to the relationship between sleep apnoea and its effects of developing LTG. Sergi et al, recruited 50 recently diagnosed sleep apnoea sufferers and 40 healthy controls. They all underwent an ophthalmological assessment including IOP, Humphrey visual field analysis (HVFA), cup-to-disc ratio analysis to diagnose LTG. Three of the 50 (6%) sleep apnoeic participants were diagnosed with LTG compared to none of the controls. This result when compared to the prevalence of 2% in the Caucasian population over the age of 40[2] signifies that sleep apnoea may ultimately be a risk factor in the development of LTG. In fact, based on the findings by Sergi et al. the researchers propose that there is a possibility that an individual with sleep apnoea is twice more likely to develop LTG.

Using a larger cohort of patients, Girkin, McGwin, McNeal & Owsley[14] retrospectively audited the medical histories of 667 males over the age of 50 years, to note the date they

were diagnosed with POAG and whether this correlated with the time they were diagnosed with sleep apnoea, if at all. Despite females sharing in the 5% prevalence of sleep apnoea in Western Countries[17], they were excluded from the study as the researchers stipulated that a meaningful analysis could not be achieved with the small sample number of females identified. Girkin, McGwin, McNeal & Owsley found that there was a weak correlation between sleep apnoea and the development of POAG. The correlation coefficient was 0.76, which proved borderline significance. No participant in the age and sex matched control group that had pre-diagnosed sleep apnoea developed glaucoma by the end of the observation period, however this time frame was not specified in the research paper. Therefore it is not known to the reader if this was a long enough time frame for POAG to develop. Furthermore, it is important to note that the lack of blood flow and oxygen that does not circulate throughout the body during apnoeic episodes has an effect on the eye[9] is more likely to cause LTG due to damage to the optic nerve as a result of an insufficient vascular supply over time[15] as opposed to the individual developing POAG as a result of mechanical compression[13]. It is therefore possible for a higher prevalence to occur if the same methodology was used to analyse LTG.

Mojon, et al.[10] aimed at determining the prevalence of glaucoma, both POAG and LTG in sleep apnoea sufferers. The researchers used an ophthalmological assessment in combination with an overnight polysomnography to aid in their diagnosis of both types of glaucoma and sleep apnoea. The researchers included 114 participants who were referred for polysomnographic testing with suspected sleep apnoea. A history, visual acuity, applanation tonometry, slit lamp examination evaluating the anterior segments; gonioscopy and automated perimetry were performed. Mojon et al. calculated the prevalence of those being diagnosed with some degree of sleep apnoea to be 60.5% (69 from 114 participants) based on the overnight assessment. In this cohort of patients Mojon et al., found that 3 of the 114 participants had POAG and 2 with LTG. The 5 participants with either POAG or LTG were diagnosed with moderate or severe sleep apnoea. The prevalence for those diagnosed with glaucoma and sleep apnoea was therefore reported to be 7.2% (5 of the 69 participants with sleep apnoea). However, 3 of the 5 individuals with glaucoma had already been diagnosed prior to the research; therefore it is not clear if glaucoma resulted from the apneic episodes or from other glaucoma risk factors (i.e. family history). Although a history was taken, the findings from this did not lead to the exclusion of any of the participants, in particular those with other risk factors of glaucoma, such as cardiovascular disease. This limitation would suggest that the finding may reflect a skewed impression of the association of sleep apnoea and glaucoma. Moreover, when comparing the prevalence of glaucoma in patients with sleep apnoea found in this study (7.2%) to that of the general population over the age of 40 (2%)[2], the considerably higher prevalence of glaucoma in sleep apnoea sufferers questions the reliability of the findings.

To build to their previous work, Mojon and his colleagues investigated the prevalence of POAG[11] and LTG[12] in sleep apnoea sufferers as separate target groups. Mojon et al.[11] recruited 30 participants who had POAG and were admitted for an overnight polysomnography to determine if they had sleep apnoea. The researchers found the prevalence of sleep apnoea in those diagnosed with POAG to be 20% (6 of the 30 participants) which was reasonably high when compared to that of the control group of 11% (3 out of the 30 controls). A similar methodology was employed in the study by Mojon et al.[12] who recruited 16 participants with LTG for an overnight polysomnography to diagnose sleep apnoea. Mojon et al.[12] found that the prevalence was 44% (7 out of the 16 participants had sleep apnoea). Based on these findings, the researchers concluded that there is an association between glaucoma and sleep apnoea, but with a higher prevalence in those diagnosed with LTG as compared to POAG.

The difference in prevalence of sleep apnoea in POAG and LTG reported in Mojon's and his colleagues' studies may be better explained by the vascular theory on optic nerve damage in sleep apnoea sufferers than mechanical compression. However, the chosen methodology utilised by Mojon et al.[11] and Mojon et al.[12] is susceptible to a referral bias. In addition, it is difficult to include sleep apnoea as a risk factor for developing glaucoma when Mojon et al.[11] and Mojon et al.[12] observed individuals who have already been diagnosed with glaucoma. Consequently, a direct causal relationship between sleep apnoea and glaucoma is difficult to make. It would be beneficial to recruit a cohort of participants who have clinically diagnosed sleep apnoea and no glaucoma and observe those who develop POAG or LTG and compare them to a control group of healthy participants. This would better determine if sleep apnoea is a true risk factor in developing glaucoma. In addition, if treatment was given to these individuals with sleep apnoea, it may improve their glaucoma. It may decrease the damage that can occur at the optic nerve and it is this observation that may clarify the role that sleep apnoea plays in glaucoma[22].

Geyer, Cohen, Segev, Rath, Melamud, Peled & Lavie[13] also investigated the relationship between sleep apnoea and POAG but reported different prevalence rates as compared to Mojon's group[11]. They recruited, via a contact telephone conversation, 228 participants with previously diagnosed sleep apnoea. An ocular examination was scheduled to determine the prevalence of POAG in this population. The eye examination included applanation tonometry, gonioscopy, optic disc assessment and 24-2 automated perimetry testing. An overnight polysomnography was also used to confirm sleep apnoea. Geyer et al[13] found that 5 of the 228 participants had POAG, resulting in a 2% prevalence of

glaucoma in those individuals diagnosed with sleep apnoea. This finding is more in line with the prevalence of glaucoma in the general population (2%)[2]. The larger sample size would suggest a more realistic prevalence of sleep apnoea and glaucoma in the Geyer et al[13] study, however no control group was included as it was in Mojon et al's[11] study.

CONCLUSION

There is support in the literature[10-13, 15-16] for a relationship between sleep apnoea and glaucoma (POAG and LTG). However, sleep apnoea as risk factor for developing glaucoma is yet to be firmly established. Further research needs to be conducted to explore this relationship. A prospective aged matched control clinical trial investigating recently diagnosed sleep apnoea sufferers and the number of individuals that go on to develop glaucoma, particularly LTG in a large cohort of participants, would be beneficial. It would also be valuable to look at snoring and its effect on the eye, as snorers often develop sleep apnoea. Studying the effects of treating an individual's sleep apnoea and whether this prevents glaucoma from developing or minimises the progression of glaucoma, is also of interest and could be further explored.

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Vision Disturbances in Pituitary Prolactinomas: A Clinical Case Study

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ABSTRACT

A pituitary prolactinoma is a benign tumour of the pituitary gland that causes excess production of prolactin, the hormone normally responsible for the formation of milk during pregnancy. It is the commonest type of pituitary tumour and is most prevalent in females under the age of 40.

Considering the close proximity of the optic nerves to the pituitary gland, it is imperative that patients diagnosed with this condition undergo regular ophthalmologic examinations, including perimetry, to monitor any potential changes. The visual field defect commonly seen in patients with pituitary tumours is a superotemporal quadrantanopia as the inferonasal fibres are affected. Bitemporal hemianopias are also commonly seen. Aside from the visual disturbances associated with pituitary prolactinomas, affected individuals can also experience infertility, low bone density and hypopituitarism.

A case study of an 18 year old woman diagnosed with a pituitary prolactinoma who interestingly also became pregnant will be presented. It is well documented that women with prolactin-secreting tumours can experience further pituitary enlargement than what is expected in a healthy pregnant woman. The progress of this case was closely examined with MRI scans and perimetry, all of which will be presented.

Keywords: pituitary gland, prolactinoma, pregnancy, quadrantanopia, Bromocriptine.

