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EDITORIAL

"Time to review" said our president as she opened our scientific meeting.

In a sense, it is always time for review. Reviews of case histories of one type or another have often given us a clearer picture of possible etiologies, responses to be expected, criteria for judging prognosis, profitable or unprofitable treatment.

It would probably, too, be helpful to review published papers on particular topics, from say the 1939 (first) British Orthoptic Journal, to the present—perhaps on accommodative squint, superior oblique weakness, or suppression. We might well find some forgotten but useful ideas, and learn how terminology changes.

At the moment it is easier to review what went on at that scientific meeting on the Pacific shore. Papers presented told of new instruments and of new uses for older instruments, of vision tests and screening, new facts about eso and exophoria, new needs for teaching central fixation, and of course, stereopsis, and a refresher course on the developments of the seventies for the orthoptists of the nineteen sixties. The more it changes, the more it remains the same. We still have severe critics to keep us on our toes. We still have new ideas to report, new goals appearing. In other words, our profession continues to be a developing and challenging one.

Diana Craig

ORTHOPTIC ASSOCIATION OF AUSTRALIA
38th ANNUAL CONGRESS, SURFERS PARADISE, QUEENSLAND, SEPTEMBER 1981

PRESIDENTIAL ADDRESS

Mr Minister, Dr Stark, Distinguished Guests, Colleagues all:

On behalf of the O.A.A., I join with Jess Kirby our Queensland President, in welcoming you to our 38th Annual Scientific Conference. The theme "Time for Review" has been set for profound reasons. It is time to examine the development of orthoptics, to take stock, and to seek clear guidelines for planning future progress.

The O.A.A. was formed in 1943 by fourteen orthoptists. Two of these pioneers are with us today. These women took on the task of establishing orthoptics as an important paramedical science, at a time when there was much scepticism about our work, and few proven facts. To win the battle, they had to extend their knowledge, to improve their systems of treatment and to be prepared to discard methods that were unsuccessful. In other words, our knowledge has come from reasoning, reading, trial and error.

Today we have 298 members, two well-established colleges equipped with the latest teaching resources, and quite an accumulation of useful knowledge despite our very short history. The orthoptic graduate today is required to know much more to prepare her for the continually changing role in the eye-health program.

The more we know, the more we know we don't know. Hence comes motivation to seek further knowledge. We must recognise orthoptics as an applied science, as part of a whole system of science with pure science and research at the top.

A single example is the C.A.M. vision stimulator. Devised as an application of concepts evolved through advanced research, this instrument has been tested in clinical use by many of us and by many ophthalmologists, and the results have been fed back as further data for pure science.

New knowledge may also come from alert, concerned observers in the medical field. Through careful recording, noting coincidences, consulting records and questioning, Norman Gregg linked congenital cataract with rubella. Thus he showed the way to prevent such cataracts, and demonstrated for the first time that congenital malformation may be caused by uterine infection. Kate Campbell, with similar care and persistence showed that retrolental fibroplasia in premature babies developed only after high oxygen intake, and with this warning saved untold numbers of future children from blindness.

Orthoptics is a small limb of science interrelated with a whole wide field of knowledge. In our clinics we can see science applied in every department. To keep our place in this system we must be alert and we must work to help fill those gaps in knowledge with proven facts.

Our function here is simple. Here we are, 50 of us, dedicated to our profession and each of us with a variety of experiences. Perhaps we've made different assessments of a similar experience. Wouldn't it be wonderful if we could all pool and discuss our separate experiences, so that with a collective mind we can return from this conference to our corners with enhanced knowledge, and confidence in our profession.

Keren Edwards, D.O.B.A.,
President,
Orthoptic Association of Australia,
1980-1981.

ON THE RELATIONSHIP OF ESO TO EXO-TROPIA IN NEWCASTLE. 1980

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Abstract

All cases of manifest horizontal deviation presenting during 1980 in a solo Australian private orthoptic practice were analysed in relation to type of deviation, type of onset, age, race, sex, refractive error, amblyopia, concomitance, constancy and delay in presentation. The 1980 incidence of eso and exo deviation was compared with the figures from the same solo practice over the previous 25 years.