INTRODUCTION

The pituitary gland is a small, bean-shaped gland that is situated at the base of the brain, sitting inside the sella turcica. As part of the endocrine system, its role as the '*master gland*' involves the regulation of growth, development, reproduction and metabolism[1]. A pituitary prolactinoma is the most common type of hormone-secreting pituitary tumour that occurs mostly in women under the age of 40. It is a benign tumour that produces the hormone prolactin[2]. They are clinically classified according to their size: microadenomas do not exceed 10mm in diameter whereas macroadenomas measure greater than or equal to 11mm in diameter[2]. The association between a pituitary prolactinoma and ophthalmology lies in the proximity of the pituitary gland to the optic nerves. The optic nerves, chiasm and optic tracts sit directly above the pituitary gland and therefore suprasellar extension of the gland can cause compression leading to visual disturbances[3]. When the tumour size reaches 10mm or more, it can impinge on the optic chiasm, located 8-13mm above the pituitary gland. The chiasm can either lie directly above the sella (80% of cases)[4], or alternatively, it can be pre fixed, where the chiasm is anterior over the tuberculum sellae (10% of cases). Alternatively, a post-fixed chiasm is situated posteriorly over the dorsum sellae (10% of cases)[5], thus causing altered positioning of the tracts and nerves. The chiasmal impingement causes the hallmark superior bitemporal quadrantanopia or hemianopia, and in the case of a hemianopia, with increased superior density, as the infero-nasal fibres are primarily damaged. These infero-nasal fibres are most susceptible to damage from growing tumours, as they cross low and interiorly[5]. The tumour growth is normally asymmetrical, so the field loss between the two eyes is also asymmetrical[6]. The retinal topography at the anterior of the chiasm involves the separation of crossed and uncrossed retinal fibres. Inferior crossed fibres decussate and move anteriorly into the opposite optic nerve, then move posteriorly into the optic tract[5], superior crossing fibres decussate and enter the contralateral optic tract via the superomedial ipsilateral optic tract, whereas uncrossed temporal fibres remain lateral in the chiasm. Nasal macular

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fibres, on the other hand, cross the chiasm mainly central and posteriorly[5].

Several different visual field defects can arise due to compression of the optic chiasm (Table 1). These include nasal loss, where the temporal retinal fibres are compressed, and temporal field defects due to medial compression of the nasal retinal fibres[5]. Arcuate defects are due to vascular changes in the optic nerve[7]. A unilateral hemianopic defect manifests due to a lesion occurring at the junction of the optic nerve and chiasm, where the crossed and uncrossed retinal nerve fibres separate. Therefore, a lesion at the location of the crossed and uncrossed fibres would cause such a defect[8]. A junctional scotoma is a rarely documented field defect, and is described as an early-stage feature of compression of the chiasm[5], and finally, a paracentral scotoma located superior and temporally, may be a very early indicator of a tumour that involves the nasal retinal fibres, which just extends to the chiasm[5]. Vascular compromise can also occur at the diaphragmatic sellae, causing tumour ischemia. This ischaemia can then result in necrosis and haemorrhage. This vascular compromise may lead to a quickly expanding sellar mass which in turn causes optic nerve compression, headaches, and meningeal irritation on occasion[4].

The signs and symptoms that manifest with a prolactinoma arise due to hyperprolactinaemia (excess prolactin levels in the blood) or from compression, if the tumour is large[17]. The elevated prolactin levels affect the reproductive system; hence the symptoms may vary between genders. Females can experience irregular or lack of menstrual cycle and possible galactorrhoea, whereas males can experience impotence and loss of body hair. Both genders can experience headaches, infertility, low bone density and visual disturbances. Whilst prolactinomas can cause an increase in pituitary volume and increased secretion of prolactin, pregnancy can further exacerbate a prolactinoma. During pregnancy, prolactin-secreting lactographs that normally constitute 20% of all pituitary cells in nulliparous women (and in men), increase to 50% of all pituitary cells at the end of pregnancy. Radiologically, the pituitary gland develops an upward convexity of the superior surface[2, 12]. Consequently, the pituitary gland increases in weight and size by 35% and 50-70% respectively, owing to the increased number of lactographs[2]. Hence, if a woman presents to her doctor with unexplained galactorrhoea, irregular menstrual cycle or infertility, prolactin levels in the blood must be tested. A case study, exhibiting some of these characteristics will be presented.

CASE STUDY

An 18 year old woman presented to her doctor with galactorrhoea. Her blood test indicated prolactin levels of 2927ug/mL; normal prolactin levels range from 60-480 ug/mL[13]. High prolactin levels are expected in pregnant women; however the patient was not pregnant. These levels were therefore considered suspicious and thought indicative of a pituitary prolactinoma. The patient underwent a cranial Magnetic Resonance Imaging (MRI) as the diagnosis of a prolactinoma is confirmed by the presence of hyperprolactinaemia and a positive MRI scan[2]. The radiology report of the most recent MRI scan (Figure 1) read as follows:

> *'The lesion is again identified in the dorsum sella on the left side. It measures 1x1x1cm in size. On measuring the adenoma on the previous scan 6 months earlier, the dimensions of the lesion are entirely unchanged. The chiasm is just contacted by the upper surface of the gland but there is no evidence to suggest compression. The cavernous sinuses are clear bilaterally.'*

This patient's prolactinoma was classified as a microprolactinoma as it measured 1cm in size. Her complete diagnosis was a Left Pituitary Microprolactinoma producing galactorrhoea with hyperprolactinaemia. Bromocriptine was prescribed as part of treatment.

Soon after being prescribed Bromocriptine, the patient returned to her endocrinologist as she had since become pregnant. She was advised to discontinue Bromocriptine therapy and attend for regular check-ups and visual field testing. Her ophthalmologic testing revealed normal visual acuities of 6/5 and 6/4 of the right and left eye respectively, normal pupil reactions and intraocular pressures of 16mmHg in both eyes. Her cup to disc ratios were normal and she did not exhibit any pallor or swelling. Her initial visual fields, as measured on the Humphrey Visual Field Analyser, using

Table 1. Different visual field defects due to compression of the optic chiasm

Field Defect	Cause
Nasal defect	Temporal retinal fibres are compressed
Temporal defect	Medial compression of the nasal retinal fibres
Arcuate scotoma	Vascular changes in the optic nerve
Unilateral hemianopia	Lesion at the junction of the optic nerve and chiasm
Junctional scotoma	Early-stage feature of compression of the chiasm
Paracentral scotoma located superior and temporally	Early indicator of a tumour involving the nasal retinal fibres, which just extends to the chiasm.

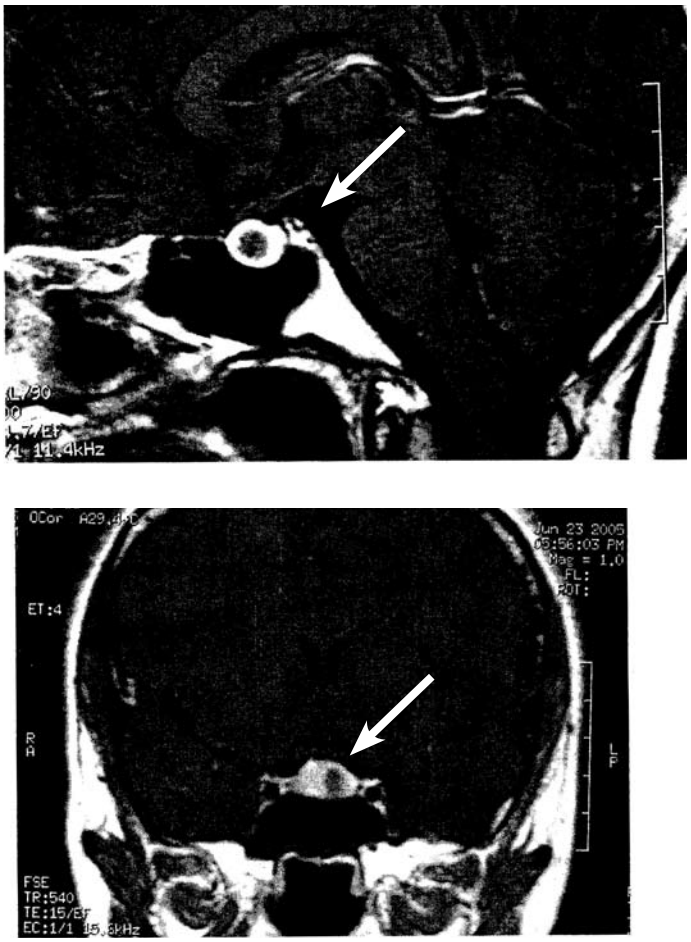

Figure 1. MRI scans depicting this patient's 1x1x1cm microprolactinoma.

a central 24-2 threshold test, were unremarkable and both were within normal limits (Figure 2). However, 6 weeks later some changes were detected in both eyes using a central 30-2 threshold test (Figure 3). Each eye exhibited an additional 6 defects as noted on the pattern deviation, which adjusts for increases or decreases in the patient's hill of vision. All field changes were localized to the superior temporal quadrant of each eye. While there were changes evident on the visual fields, her vision remained unchanged. As there were visual field changes, it was essential to monitor this patient throughout her pregnancy to observe the tumour size and her visual fields. However, this patient was lost to follow-up as she failed to attend her follow-up appointments.

DISCUSSION

Given the stimulatory effects of pregnancy on the lactographs, symptomatic enlargement of the pituitary gland can be expected. However, the number of tumours that actually do expand is very small. The risk of clinically significant enlargement for pregnant women with microprolactinomas is 1.3%[12]. The risk of enlargement for women with untreated macroprolactinomas is 23.2%, whereas a treated macroprolactinoma has a 2.8% risk of clinically significant enlargement[12]. Similarly, Randeva et al.[2] reported the risk of clinically significant enlargement for women with macroprolactinomas during pregnancy as being between 15.5-35.7%.

Chiasmal compression can also be linked with other visual symptoms, including cranial nerve palsies, post fixational blindness, hemifield slide and see saw nystagmus[5]. Cranial nerve palsies can include the third, fourth or sixth cranial nerves and can result in involvement of the extraocular muscles, hence causing a strabismus and possible diplopic symptoms[5]. These type of palsies occur when there is involvement of the 'cavernous sinus by lateral extension of a pituitary tumour'[14]. The hemifield slide phenomenon may be responsible for horizontal or vertical diplopia in cases where there is no obvious muscle palsy or cranial nerve paresis[5]. This phenomenon may result in problems relating to fusion[15] due to the development of a bitemporal hemianopia. Post-fixational blindness is another symptom relating to chaismal compression. When a patient with a bitemporal hemianopia fixates a near object, a totally blind area is produced because the two blind temporal fields cross over[5]. See-saw nystagmus occurs due to the close proximity of the structures responsible for see-saw nystagmus to the chiasm[5].

The aims of treatment for prolactinomas encompass 4 areas: to reduce the tumour size, to restore prolactin levels in the blood to normal, to correct any visual problems and to restore normal pituitary functioning[17]. A dopamine agonist, Bromocriptine, can be used to treat the prolactinoma, as it is the chemical that normally inhibits prolactin secretion. Bromocriptine can shrink the tumour and restore prolactin levels in 90% of cases[12]. The discontinuation of Bromocriptine in this case was because of two key issues that must be addressed when a woman with a prolactinoma becomes pregnant: the negative effects of dopamine agonists on early foetal development before a pregnancy is diagnosed, and the effects of a pregnancy on the size of the prolactinoma. After pregnancy has been confirmed, the dopamine agonist should be withdrawn and the patient must be closely monitored for tumour expansion[16]. In over 6000 pregnancies, Bromocriptine has not been shown to increase the number of spontaneous abortions or congenital malformations[2, 12]. However, while the above evidence suggests that Bromocriptine is safe during pregnancy, it is advised that exposure of the foetus to such a dopamine agonist should be limited[12]. If there is suspicion of tumour expansion, this can be investigated through an MRI scan after four months gestation and visual field testing[16]. Visual field testing is hence an integral part of monitoring change. Randeva et al.[2] has also commented that with microprolactinomas, most endocrinologists recommend visual field assessment in each trimester of pregnancy and expectant patients are urged to report any visual symptoms or headaches.

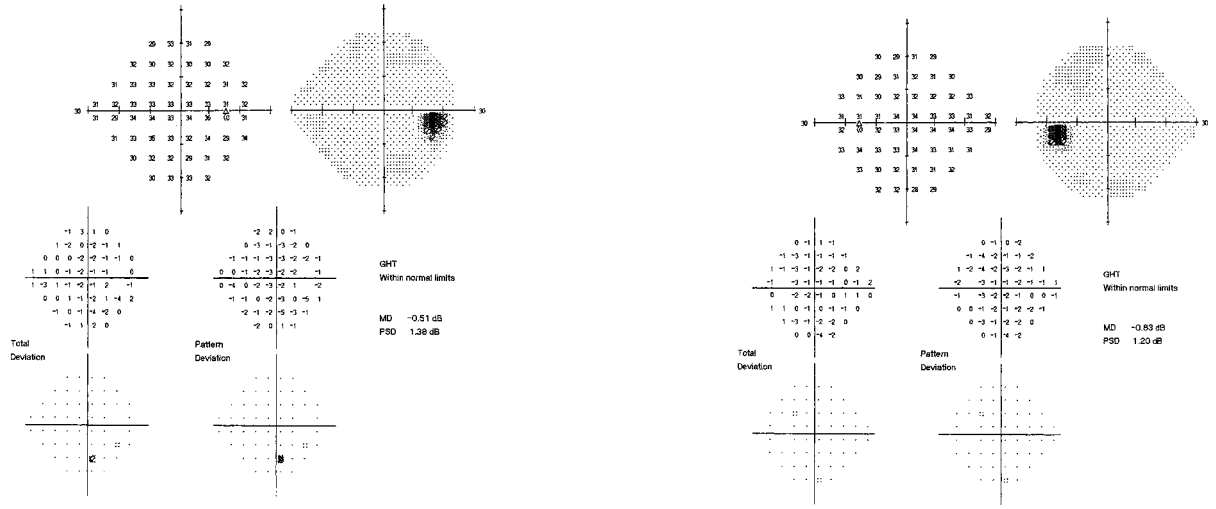

Figure 2. Humphrey Visual Field assessment (24-2) on the first visit.

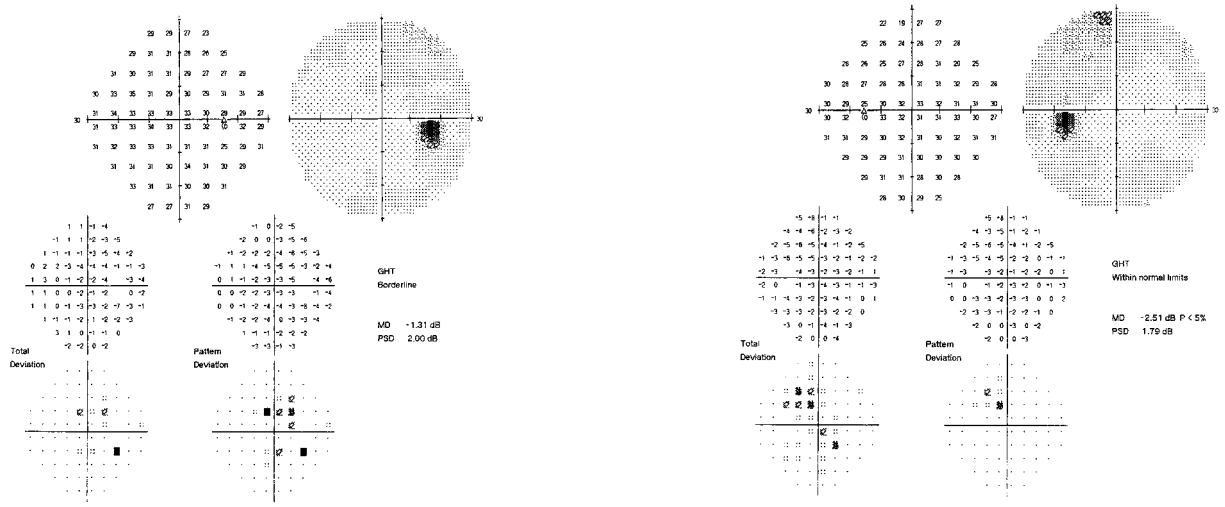

Figure 3. Humphrey Visual Field assessment (30-2) performed 6 weeks later.

Due to the increase in prolactin levels during pregnancy, regular monitoring of prolactin levels in the blood is of no use[2]. A study investigating prolactinomas and optic nerve compression found that a participant with a prolactinoma, who had been experiencing visual disturbances for 8 months, underwent Bromocriptine treatment, and within two weeks had complete recovery of their visual fields and an acute fall in their prolactin levels. Additionally, on CT scans, the suprasellar extension had disappeared. On the other hand, the same study reported another participant who had a two year history with no visual improvement after one year of treatment. However, the CT scan revealed no suprasellar extension when repeated after three months[17]. Hence, the researchers concluded that Bromocriptine is capable of tumour shrinkage and can replace surgical intervention in certain patients.

A study by Kupersmith, Rosenberg, & Kleinberg[18] examined the potential risk for developing visual loss during pregnancy in women with pituitary adenomas. The researchers recruited 65 women with pituitary adenomas who had not been treated with surgery. They were all monitored during their pregnancies and all had their prolactin levels measured. Sixty of 65 women had elevated prolactin levels. In measuring tumour size, 57 patients had tumours of greater than 0.3cm. The remaining eight patients had macroadenomas greater than 1.1cm. Visual loss was experienced by six out of these eight participants. In eight eyes of these six patients, there were incomplete superior temporal quadrantanopias. In three eyes of three patients there were complete superior temporal quadrantanopias. Therefore, these results indicate that those patients with pituitary adenomas of 1.2cm or greater are at a greater risk of developing visual loss during

pregnancy than those patients who had microadenomas. It is important to note that all of the women in this study with visual field loss had adenomas of 1.2cm or more. A study by Gemzell & Wang[19] also reviewed tumour size and symptoms in 217 pregnancies in 187 women with prolactinomas. Microprolactinomas without surgical intervention were seen in 91 pregnancies in 85 women. Systematic tumour enlargement was seen in 5 pregnancies (5.5%), and these manifested as headaches or visual disturbances. Untreated macroprolactinomas were seen in 56 pregnancies of 46 women, and 20 of these pregnancies (35.7%) had severe headaches or vision impairment.

CONCLUSION

The clinical history presented in this paper indicates that whilst the patient was dignosed with a microprolactinoma, she was asymptomatic to any visual disturbances during her pregnancy. However, she constitutes the small minority of women with microprolactinomas that do demonstrate visual field changes. Unfortunately, her visual progress could not be followed-up as she had not undergone any additional visual field tests because of failure to attend subsequent appointments. However, this case study demonstrates the need to adhere to strict visual field monitoring of pregnant women with pituitary prolactinomas.