Key words: *Survey, manifest horizontal deviation, related factors, incidence.*

INTRODUCTION

The International Orthoptic Association has planned a world wide study of the relative incidence of esotropia and exotropia, with as many countries participating as possible. In particular the association wishes to assess whether the prevalence of one or the other condition can be related to one or more of the following factors: latitude, hours of sunshine and race.

Additional factors to be studied include: concomitance or incomitance; congenital or acquired; constant or intermittent (when first presenting); presence of refractive error and amblyopia.

SURVEY

A survey of all new cases of eso and exo-tropia presenting in one Newcastle practice during 1980 has been undertaken as part of the International project.

All the patients in this study have lived at about 33°S for all or most of their lives, with an average exposure of 8 hours of sunshine daily and are of mainly Northern European race. In 1980 there were 159 new cases of esotropia and 31 new cases of exotropia.

In order to put the figures of the year 1980 into perspective, the ratio of eso to exo-tropia has been calculated for the previous 25 years (see Figure 1). The ratio varies from year to year but shows a general rise which has reached a peak of 4.6:1 in 1980. Taking the mean of these ratios in 5 year spans (see broken lines), there is a gradual increase from 1.9:1 in '55-'59 up to 3.2:1 in '75-'79.

Age at Presentation

Figures 2 and 3 show the number of males and females presenting in 1980 at various ages with esotropia and exotropia.

Tables 1 and 2 shows the actual number of cases in each group with percentages (approx.) in brackets.

Over half (57%) the esotropic cases presented in the birth to 3 years old age group, but only 30% of exotropes were in this age group. Esotropia was more common in males than it was in females in this series but females presented slightly more frequently with

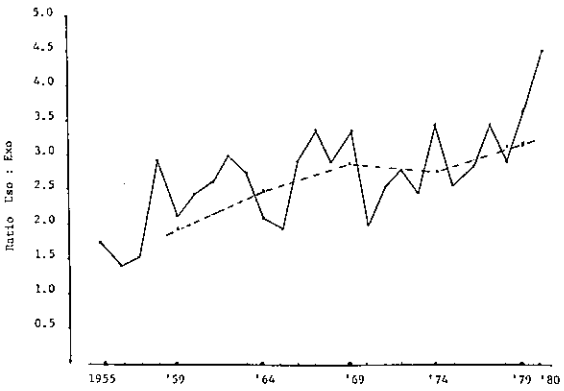

Figure 1: Graph showing the ratio of eso to exo deviation (continuous line) 1955-1980.
Broken line represents the mean ratio of eso to exo deviation in 5 yearly spans (1955-1979).

exotropia. It is interesting to note that all the males with exotropia presented under age 7 years.

Type of Deviation

Figure 4 and Tables 3 and 4 show the number and percentages of cases of congenital and acquired eso and esotropia in 1980. The International Orthoptic Association (I.O.A.) guidelines define "congenital" as dating from birth or with onset within the first 9 months of life. "Acquired" means onset after the age of 9 months. Constant and intermittent status was noted at the time of presentation.

Most cases (76%) were intermittent in both esotropia and exotropia. There was no incidence of incomitance in the 31 cases of exotropia.

Refractive Error and Amblyopia

Refractive error is defined (I.O.A.) as 1D or more error in any meridian and amblyopia is said to be present where there is one or more lines difference in visual acuity between the eyes before treatment. Tables 5 and 6 and Figure

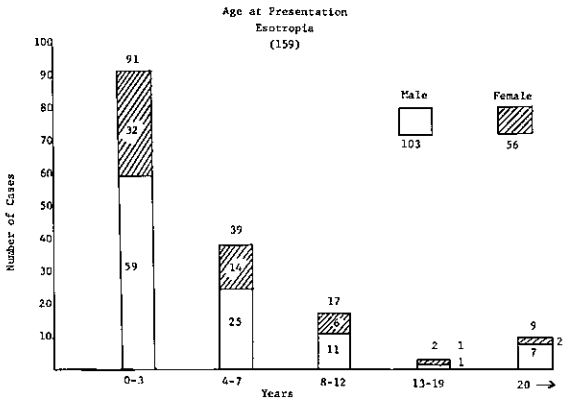

Figure 2.