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Ocular Tilt Reaction Caused by a Polycystic Astrocytoma: A Case Report

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ABSTRACT

An ocular tilt reaction consists of a vertical misalignment of the eyes (skew deviation), a head tilt and conjugate ocular torsion in the direction of the hypotropic eye. Ocular tilt reaction, however, may be mistaken for a superior oblique palsy due to the similarities in clinical findings of the two conditions. They both display similar vertical deviations and head tilts on presentation. In order to differentiate between the two conditions torsion needs to be assessed and measured. An ocular tilt reaction will display paradoxical conjugate torsion unlike a superior oblique palsy. This paper describes a case of a patient with an ocular tilt reaction that was initially thought to be a superior oblique palsy. An MRI scan revealed a polycystic astrocytoma in the midbrain region consistent with reports in the literature associating midbrain lesions and an ocular tilt reaction. Although rare, an ocular tilt reaction should never be ruled out until torsion is measured in patients presenting with a vertical deviation and head tilt.

Keywords: ocular tilt reaction, polycytic asrocytoma, torsion

INTRODUCTION

The vestibular system, along with the optokinetic and smooth pursuit systems, contributes to eye movements by maintaining clear vision during head movements[1, 2]. The vestibular system consists of a central and peripheral component, where the otolith organs and semicircular canals comprise the peripheral component[2]. There are also connections to the vertical gaze centres in the upper midbrain region[1-3]. The otoliths are responsible for the otolith-ocular reflex that counter-rolls the eyes during a head tilt[2]. Physiological counter-rolling of the eyes produced by the otolith-ocular reflex is characterised by conjugate ocular torsion in the opposite direction of the head tilt (Figure 1). This ocular counter rolling reflex occurs because of the central projections from the semi-circular canals and otoliths to the ocular motor sub-nuclei[1,4]. All of these structures are important in maintaining a stable retinal image. Lesions, such as haemorrhages, abscesses or tumours, that can cause a disturbance in the otoliths or their vestibular connections may interfere with the otolith-ocular reflex which in turn may cause a condition known as an ocular tilt reaction (OTR)[3, 5].

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An OTR consists of a triad of clinical findings including a head tilt, conjugate ocular torsion and a skew deviation[3-6] (a skew deviation being a vertical strabismus caused by disruption of the prenuclear inputs into the oculomotor and trochlear nuclei[1, 2]). However, in OTR it is typical to find the direction of head tilt and ocular torsion are all towards the same side of the hypotropic eye[7] (Figure 2). The ocular torsion is also inconsistent with superior oblique palsy where the hypertropic eye demonstrates extorsion as opposed to the intorsion seen in OTR[3].

This paper presents a 9-year old child found to have a polycystic astrocytoma in the midbrain area causing an OTR. The causes of OTR and the importance of differential diagnosis are discussed.

CASE REPORT

A 9-year old female presented to the clinic displaying a head tilt to the right and complaining of intermittent vertical diplopia. Her mother had noticed the head tilt the day before but could not rule out the possibility of it occurring earlier. The patient's medical history was unremarkable along with her past ocular history. However, there were earlier reports of headaches and nausea but at the time of presentation, the patient was no longer experiencing either of these symptoms.

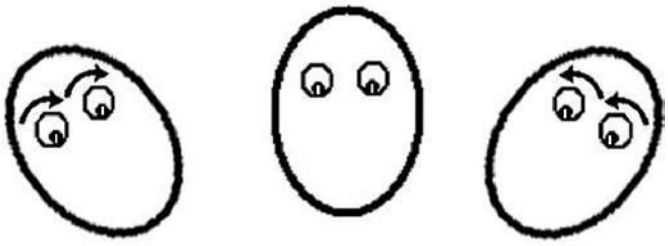

Figure 1. Physiological counter-rolling of the eyes in head tilt. A head tilt to the right causes conjugate torsion towards the opposite direction, that is, intorsion of the right eye and extorsion of the left eye. A head tilt to the left causes the opposite effect.

Figure 2. In OTR, conjugate torsion occurs towards the side of the head tilt and lower eye. In this figure, there is intorsion of the hypertropic eye and extorsion of the hypotropic eye. In a superior oblique palsy there is extorsion of the hypertropic eye instead. This conjugate torsion is also in contrast with the physiological counter roll reflex where there is torsion in the opposite direction of the head tilt.

On examination, uncorrected visual acuities of 6/7.5 OU were recorded. On cover testing, a small right hypotropia was detected. It remained fairly consistent in the 9 positions of gaze. Pupillary reactions were normal. The patient had signs and symptoms suggestive of a left superior oblique palsy. Fundus examination, however, revealed intorsion of the left eye and extorsion of the right eye. This was inconsistent with a left superior oblique palsy where one would expect to find extorsion of the hypertropic eye[3]. The presence of conjugate ocular torsion represents a skew torsion and together with a right head tilt and right hypotropia, led to a diagnosis of OTR. Due to these clinical findings magnetic resonance imaging (MRI) scans were performed and a polycystic astrocytoma was identified in the midbrain region (Figure 3). This was consistent with the diagnosis of an OTR.

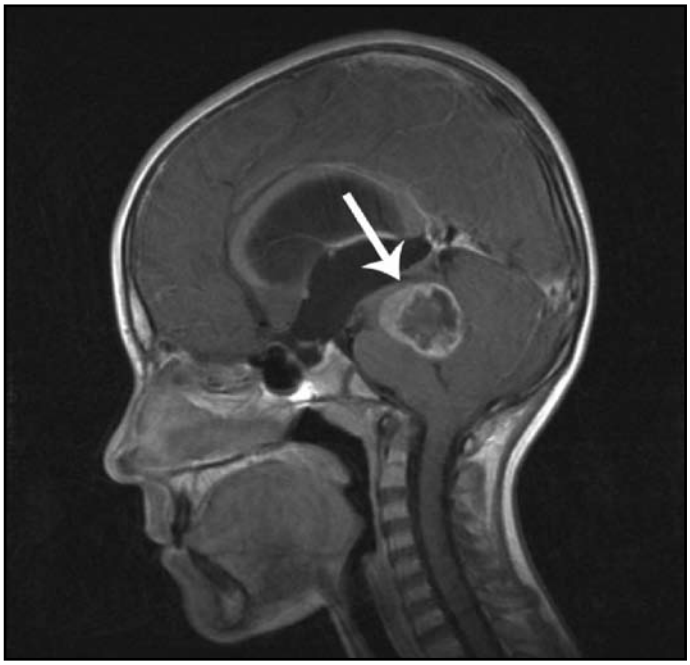

Figure 3. An MRI scan, T1 weighted image, shows the astrocytoma located in the region of the midbrain extending towards the cerebellum (arrow).

DISCUSSION

Westheimer and Blair[7] first described OTR in 1975 in a monkey by stimulating the midbrain regions lateral and dorsolateral to the III and IV nerve nuclei, with the prominent stimulation site being the interstitial nucleus of Cajal (INC). Leuck et al[8] came upon a similar finding, however this time in a human, where a patient underwent insertion of an electrode into the periaqueductal grey area for the relief of chronic pain but instead developed OTR. It was found that the electrode was situated in the INC. Since then, several reports regarding lesions involving the midbrain have been reported to cause an OTR[3, 9-11]. Cases have been described with more localised lesions involving areas outside the midbrain that have been reported to cause an OTR. They include the vestibular nerve[12, 13], cerebellum[5, 14] and utricular nerve[6].

By considering the pathways and structures in the midbrain that are involved in vertical eye movements pathways and how the vestibular system integrates into it, a better understanding of why an OTR occurs can be made. Vertical and torsional saccades are thought to be generated in the rostral interstitial nucleus of the medial longitudinal fasciculus (riMLF)[1, 15]. Projecting axons that reach the ocular motor neurons for smooth pursuit originate in the vestibular nuclei. The medial longitudinal fasciculus (MLF) is the important ascending pathway for these projections which carry the neural signals, from medulla to midbrain, for vertical smooth pursuit and vestibular eye movements[1, 15]. Other contributing pathways include the brachium conjunctivum and the ventral tegmental tract, but the MLF is the most important pathway[1, 15]. The vestibular nuclei also combine inputs from the semicircular canals and the otolith organs[1]. These peripheral components of the vestibular system also converge at the ocular motor nuclei to perform their vestibular function in the vertical and roll plane[16].

The INC is the neural integrator for the vertical gaze system[1, 15]. The INC receives input from the riMLF and the vestibular nuclei. It also has many projections which include the oculomotor, trochlear nuclei, contralateral INC, mesencephalic reticular formation (MRF) and also bilaterally to the riMLF. The major burst neurons of the INC involve the mechanisms for gaze-holding and eye coordination in the roll plane[1, 15]. The numerous inputs and projections to and from the INC make it an important neural integrator for vertical gaze and vestibular function. It may be for this reason, disruption to this structure may cause OTR[7, 8].

Table 1. Clinical similarities and differences between OTR and isolated superior oblique palsy.

Clinical Characteristic	OTR Cause	Superior Oblique Palsy
Hypertropia	Yes	Yes
Head tilt	Towards lower eye to correct subjective visual vertical	Towards lower eye to minimise vertical deviation and excylotorsion
Torsion	Intorsion of higher eye and extorsion of lower eye	Extorsion of higher eye

However, lesions including the vestibular nerve[12, 13], cerebellum[5, 14] and utricular nerve[6] have also been reported to cause OTR. This suggests that lesions anywhere along the graviceptive pathways, which are the pathways subserving the vestibulo-ocular reflex involving the semicircular canals and the otolith organs, can cause OTR[3, 16, 17]. The graviceptive pathways begin at the vestibular organs, travel through the brainstem and reach the midbrain to contribute to the vertical gaze structures[16, 18]. The triad of clinical findings in OTR correlates with known function of these pathways. The vertical skew deviation occurs because of the disruption of the vestibular nuclei which is responsible for vertical smooth pursuit and has inputs to the INC for gaze holding[1]. Conjugate torsion occurs because the otolith-ocular reflex is disrupted leaving it unbalanced in the roll plane. This may also explain the head tilt which occurs due to a tilt in the subjective vertical visual and not in order to minimise the vertical deviation[3]. The position of the eyes and head are adjusted to what the vestibular system has mistakenly judged to be the vertical[19].

The triad of clinical findings in OTR may also present a challenge to the examiner because of its similarities to an isolated superior oblique palsy[3, 20]. A recently acquired superior oblique palsy may present with a vertical deviation and a compensatory head tilt to the side of the lower eye, similar to OTR. However, unlike OTR, a superior oblique palsy will display extorsion of the hypertropic eye whereas an OTR will display intorsion of the hypertropic eye. This makes measuring torsion of the hypertropic eye using ophthalmoscopy, fundus photography or the double Maddox rod an important step in differentiating the two conditions [3, 20]. Although isolated inferior oblique palsies are rare, they too may be mistaken with OTR due to the similarity in vertical deviation and head tilt[21]. Measuring ocular torsion will also differentiate the two conditions[21]. The Bielschowsky head tilt test was not used in the assessment of this patient. Donahue, Patrick, Lavin and Hamed[20] reported that the Bielschowsky head tilt test does not definitively differentiate the two conditions and suggested that measuring torsion should be the fourth step added to the '3 step test'. Associated neurological signs like ataxia may also lead the examiner to suspect more widespread brainstem disease rather than isolated cyclovertical muscle palsy[20]. Table 1 summarises these findings.

Furthermore, it is important to differentiate an OTR from an isolated superior palsy because of the difference in treatment implication each condition brings. OTR is often thought to be transient which implies that treatment should remain conservative until spontaneous recovery occurs[3]. Prisms may provide relief from diplopia, but it must be reiterated that these will not alleviate the head tilt. The head tilt in OTR occurs in response to altered subjective visual vertical unlike in superior oblique palsy where a head tilt occurs to minimise the vertical deviation and unilateral excyclotorsion[1, 3, 20, 22]. Furthermore, surgically weakening or strengthening an oblique muscle in a persistent OTR to correct the skew deviation may be contraindicated because of its negative effect on ocular torsion[20, 21]. However, Donahue, Patrick, Lavin and Hamed[20] have reported success in one patient who underwent surgical weakening of an overacting cyclovertical muscle.

Our patient presented with subtle signs of headache and nausea but no other neurological signs or symptoms of poor coordination or balance. The OTR occurring in our patient was most likely due to midbrain pathology involving the INC and its connections with the vestibular nucleus.

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Selected Abstracts from the OAA 63rd Annual Scientific Conference, held in Sydney, 5–8 November 2006

A MULTI-CENTRE RESEARCH TRIAL IN AUSTRALIA

Nathan Clunas, Neryla Jolly
Sydney University

In 2005 Neryla Jolly from the School of Applied Vision Sciences, The University of Sydney floated the possibility of setting up a research group which included orthoptists from several locations. The aim of the group was to enable collection of large data sets from across several practitioners rather than small numbers which resulted in inconclusive outcomes.

In 2006 interested orthoptists met and established principles of involvement, what the group wished to achieve, who would manage the project, how to include a range of practitioners and retain uniformity, who was entitled to have their name on any publications and topics to be researched.

Further discussion needs to include how each project will be funded. The first topic to be researched will be "How much does amblyopia impact on adult life?"

Staff of the School of Applied Vision Sciences involved in the multi-centre research group are enthusiastic about the possibility of developing a collegial approach, and the group already includes members from NSW (both city and rural), Victoria and an ophthalmologist.

A WebCT site has been constructed to generate discussion, report literature search results and post attachments.

The purpose of this presentation is to garner further interest throughout the orthoptic community, and to generate discussion on how to enable the success of this venture.

IS THE JIKEI UNIVERSITY CONTRAST GLARETESTER CORRELATED WITH ON-ROAD SENIOR DRIVING SKILL PROBLEMS?

Nathan Clunas, Neryla Jolly, Sue Silveira, Lynnette Kay
Sydney University

A multi disciplinary team from the Faculty of Health Sciences, The University of Sydney, comprising Orthoptists, Occupational Therapists and specialist Driving Instructors conducted off and on-road assessments of a population of 100 senior drivers across a broad range of ages from 60 to 86 years.

Clinical off-road vision assessment included basic vision tests of visual acuity and peripheral vision. In addition contrast sensitivity was assessed using the Vistech system, and glare sensitivity using the Contrast Glaretester (Jikei University) was carried out. The Contrast Glaretester was used to assess each driver's glare sensitivity and compare this to on-road driving performance as senior drivers commonly report problems with glare.

An on-road driving assessment was conducted to determine driver skills in different vision-based situations. At the completion of the assessment each subject's driving performance was rated as either pass, in need of driving lessons or fail.

Statistically significant correlations were seen amongst a number of factors. As participant age increased, discrimination under glare conditions decreased on the Contrast Glaretester. Subjects with better visual acuity had improved discrimination in glare situations. Participants who regularly drove at night also showed improved discrimination in glare situations. In addition, participants who were not comfortable with night driving had poor discrimination in glare conditions. Vistech Contrast Sensitivity correlated well with the Contrast Glaretester for the photopic range, showing that as discrimination under glare conditions decreases, so too does contrast sensitivity; and an improved discrimination under glare conditions correlated with passing the on-road driving performance.

HOW MUCH ECCENTRIC VIEWING IS ENOUGH?

Kerry Fitzmaurice, Meri Vuicevic
Dept. Clinical Vision Sciences

Background: Eccentric viewing is a strategy to ameliorate the impact of macula vision loss. The reports of eccentric viewing strategy in the literature vary in terms of need, success, technique and time spent on training. The strategy is often seen by service providers as expensive requiring time consuming face to face training.

Whilst the number of training sessions has been shown to have a small negative correlation with outcome measures such as decreased print size there has been no documented evidence of an optimum number of training sessions. The aim of this research is to determine if an optimum number of training sessions can be recognised.

Method: This is a retrospective study of data from the eccentric viewing data base of the Vision Rehabilitation Centre, LaTrobe University and data collected from a pilot study and a random control study of eccentric viewing both undertaken through La Trobe University.

Preliminary results and discussion: Training sessions varied between 1 and 80 sessions. There appears to be a pattern to improvement demonstrated in outcome measures and the number of training sessions. Other variable such as frequency of sessions and out of session practice also seem to have some impact. If an efficient combination of training techniques and session numbers can be identified this information may encourage the regular application of this valuable rehabilitation strategy for persons with macular disorders.

THE SPEED OF EMMETROPIA?

Zoran Georgievski[1], **Connie Koklanis**[2], **Josie Leonie**[2],
[1] Outpatients Department, The Nothern Hospital, Melbourne),
[2] Dept. of Clinical Vision Sciences, La Trobe University, Melbourne

The disruption of the emmetropisation process is commonly now cited as one important reason for not prescribing glasses for hypermetropia in infants – if, of course, there are no other indications for prescribing (e.g. the presence of anisometropia or strabismus or perhaps a strong family history). The purpose of this rapid fire presentation is to briefly re-visit what is considered to be a "normal"

amount of hypermetropia in infancy and the issues concerned with refractive correction and prescribing in younger children. Using a case study, it is also aimed to stimulate discussion about the speed or rate at which emmetropia can occur.

COLOUR VISION – THE FORGOTTEN TEST

Kylie Green
Sydney Hospital & Sydney Eye Hospital

Purpose: To determine the most appropriate colour vision test for investigating acquired vision loss. The Ishihara is commonly used in many clinical settings for detecting acquired colour vision defects. The Ishihara is a screening test specifically designed to detect congenital red-green colour vision defects. While optic nerve pathology often causes red-green defects, this is not the same as a congenital loss. Therefore there is a strong need for in depth colour vision testing to be routinely utilised in clinical settings as this is often the first sign of pathology.

Method: Patients presenting to the orthoptic clinic with suspected optic nerve or macula pathology underwent formal colour vision testing with

the Farnsworth-Munsell 100 Hue Test, Roth 28 Hue Test and Ishihara. The results of these three tests are compared.

Results: To date, all patients in the study scored 100% on Ishihara, and minimal discrimination loss with the 28 Hue. However the 100 Hue Test detected significant changes/abnormalities in colour vision, which reflected the pathology.

Conclusion: While Ishihara is a commonly used test, the comparison of all three tests shows that Ishihara is not sensitive enough to detect acquired colour loss and is a poor substitute. Colour vision testing is a key diagnostic tool and the correct test should be used routinely in all clinical settings to aid diagnosis and investigation of optic nerve and macula pathologies, as the current method of testing is not sensitive to acquired changes.

THE MACTEL PROJECT

Nicola Hunt, Robyn Guymer
CERA

Idiopathic juxtafoveolar telangiectasis, also known as macular telangiectasis type 11 (MacTel), is an uncommon disorder in which blood vessels temporal to the central macular become dilated and develop abnormal branching patterns. The clinical presentation and course of the disorder are incompletely documented and the underlying cause of the disease is unknown. There is no proven treatment. MacTel does not usually cause total blindness but commonly causes loss of central vision over a period of 10-20 years. Although MacTel has been previously regarded as a rare disease, it is in fact probably much more common than previously thought. The very subtle nature of the early findings in MacTel means that the diagnosis is often missed. No new information has emerged about the condition since its clinical features were first well described by Dr. J. Donald Gass in 1982.