TABLE 1
Age at Presentation of Esotropia

Age in years		0-3	4-7	8-12	13-19	20→
Males	103 (65)	59 (37)	25 (16)	11 (7)	1 (0.5)	7 (5)
Females	56 (35)	32 (20)	14 (9)	6 (4)	1 (0.5)	2 (1)
Total	159 (100)	91 (57)	39 (25)	17 (11)	2 (1)	9 (6)

Percentages in brackets.

TABLE 2
Age at Presentation of Exotropia

Age in years		0-3	4-7	8-12	13-19	20→
Males	13 (42)	6 (20)	7 (22)	0 (0)	0 (0)	0 (0)
Females	18 (58)	3 (10)	4 (13)	5 (16)	1 (3)	5 (16)
Total	31 (100)	9 (30)	11 (35)	5 (16)	1 (3)	5 (16)

Percentages in brackets.

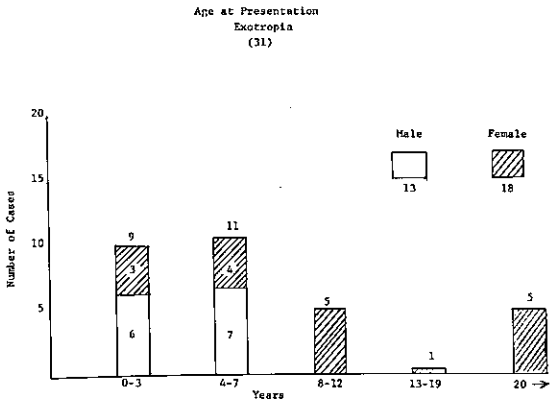

Figure 3.

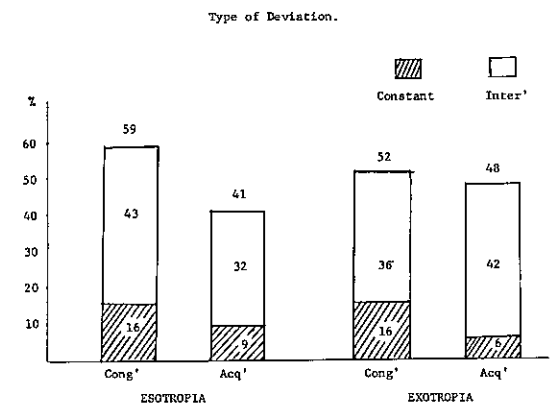

Figure 4.

DISCUSSION

Surprisingly, similarities between eso and exo-deviation are more apparent in this series than dissimilarities.

Information on latitude, hours of sunshine and race from this study will only be useful when it is considered in relation to the world-wide figures and will not be discussed here.

Figure 1 shows a relative increase in the proportion of eso-tropia to exo-tropia, rising

TABLE 4
Exotropia — Type of Deviation

	Constant	Inter	Total
Congenital 16 (52)	5 (16)	11 (36)	16 (52)
Acquired 15 (48)	2 (6)	13 (42)	15 (48)
Total	7 (23)	24 (77)	31 (100)

Percentages in brackets.

1.7:1 in 1955 to 4.6:1 in 1980. Similar variations may be occurring in other areas. The National Trachoma and Eye Health Program figures show a ratio of eso to exo deviation of 3:1 among aborigines, whereas non-aborigines in the same survey had a ratio of almost 1:1 (37:40) in an area where the incidence of strabismus appears much lower — 0.05% for

TABLE 3
Esotropia — Type of Deviation

		Constant	Inter	Total
Congenital 94 (59)	Concomitant	16 (10)	59 (37)	75 (47)
	Incomitant	10 (6)	9 (6)	19 (12)
Acquired 65 (41)	Concomitant	9 (6)	47 (29)	56 (35)
	Incomitant	4 (3)	5 (3)	9 (6)
Total 159 (100)		39 (25)	120 (75)	159 (100)

Percentages in brackets.

5 show the number of cases of congenital and acquired eso and exo-tropia affected by refractive error and amblyopia, including those affected by both or neither condition.

aborigines and 0.1% for non-aborigines.[1] The rate for urban Western type society varies between 1% and 3% depending on the age group involved.[2]

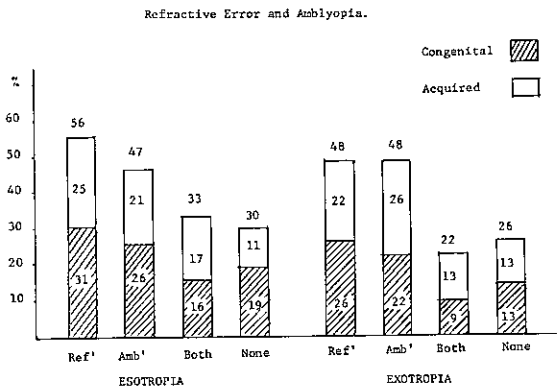

Figure 5.

Divergent squint is more common in aborigines than in non-aborigines. Hollows (1980) states that "Aboriginal children have less amount of convergence per unit of focussing power than do Caucasion children. Although this phenomenon is probably genetic it may include some adaption to high-light environments. Squint in aborigines also tends to occur later in childhood and it is not unusual for the poorer sighted eye to diverge at this stage".

The high percentage (57%) of esotropes presenting under the age of 3 years, compared with only 30% of exotropes in the same age groups is interesting. Does Western style culture predispose humans to "too much, too close too soon?" Has the human race not really adapted to the demands of the highly sophisticated living we accept as normal in 1980?

The proportion of "congenital" to "acquired" was about the same in both types of deviation. This may be a reflection of the arbitrary time chosen by the I.O.A. to divide congenital and acquired (nine months).

Most patients sought treatment within a few months of the deviation becoming apparent. Only a very small number of patients presented after a prolonged period of neglect of the deviation. Only 4 (13%) of the exotropes and 21 (13%) of the 159 esotropes could be termed "neglected".

TABLE 5
Amblyopia and Refractive Error in Esotropia

		Ref' Error	Amb'	Both	Neither
Congenital	94 (59)	49 (31)	41 (26)	26 (16)	30 (19)
Acquired	65 (41)	40 (25)	34 (21)	27 (17)	18 (11)
Total	159 (100)	89 (56)	75 (47)	53 (33)	48 (30)

Percentages in brackets.

TABLE 6
Amblyopia and Refractive Error in Exotropia

		Ref' Error	Amb'	Both	Neither
Congenital	16 (52)	8 (26)	7 (22)	3 (9)	4 (13)
Acquired	15 (48)	7 (22)	8 (26)	4 (13)	4 (13)
Total	31 (100)	15 (48)	15 (48)	7 (22)	8 (26)

Percentages in brackets.

The early presentation for both conditions is very satisfactory, as early treatment of ocular muscle imbalance should produce the best possible chance of fully functional results. This reflects gradually increasing local parent and practitioner awareness of the desirability and practicability of early diagnosis and treatment.[3]

Refractive error appears to be a predominant factor in both eso and exo cases. This may be because of the parameters set for this study and the fact that so many of the patients were very young, where an "error" of 1D is common and natural. Nevertheless, early correction of refractive error in ocular muscle imbalance seems highly desirable: form deprivation, meridional and strabismic amblyopia may thus be avoided.[4,5,6,7] In the exotropic group 8 (26%) had no other defect other than their divergence.

CONCLUSION

The unexpected features of these results may be mainly local deviations from the norm; and the full significance of these figures will not be evident until the world wide figures are available for comparison.

I would like to urge all orthoptists to complete their surveys as adequately as possible and to add retrospective studies of other years for comparison, in order to enhance the value of the Australia-wide picture in the world scene.

ACKNOWLEDGEMENTS

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CENTRAL RETINAL LESIONS AND ORTHOPTICS: A report on a visit to a Swiss clinic

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Abstract

An account is given of work done by Professor Dr. med. J. Otto and by orthoptists and students as observed by the author during an eight weeks visit to the East Switzerland Pleoptic and Orthoptic School (OPOS).

People having damage to the central retina due to organic lesions, for example macular degeneration, are likely to adopt eccentric fixation, which seriously disrupts their orientation in space. In many cases there are still undamaged areas or "islets" on the macula which can be utilised for central fixation. Patients are given a course of "visual retraining" exercises by which central fixation and correct orientation are reestablished.

In every case observed there was an improvement in visual acuity and spatial orientation when exercises were given. The results however were not permanent if the retina further deteriorated due to the nature of the disease.