The traditional understanding of Mactel is that the primary abnormality is in the retinal blood vessels, which were thought to become more leaky, although there is little understanding as to why this occurs and traditional treatment for leaky vessels, laser photocoagulation has failed to help in this disease .

In order to understand the disease better, to raise its profile and to determine if new treatments for macular disease have a place in Mactel, a multinational research program has been set up in 2005. Clinical Research Groups have now started to conduct a prospective 4 year survey of at least 200 MacTel patients drawn from collaborating centres across Europe, North America and Australia. This survey will provide new information concerning the clinical features, natural history and possible aetiology of this disease.

INCREASING SENIOR DRIVER SAFETY THROUGH VISION TESTS AND EDUCATION – A COMMUNITY BASED PROGRAM

Neryla Jolly, Shona Blanchette, Jody Major
Sydney UniversityAims

This paper reports on the correlation between driver's opinions of performance in visually based driving situations and a decrease in the clinical test responses for vision sensitivity. This paper will also explore the relationship between visual sensitivity and driving behaviors such as driving at night and average hours per day spent driving to see if drivers adapt to be safer.

Content: The paper reports on the outcome from, the vision assessment, which is one segment of a community based Senior Driver Education Program supported by three Shire Councils in NSW and facilitated by a Driver & Work Safety Consultant. At the initial session, each driver undertook a vision assessment and responded to a questionnaire about preferred driving situations. The vision assessment included basic tests that screen to determine whether the licensing standard has been met (central acuity, peripheral vision and detection of double vision) and tests that investigated a greater range of vision skills (contrast sensitivity, depth perception and the impact of reduced light on vision performance). The outcomes were correlated with the response from the questionnaire. The tests and results will be reported.

The results show that whilst the response for screening tests remains at a pass standard, there is a decrease in vision sensitivity in the senior driver and that this is related to decreased comfort in some driving circumstances, such as driving in heavy traffic and speeds over 60 kms per hour. Anecdotal responses indicate that some senior drivers who have decreased visual sensitivity, modify their driving pattern to avoid driving in those circumstances. Senior drivers were pleased to know that their vision could be contributing to the problem and accepted the recommendation that they modify their driving pattern.

Conclusion: The physical vision response changes with age and has been found to be associated with driver reported difficulties in some driving situations. Senior drivers, who are informed of their vision status can be supported to manage their driving behaviour to support safe driving practice.

24 YEAR OLD FEMALE PRESENTS WITH A 5 DAY HISTORY OF LEFT BLURRED VISION – COULD IT BE MULTIPLE SCLEROSIS?

Anne Zara Klawir
Ashwood Eye Centre

Introduction: With a past history of a similar attack, Ms S presented with a 5 day history of left blurry vision. A migraine sufferer, she explained that these symptoms were different, effecting mainly her central vision. There were no associated features, such as headache or migraine, eye pain on movement or flashing lights.

Testing revealed reduced left visual acuity at 6/36 with no improvement with pinhole and reduced colour vision. Humphrey Visual Field results indicated a severe loss of the left visual field. The pupil reactions were normal and there was no sign of an afferent pupil defect. The fundus examination showed healthy optic discs and no evidence of oedema or haemorrhages. The provisional diagnosis was retro-bulbar optic neuritis and an MRI of the brain and orbits was arranged.

Results: MRI scanning indicated numerous white matter lesions with the appearance typical of demyelination. The left optic nerve showed an abnormal T2 signal extending from a point just anterior to the chiasm forward to involve a short segment of the intra-orbital component of the nerve. She was diagnosed with multiple sclerosis.

Discussion:
What does she need to know about this condition?
What does her future hold?
Are any other tests required?
What treatment is required?
Is vision loss common as a presenting symptom?
Is MS common among females of her age?

FACTORS ASSOCIATED WITH THE RECURRENCE OF INTERMITTENT EXOTROPIA FOLLOWING SURGICAL CORRECTION

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Exotropia (XT) occurs in approximately 25% of children with strabismus – intermittent divergence excess type being the most common. Indications for surgical intervention relate to the size and frequency of the deviation. Surgery most commonly involves either a unilateral lateral rectus recession and medial rectus resection or bilateral lateral rectus recessions. The surgery of choice continues to be debated with little evidence that one procedure provides more a successful outcome than the other in the longer term.

Many factors, however, may potentially influence the outcome of strabismus surgery for intermittent XT. These may include age of patient at initial surgery, duration of the deviation, size of the deviation, refractive error and presence of amblyopia or sensory status etc.

This study sought to investigate factors associated with the recurrence of an exo-deviation following horizontal muscle surgery for intermittent XT of the divergence excess type. We retrospectively reviewed the medical histories of patients who underwent surgery for the correction

of intermittent XT between January 1998 and June 2005 and who were followed up for at least 12 months post-operatively.

The results of this clinical audit will be discussed and audience comment invited.

EVIDENCE BASED PRACTICE IN ORTHOPTICS

Connie Koklanis, Zoran Georgivski
Outpatients Department, The Northern Hospital, Melbourne
Department of Clinical Sciences, La Trobe University, Melbourne

In order to provide the best possible patient care, clinical decision making should be based on high quality, robust evidence. Study design plays a significant role in the validity of research and its ability to be used as supporting evidence for recommendations and to be translated into practice. The translational process, which involves taking knowledge and applying it to the patient level, is an imperative part of evidence based practice.

This presentation will review the basis of evidence based medicine and the need for high quality research evidence in orthoptics and specifically in the management of strabismus and ocular motility disorders. This will be discussed in the context of a systematic review we recently conducted in neurotrauma research, which highlights the high level of research activity conducted in other disciplines.

AN AUDIT OF AN ORTHOPTIST-LEAD DIABETIC RETINOPATHY SCREENING SERVICE IN A PUBLIC HOSPITAL OPHTHALMOLOGY SETTING

Ignatios Koukouras[1], **Zoran Georgievski**[1],
Adam Fenton[2], **Connie Koklanis**[2]
[1] Department of Clinical Sciences, La Trobe University, Melbourne,
[2] Outpatients Department, The Northern Hospital, Melbourne

As the number of people diagnosed with diabetes escalates, so too does the demand for routine ophthalmologic monitoring/screening for diabetic retinopathy. Consequently, this is leading to increasing numbers of appointments, waiting times and consultation times in eye clinics. To help alleviate the increasing burden in a hospital outpatient eye clinic, a separate, orthoptist-lead diabetic retinopathy screening service was established to work in parallel with the ophthalmology service.

Patients referred to the outpatient eye clinic principally for a routine diabetic eye check were booked onto the screening clinic. A trained orthoptist performed a general eye assessment, including assessment for best correct visual acuity and fundus photography using a non-mydriatic digital retinal fundus camera. Fundus images were graded by the orthoptist or an ophthalmologist, then presented and explained to the patient. A two-up colour printout was kept in the patient file, the digital images were stored on a PC and a letter was sent to the referring GP.

Over a 3-year trial period, 502 patients (1004 eyes) were assessed (255 male and 247 female). Of 1004 eyes, 631 eyes (62.85%) were considered to have no abnormality; 177 (17.63%) had minimal NPDR; 63 (6.27%) had mild NPDR; 26 (2.59%) had moderate NPDR and 8 (0.8%) were found to have proliferative retinopathy. Further, the photographs of 32 eyes (3.19%) were deemed ungradeable (thus requiring ophthalmologic assessment), and pathology other than diabetic retinopathy was noted in 38 eyes (3.78%).

INTERMITTENT EXOTROPIA IN CHILDREN AND THE ROLE OF NON-SURGICAL THERAPIES

Lindley Leonard, Colin Chun Wai Chong,
Susan Cochrane, Frank J. Martin
Ophthalmic Associates

Aim: The optimal management of intermittent exotropia or X(T) is not established due to the lack of definitive evidence. We report the management outcomes of patients from a tertiary referral practice and a university teaching hospital.

Methods: Chart review of 190 patients with X(T) was undertaken to evaluate the outcomes of non-surgical and surgical therapies. Because of variable follow-up time, cumulative survival analysis was performed. The outcome measures were the distance/near control, distance/near binocular vision and cosmesis. To determine the success of non-surgical therapies, we assessed the correlation between compliance with orthoptic treatment, optical therapy and occlusion therapy and distance control of X(T).

Results: The majority (n=188) had either basic or divergence excess X(T). In the non-surgical group (n=145), 50% of patients maintained or had improved distance control of X(T) after 6 years. More than 70% of patients maintained or improved distance binocular vision up to 18 years and 50% of patients remained cosmetically acceptable up to 5.6 years. In the surgical group, 50% had worse distance control by 5 years. In the non-surgical group, compliance with orthoptic treatment was strongly associated with distance control of X(T) ($r2 = 0.32$, $P < 0.001$). Compliance with occlusion therapy and optical therapy showed weaker associations ($r2=0.15$, $P<0.001$ and $r2=0.00$, $P=0.037$ respectively).