Key words: *Macular degeneration, re-orientation, localisation, eccentric fixation, scotoma.*

The purpose of the visit to the East Switzerland Pleoptic and Orthoptic School (Ostschweiz Pleoptik und Orthoptik Schule or OPOS,) was to observe the treatment given to patients with ocular organic lesions, such as macular degeneration.

The main aims of the orthoptist are to try to improve visual acuity and to re-establish central fixation. If one of these aims can be achieved then the other may be achieved automatically, because the best vision is at the central retina. Better spatial orientation will then follow. Eccentric fixation achieving the best visual acuity possible is only encouraged when the central retina is too severely damaged.

Orthoptic Investigation

The problems and signs will vary from patient to patient according to the type and severity of the retinal damage.

Fixation

It is well known that patients with defective vision due to organic lesions have poor or eccentric fixation. Fixation of the eyes is observably eccentric. The eyes do not appear to be looking at the fixation object and often there are unsteady eye movements when an attempt is made to fixate an object.

When patients begin to use eccentric fixation they lose the ability to execute precise eye movements and the use of optical aids to see things will often only magnify the problem.

Orientation

One can observe how well a patient can orient himself in space. For example, does he bump into things or walk hesitantly? Does he make eye contact with you when talking to you? Patients' movements and reactions can also be observed when doing the investigative tests.

Often head movements are present as if the patient is trying to see around something. Comments are volunteered on orientation problems in everyday life.

For example, a patient does not know how or when to grasp an object, what height a step is, or how many steps there are to be climbed.

Visual Acuity

Visual acuity is measured each eye, with correction, at a distance of five metres. Near visual acuity is tested and assessed to find out if the patient can read better with additional correction to his reading glasses.

Because of the poor visual acuity of the patients, the 5 metre charts are used at 50 centimetres and the patients are given a +2.00 D.S. addition to their glasses so that a linear visual acuity test can be done. Most patients find it difficult to read a progressive text.

Following Movements

Following movements depend largely on intact foveal perception. If the latter is deficient, movements cannot be accomplished on a continuous basis despite good ocular musculature. This becomes apparent in patients with early childhood functional amblyopia, patients who have been operated for congenital cataracts and also patients with diseases of the retina or optic nerve, e.g. macular degeneration, Fuch's spot, temporal atrophy.

Otto[1] frequently found a pattern when examining patients with macular degeneration:

In primary and horizontal positions, where the eyes are moved most in daily life, the object of fixation is followed jerkily and irregularly. If one, however, directs following movements into unaccustomed positions of gaze, one is surprised to see that the eye movements suddenly become continuous and smooth.

Otto[1] says that this behaviour signifies that there must be still, within the damaged sector of the macula, activated "islets" capable of perception, the functioning of which is less hampered in unaccustomed directions of gaze than in the more frequently used directions.

Localisation Tests

There are two diverse visual requirements here:

(a) A flat object is presented without any particular requirements as to distinguishing it. To be observed:
  (i) The orientation of the eye.
  (ii) The behaviour of the eye and hand when the patient is required to touch the centre of a plain surface with his finger.

(b) An object to be distinguished is presented, e.g. the examiner's finger tips. Once again one observes:
  (i) The orientation of the eye.
  (ii) The behaviour of the eye and the hand when asked to touch the object to be recognised.

During these tests, two types of characteristic behaviour are distinguishable:

The stimulation on the retina, induced by the large surface, allows the eye to adapt physiologically, because no macular or foveolar perception is required. The patient localises correctly and it is of no importance in this regard that he see the centre as distinctly as the other areas (correct localisation due to intact retinal periphery).

In the second case, macular perception demands are registered and provoke:

(a) Agitation and uncertain adaptation of the eye.

(b) Uncertainty or error in the attempt to touch the object of fixation. The patient is conscious of his lesion and therefore employs a peripheral sector of the retina to see, thus losing his security in orientation.

Binocular Functions

Convergence, Worth lights, synoptophore assessments may be done as part of a general orthoptic investigation. Throwing and catching a ball is one way of assessing depth perception and eye orientation.

Colour perception may be tested grossly, using graded, coloured dice or by using the Ishihara colour plates.

THERAPY

At the OPOS, exercises are generally given once a day, everyday for two weeks. In this time, the patients, depending on their eye condition, may be given retrobulbar injections, blood transfusions which have extra oxygen in them, oxygen to breathe to strengthen their immunity to disease and to improve blood circulation and supply to the eyes. Amnion, which is absorbed slowly, may be retrobulbarly injected every two months for the prevention of allergies.

Exercises are usually given before or at least three hours after the injections, as the eye becomes very swollen.

During the fortnight, the patients either stay at the OPOS or in a hotel.

Exercises

When both eyes are afflicted, the better eye is usually given the exercises first, unless that eye has a strongly functioning eccentric fixation point.

Exercises should be undertaken as if the macula had not undergone any alteration, that is, as if orientation were more important than the results of perception. The exercises are made to be as natural as possible.[2]

"E" Cards

Cards made from 15 centimetres square white cardboard, are edged in black which serves as a boundary. In the centre of each card is a single "E", or letter or number. The sizes are graded. The patient is asked to identify the symbol, which is shown from varying distances and directions.

When the patient has difficulty in seeing, the fixation of the eye becomes unsteady and head movements are noticed. At this point, the patient must be told not to move his head and perhaps to close his eye when fixation falters.

Accommodation can blur vision. This sometimes occurs when the patient becomes nervous and tense. In some cases, a small plus lens correction is given when the patient cannot relax.

When following movements have proved to be defective, the patient practises reading linear charts at 5 metre, 50 cms, and at reading distance.

The patient practises tracing broken lines with a fine pointer, learning to stop and start exactly where the line stops and starts.

Miniature counters with coloured beads are used to encourage smoother eye movements. The orthoptist changes or rearranges the number of beads and the patient must count them. Here you can stimulate the same functions needed for reading.

The patient may practise reading words printed on a blackboard from 1 metre to 5 metres away.

He then practises reading graded print or pictures and progresses to reading books in a range of sized print and styles.

Based on the principle that the best ability to perceive colour is at the macula, there are many exercises done with colours to stimulate central fixation.

Sometimes a sheet of light green plastic is placed over the print the patient is reading.

Playing cards of different sizes are presented to the patient and their colour and symbols must be identified. The orthoptist may present the cards from different distances and directions. Similarly, coloured dice of different sizes may be presented. Green cards with red symbols in the centre may be presented to be identified.

A game of dominoes may be played or just used to identify the colour and number of dots.

In all of these exercises, a close regard must be paid to the orientation of the eye, as fixation becomes unsteady when the patient cannot see well enough or loses confidence.

Orientation

The patient practises identifying, locating and naming the colour of various objects in the room, e.g. the telephone, a book on the table, a potplant. The same thing is done when you take the patient outside for a walk, e.g. flowers, cars, buildings.

Most patients have more success in improving their near visual acuity. In the distance, there

TABLE 1

Results of Visual Retraining in 10 cases of bilateral macular damage with loss of spatial orientation. (Translated and modified from a table in Otto and Safra.[3])