Conclusion: Non-surgical therapy is effective in maintaining or improving the degree of control, binocular vision and cosmesis in X(T) over a long time-period. Compliance with orthoptic treatment is important in achieving good control of distance X(T).

MANAGEMENT OF MEDULLOEPITHELIOMA IN A 20 MONTH OLD

Lindley Leonard, Frank J. Martin
Ophthalmic Associates

A 20 month old boy presented with a six month history of an irregular shaped right pupil. Examination found a mass behind the right temporal iris with slight shallowing of the anterior chamber and a solid tumor in the immediate subjacent ciliary body. Ultrasound confirmed diagnosis of Medulloepithelioma.

Management requiring a multidisciplinary team: Biopsy? Enucleation? Localised Resection? Or Brachytherapy??

THE PROGNOSTIC VALUE OF THE CYCLO-SWAP TEST IN THE TREATMENT OF AMBLYOPIA USING ATROPINE: A PILOT STUDY

Josephine Leone, Connie Koklanis, Zoran Georgievski
Outpatients Department, The Northern Hospital, Melbourne
Department of Clinical Sciences, La Trobe University, Melbourne

Although atropine is commonly used in the management of amblyopia, best practice guidelines regarding its use have not been adequately determined. The recent PEDIG trials concerning atropine treatment seem to have raised more questions than have been answered. Atropine treatment is widely believed only to be effective in milder degrees of amblyopia, where a swap in fixation to the amblyopic eye is more likely to occur. The 'cyclo-swap test' may be performed prior to prescribing atropine treatment in order to determine a patient's likely fixation behaviour during the treatment. Though perhaps not widely, this test has been used clinically, though there is scant clinical research into its use in predicting which patients will best respond to atropine treatment. Furthermore and since the relevant PEDIG study, it is currently debated as to whether a fixation swap to fixation with the amblyopic eye is actually required to achieve improvement in vision. In response to this, we have conducted a pilot study to investigate the validity and prognostic value of the cyclo-swap test. The relationship between fixation behaviour before and during treatment and visual acuity outcomes is also being assessed. The preliminary findings of this study will be discussed.

THE EFFECTS OF ANTIDEPPRESSANTS ON IOP AND ANGLES IN THE EYE

Ursula Losew
Marsden Eye Specialists

Antidepressants come from a group of drugs called Selective Serotonin Reuptake Inhibitors (SSRIs). They are non-selective inhibitors of the

reuptake of seratonin, norepinephrine, dopamine and has no anticholinergic activity.

However in a study performed in the US in 1998, it was found that patients on SSRIs raised the intraocular pressure and could invariably lead to acute angle closure glaucoma. In the study 20 patients were given either the anti-depressant fluoxetine (Prozac) or a placebo in randomised order. It was noted that the patients who took the anti-depressant that IOP increased by up to 4mmHG lasting up to 6 hours.

The mechanism that these drops affect IOP has been studied extensively and two main theories have been developed.

1. It may be due to weak anticholinergic or mydriatic effects of the seraton ergic drugs which can precipitate angle closure.
2. Serotonin and serotonin receptors have been found in the human ciliary body and it can lead to increased IOP.

VERBAL AND NON-VERBAL IQ LEVELS OF INDIVIDUALS WITH CONGENITAL NYSTAGMUS

Linda Malesic, Ashish Kumari
La Trobe University

Purpose: Limited research has been conducted on the intellectual and educational abilities of individuals with congenital nystagmus (CN). This study compared the verbal, non-verbal and full IQ levels of individuals with CN.

Methods: 17 individuals with CN aged between 4 and 67 years (mean 24 years; SD ±10.80) participated in this study. 9 participants were classified as CN only (idiopathic) and 8 were albinos with CN. Vision ranged from 6/9 to 6/60. Verbal and nonverbal intellectual ability was measured using the Kaufman Brief Intelligence Test (K-Bit) and educational ability was measured by the reading, spelling and arithmetic tests of the Wechsler Individual Achievement Test II (WIAT II). All participants completed a questionnaire and the responses given were used to determine if certain environmental and/or genetic influences correlated with the IQ scores obtained.

Results: 77% of the participants achieved an 'average' full IQ score and 23% achieved an 'above average' full IQ score when compared to the normal age-matched IQ data provided in the K-Bit manual. No participant with CN achieved a full IQ score that was 'below average'. Performance on the K-Bit and WIAT II was not related to level of visual acuity and nystagmus classification. The comparison of verbal and non-verbal IQ scores indicated that 67% of the participants performed better at non-verbal IQ tasks than verbal IQ tasks. There was a statistically significant correlation between non-verbal IQ and arithmetic skills (P= .649, p= .007) and verbal IQ and spelling skills (P= .599, p= .014). The questionnaire responses were suggestive of a relationship between the preferred indoor leisure time activity (e.g. reading) and the K-Bit and WIAT II scores achieved.

Conclusion: The level of visual acuity or classification type (albino or idiopathic) does not predict the intellectual and educational performance of individuals with CN. Reading, spelling and arithmetic skills were related to environmental and genetically predisposed factors rather than to the CN characteristics of the individual.

THE RELATIONSHIP BETWEEN THE CURRENT LICENCING AUTHORITY VISION STANDARDS AND SAFE ONROAD SENIOR DRIVER PERFORMANCE

Sue Silveira, Neryla Jolly, Nathan Clunas, Lynette Kay
University of Sydney

Current licencing authority's vision standards are based on assessment of visual acuity using a standard Snellen chart and visual fields using a variety of automated and non automated tests. These vision standards are rigorously enforced and failure to meet the required level can lead to cancellation of a driving licence. Attempts to locate the origins of the standards have been unsuccessful. While much has been written on the relationship between driving and vision, no such research has previously been done.

Enforcement of vision standards is very relevant to senior drivers because the incidence of vision defects increases with age. This research aimed to determine the relationship between current vision standards and safe senior driver onroad performance. A multi disciplinary team from the Faculty of Health Sciences comprising Orthoptists, Specialist Occupational Therapists and Driving Instructors was formed. The team conducted off and on-road assessments of 100 senior drivers (35 females, 65 males) between 60 to 86 years.

Drivers with obvious general physical or cognitive defects were excluded to eliminate influences other than those related to vision or the age of the participants. At least 20% of participants had vision defects to enable evaluation of drivers with both full and defective visual function.

The results of analysing the relationship between visual acuity, visual fields and onroad performance will be presented.

NSW VISION SURVEILLANCE AND SCREENING IN 2006 – SOME QUESTIONS ANSWERED, MANY MORE TO ASK

Sue Silveira
University of Sydney

During 2006 a statewide review of the Personal Health Record (PHR), commonly known as the "Blue Book" was conducted by a multidisciplinary committee consisting of health professionals involved in early childhood health. This included orthoptists, general practitioners, paediatricians, early childhood nurses, midwives, lactation consultants, audiologists, oral hygienists and immunization consultants.

The review began with an online survey complete by parents and health professionals and the outcome of the survey was used to determine areas of change. This was a simple as what colour and format the PHR should take, to ensuring surveillance and screening protocols adequately represented all essential child development and health issues.

Vision and hearing both came under close scrutiny by the committee, despite traditionally being considered vital areas to surveill and screen during a child's life. Doubt was cast over their inclusion due to the lack of scientific evidence to support current practice when children undergo surveillance and screening.

This paper will present the final outcome of the review of the Personal Health Record to inform clinicians of new protocols and what their role in these protocols may be. It will also open for discussion the way forward in vision surveillance and screening.

PAEDIATRIC OCULAR INJURY AND PREVENTION – A REVIEW OF THE CURRENT LITERATURE

Sue Silveira
University of Sydney

In 2006 a grant was awarded by the Statewide Ophthalmology Service, The Greater Metropolitan Clinical Taskforce, to allow a review of the current scientific literature on paediatric ocular injury and prevention.

Three questions were asked – what current literature is available on the incidence, cause and outcome of paediatric ocular injury? What prevention programs are in place and have they been evaluated? What conclusions can be drawn from the literature about "eye safe locations" for children?

A synopsis of the literature will be presented with a health promotion framework for prevention of paediatric ocular injury.

TEMPERATURE – A CONTRIBUTING FACTOR IN A CASE OF SUPERIOR OBLIQUE PALSY

Kirsty Somerville McAlester, Julia Kelly
Sydney Hospital & Sydney Eye Hospital

Purpose: An unusual case of superior oblique palsy with vertical diplopia, exacerbated by temperature change is presented. The presenting symptoms raised suspicion of a clinical condition akin to that of "Uhthoff's Phenomenon," as seen in Multiple Sclerosis, however the increased body temperature in this patient lead to diplopia not vision impairment. A

literature search revealed that changes in temperature, influence muscle fatigue in myasthenic patients.

Method: Clinical signs are presented and investigative tests to determine if a suspected diagnosis of Ocular Myasthenia Gravis (OMG) are discussed. The clinical findings are examined in the light of current evidence in the literature regarding diagnostic tests for OMG. Special attention is given to the "Ice Test", a simple clinical test that aids in the diagnosis of OMG.

Results: OMG was excluded because of negative Acetylcholine Receptor Antibody Assay and single fibre electromyography studies. A diagnosis of acquired idiopathic fourth nerve palsy was accepted with subsequent inferior oblique surgery.

Conclusion: In the presence of a negative diagnosis of OMG, is this case an example of false negative responses to specific OMG testing, as documented in the literature?