Patient number	Name	Age (in years)	Sex	Diagnosis (all bilateral)	Orientation disturbances: In the street	Unable to read	Unable to recognise colours	Failure to gain benefit from optical aids	Vision (in single symbols)		Therapy: Number of sessions	Orientation	Recognition of colours	Vision (in single symbols)
1.	K.T.	75	F	S.M.D. (atrophic form)	R	+	+	+	R	0.6 @ 1 m	37	+	+	2.0 @ 1 m
					L				L	0.7 @ 1 m	31	+	+	2.0 @ 1 m
2.	M.F.	55	M	S.M.D. (atrophic form)	R	+	+	+	R	0.1 @ 0.2 m	11	+		0.1 @ 0.4 m
					L				L	1.0 @ 0.5 m	7	+	+	0.6 @ 5 m
3.	R.F.	62	M	S.M.D. (atrophic form)	R	+	+	+	R	0.1 @ 5 m	6	+	+	0.7 @ 5 m
					L				L	0.1 @ 1 m	8	+	+	
4.	B.B.	34	F	J.M.D.	R		+	+	R	0.1 @ 5 m	28	+	+	0.4 @ 5 m
					L				L	0.1 @ 5 m	16	+	+	0.2 @ 5 m
5.	W.S.	64	F	Junius-Kuhnt	R	+	+	+ +	R	0.3 @ 0.3 m	9	+	(+)	0.3 @ 3 m
					L				L	0.1 @ 2 m	9	+	+	0.4 @ 5 m
6.	W.F.	65	M	Fuch's spot in high myopia	R	+	+	+ +	R	0.1 @ 1 m	12	+	+	0.1 @ 5 m
					L				L	0.1 @ 1 m	9	+	+	0.1 @ 5 m
7.	W.W.	50	F	Fuch's spot in high myopia	R	+	+	+ +	R	0.1 @ 1 m	14	+	+	0.2 @ 5 m
					L				L	0.1 @ 1 m	9	+	+	0.3 @ 5 m
8.	S.F.	50	M	Optic atrophy	R	+	+	+ +	R	Amaurotic				
					L				L	0.4 @ 1 m	6	+		0.7 @ 1 m
9.	V.R.	14	F	C.C.P.	R	+	+	+	R	0.2 @ 3 m	10	+		0.2 @ 5 m
					L				L	0.3 @ 3 m	10	+		0.6 @ 5 m
10.	H.E.	38	M	C.C.P.	R	+	+	+	R	0.4 @ 1 m	17	+	+	0.3 @ 5 m
					L				L	0.3 @ 2 m	11	+	+	0.3 @ 5 m

Abbreviations: SMD=Senile macular degeneration; JMD=Juvenile macular degeneration; CCP=Choroiditis centralis peracta.

Additional notes on patients:

1. Single housewife with bed and breakfast boarders, was booked for a nursing home, is now independent again.
2. Merchant: having recovered ability to read slowly, is again managing his own business.
3. Flower trader: again independently judges the quality of his flowers.
4. Nursing sister: had planned to have education for the blind, instead has trained for physiotherapy, her near vision sufficing for normal training.
5. Librarian: again able to carry on her profession.
6. Director of a publishing house: again able to carry out full activities.
7. Housewife: again able to read and to help her husband in the office.
8. Reverend: again able to work; can read liturgical texts.
9. Student: again attending normal secondary school, can play music again, reading music freely.
10. Labourer: has reliable orientation without the previous compensatory head posture.

is all too often the problem that objects in a middle distance range cannot be identified as they become lost in the scotomata. Large objects are more easily seen because they are outside a scotoma and very fine objects are "in between" the damaged areas on the retina and so can be seen. Therefore a patient will often learn to orientate centrally when doing indoor activities or close work, but head movements, jerky eye movements and faulty localisation recur when the patient looks at things that "fall" into a blind spot. Unfortunately, this includes people's faces, types of cars and other socially important objects.

Not all patients seen have spatial orientation difficulties. If this is the case, the exercises are aimed at improving visual acuity and binocular functions.

The result of the two week course of exercises and other treatments was that every patient

improved to some degree in spatial orientation and visual acuity. Where damage to the retina was very extensive, results were not miraculous, but the patient learned to read large print instead of no print at all. Patients may return annually or bi-annually for therapy, as their disease may constantly cause deterioration of the retina and therefore of the vision.

CONCLUSION

The success of the therapy is dependent on a number of factors. The patient needs to be motivated enough to concentrate on the exercises. Sufficient intelligence is also required to perform the exercises. Good health is advisable as are financial capabilities in order to attend the therapy course.

Patients often become discouraged or tense, so the orthoptist must be able to relax and encourage the patient. The skill of observing the fixation of the eye requires a lot of experience.

Reference to Table 1 leads to the following conclusions:

The type of disease of the central fundus is of no vital importance in re-education.

Patients suffering from visual orientation problems were, after therapy, able to move around alone and with relative safety along the street and in unfamiliar places.

The majority of patients treated can once again read regular sized print. Slowly, of course, but without any special optical aid.

Many patients treated have been able to return to their professional occupations.

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ASSESSMENT OF VISUAL FIELD ANOMALIES USING THE VISUALLY EVOKED RESPONSE

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Abstract

A study was performed to assess visual fields using the Visually Evoked Response (VER), by both check and flash methods.

Ten normal subjects were tested using simulated defects, and subsequently patients with various field defects were assessed. Characteristically abnormal VER responses were found for several gross field defects, especially hemianopias, central scotomas and tunnel vision. Smaller defects such as quadrantinopias were assessable by the check VER only but they require more careful interpretation of the results.