Alternatively is sensitivity to temperature a previously unrecognised decompensation factor in ocular nerve palsies? The accuracy of this patient as an historian regarding the impact temperature changes had on his symptoms and deviation, should encourage us to include questions relating to body temperature in our histories. Indeed, a study of the patterns of decompensation in ocular muscle palsies compared to the time of year and temperature ranges may be an interesting future study.

LASIK: CLINICAL RESULTS AND THEIR RELATIONSHIP TO PATIENT SATISFACTION AND COMPARISON LASIK AND NON-LASIK PATIENTS

Lien Tat-Medgyessy
Prof Coroneo's Room

Purpose: The aim of this study was to evaluate the safety and efficacy of LASIK as a refractive surgical procedure, using a repeated measures design to assess satisfaction of patients who had LASIK and to correlate clinical outcomes with detailed measures of patient satisfaction to document long-term viability, monitor changes over time and patients' functional abilities post-operatively.

Method: In the study 216 post-LASIK subjects were randomly selected from among patients who underwent simultaneous bilateral LASIK. The study also included 100 non-LASIK subjects as a control group, to compare and differentiate ocular symptoms and visual difficulties between LASIK and non-LASIK patients. Clinical and subjective patient satisfaction data were evaluated.

Results: LASIK achieved relatively high patient satisfaction, with only a small number of dissatisfied patients. It was effective in correcting myopia, hyperopia and astigmatism. However, there were some under- as well as over-correction. The LASIK subjects' post-operative distance uncorrected visual acuity was not as good as their pre-operative best corrected visual acuity, but it did not significantly correlate with patient satisfaction. The findings confirmed the concept that patient satisfaction is not unidimensional and is not related to outcome solely in terms of visual acuity and residual refractive errors. Other contributing factors were identified.

Conclusions: The findings of this study are consistent with those of earlier studies. However, the repeated measures design and the comparisons between LASIK subjects and the control group revealed some new insights that were previously undocumented.

INTERESTING RETINOPATHY

Suzane Vassallo, Catherine Mancuso, Alex Harper
La Trobe University

Activities involving straining can sometimes result in a type of haemorrhagic retinopathy often resulting in sudden loss of vision. The authors present two interesting cases of such retinopathy which they have seen in the clinical setting in recent times. These cases will highlight the various aetiologies which could lead to this retinal insult, the management option employed and the outcomes which ensued in both instances.

A COMPARISON OF REHABILITATION STRATEGIES USED TO AMELIORATE THE IMPACT OF MACULAR VISION LOSS: FINAL RESULTS

Meri Vukicevic, Dr Kerry Fitzmaurice
Department of Clinical Vision Sciences

Purpose: The aim of the study was to compare the efficacy of two forms of rehabilitation used to ameliorate the impact of macular vision loss. The traditional method of vision rehabilitation has been the use of magnifiers. This intervention is widely used and considered successful. Nevertheless, it does have some limitations. Another method of vision rehabilitation and one that can be used in conjunction with magnification is eccentric viewing strategy (EVS). Although there has been some research into the efficacy of this technique, it has not been widely studied and little has been done to compare the two methods. This report provides data from a random controlled study comparing the two rehabilitation techniques.

Method: Patients attending ophthalmology clinics in Melbourne who met the inclusion criteria were invited to participate in this study. Inclusion criteria were healthy persons aged 50 years and over who are legally blind due to ocular pathology causing macular vision loss. Participants were randomly assigned to one of four age-matched groups. Magnification group, Eccentric viewing group, Combination group and Non-intervention group. Dependant variables were measures of reading performance and activities of daily living. The study was a multivariate design using repeated measures. A comparative cost analysis was also conducted during the study in order to measure the direct costs involved with each rehabilitation strategy.

Results: Statistical analysis has shown that both magnification intervention and EVS are effective, however a combination of both techniques is best, and most cost effective. The statistical analyses and potential implications for vision rehabilitation will be discussed.

THE CLINICAL APPLICATION OF OPTICAL COHERENCE TOMOGRAPHY: AN ORTHOPTIST'S PERSPECTIVE

Meri Vukicevic, Bronwyn Bierens, Stavroula Stylanou
Department of Clinical Vision Sciences

Optical Coherence Tomography (OCT) is a relatively new type of medical diagnostic imaging first developed in 1991. It enables the performance of high-resolution cross-sectional imaging of the internal microstructure of the eye. Cross-sectional images of the internal ocular structures are generated by measuring echo time delay and intensity of reflected light.

The value of OCT is in the ability to evaluate real-time in situ visualisation of ocular structures, without needing a biopsy specimen and is a powerful adjunct to the clinical techniques of slit-lamp biomicroscopy, indirect ophthalmoscopy, fluorescein angiography and visual field testing.

OCT is increasingly used in ophthalmic clinics and orthoptists are becoming an integral part of performing this useful diagnostic test. This presentation will provide a brief overview of how to interpret an OCT scan and interesting clinical cases will be used to facilitate examination of the clinical application of OCT.

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

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

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	1963-4	Leonie Collins	1979-80	Mary Carter
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1949-50	E D'Ombrain	1966-7	Helen Hawkeswood	1983-5	Neryla Jolly
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1952-4	Patricia Lance	1969-70	Jess Kirby	1987-9	Margaret Doyle
1954-5	Diana Mann	1970-1	Neryla Heard	1989-91	Leonie Collins
1955-6	Jess Kirby	1971-2	Jill Taylor	1991-3	Anne Fitzgerald
1956-7	Mary Carter	1972-3	Patricia Lance	1993-5	Barbara Walsh
1957-8	Lucille Retalic	1973-4	Jill Taylor	1995-7	Jan Wulff
1958-9	Mary Peoples	1974-5	Patricia Lance	1997-00	Kerry Fitzmaurice
1959-60	Patricia Lance	1975-6	Megan Lewis	2000-2	Kerry Martin
1960-1	Helen Hawkeswood	1976-7	Vivienne Gordon	2002-4	Val Tosswill
1961-2	Jess Kirby	1977-8	Helen Hawkeswood	2004-6	Julie Barbour
1962-3	Patricia Lance	1978-9	Patricia Dunlop	2007-8	Heather Pettigrew

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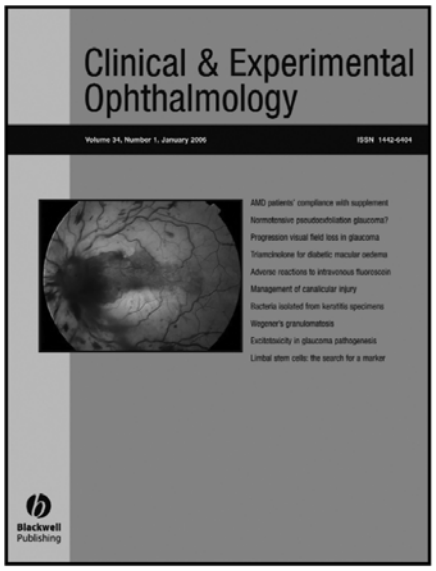

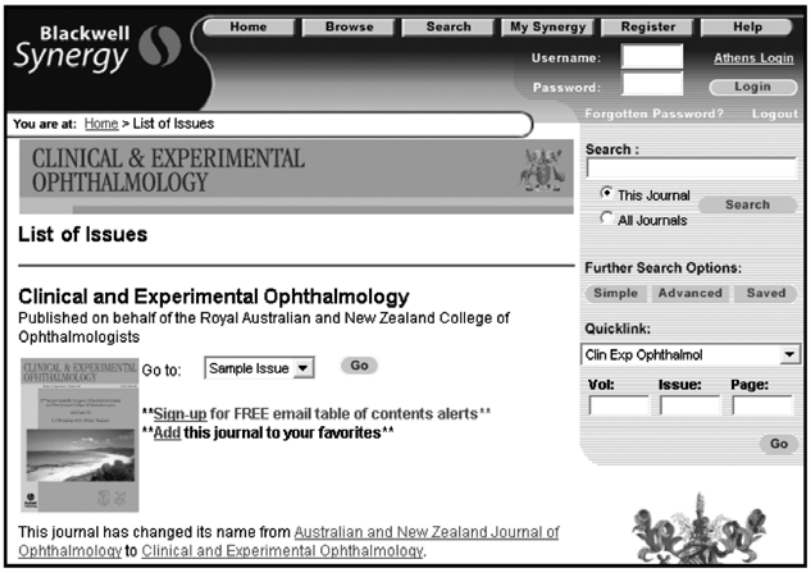

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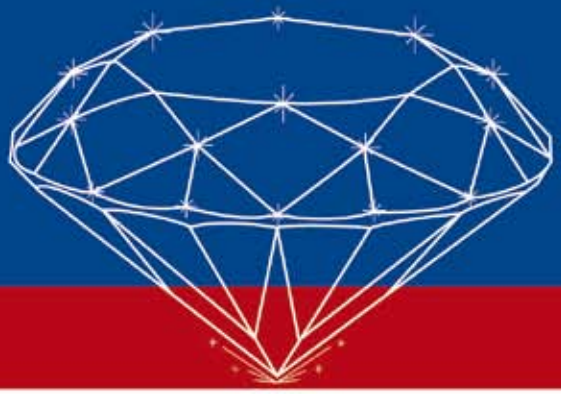

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