The value of using the VER as an alternative method of visual field assessment, with the mentally retarded, geriatric and uncooperative patient is demonstrated.

Key words: *Visually Evoked Potential (VEP), handicapped patient, simulated defects, hemianopia, quadrantinopia, central scotoma, tunnel vision.*

INTRODUCTION

The Visually Evoked Response (VER) or Visually Evoked Potential (VEP), is primarily used in the diagnosis of conditions affecting the optic nerve and the visual cortex. It shows whether or not stimuli seen by the eye reach the cortex without delay and with correct magnitude (i.e. no reduction in strength).

There are many patients whose visual fields cannot be assessed by the conventional field testing methods. They include mentally retarded or emotionally disturbed patients, patients with communication problems, malingerers, some geriatric patients, babies and the very young. If the patient is cooperative enough to have a VER test performed, any gross visual field defect should be detected.

For a check VER to be performed a certain amount of cooperation is required as the patient is required to fix on a central spot. However, no other responses are required from the patient. With the flash VER there is no patient age limit as babies may be sedated while the test is performed. The patient is only required to sit at a Ganzfield sphere and keep his eyes open or have the lids held up if sedated.

Generally the VER is advantageous with some difficult patients as there are very few instructions necessary for the patient. The test is performed more quickly on average than conventional methods of perimetry and it is much easier for both patient and examiner.

The aim of this paper is to make orthoptists aware that the VER may be used as a gross visual field assessment method for patients when conventional methods are unsuccessful.

Before continuing, the normal VER testing procedure will be outlined.

In the normal individual any visual stimulus causes an electrical signal in the brain. The VER is the recording of this signal. The recording basically originates from the nerve fibre layer in the retina and is recorded from the visual cortex. The VER is recorded monocularly.

There are two types of VER's

(1) Check VER

(2) Flash VER.

With the check VER the patient is required to fix on a central spot on the checkerboard while the check pattern alternates (see Fig. 1). Vision

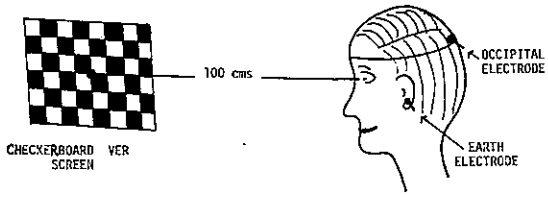

Figure 1: Checkerboard V.E.R.

of 6/36 is normally required for the patient to see the spot on the checkerboard. A 32° or 16° area of the visual field is stimulated with one of two different check sizes. An average of 64 check reversals was recorded in each case.

To perform the flash VER the patient is seated looking into a Ganzfield sphere (see

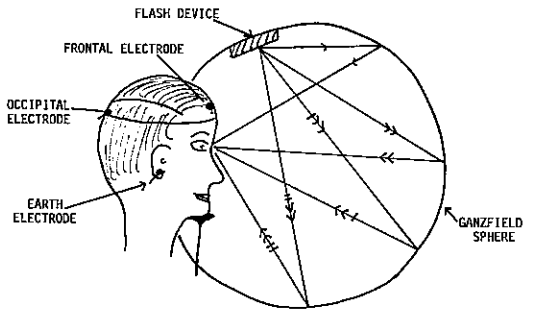

Figure 2: The flash V.E.R.

Fig. 2). Bright flashes of light occur approximately every two seconds. In this test the whole field is stimulated and, since the Ganzfield sphere is manoeuvrable, unconscious patients and babies may be assessed. (An average of 64 flashes were recorded in each case.)

When considering the VER results, the latency and amplitude of the curve are taken into account as well as the overall shape of the curve (see Fig. 3).

Latency, or the time taken for the stimuli to travel along the optic nerve to reach the occipital cortex is measured in milliseconds (ms) or 1/1000 second. With the normal subject (in the author's lab) it takes approximately 95 ms for the check response to reach the visual cortex and it takes approximately 77.0 ms for the flash response. This is reflected in the curve as the first major positive peak and is marked as point "1" and is commonly known as $\overline{P100}$ (P = Positive).

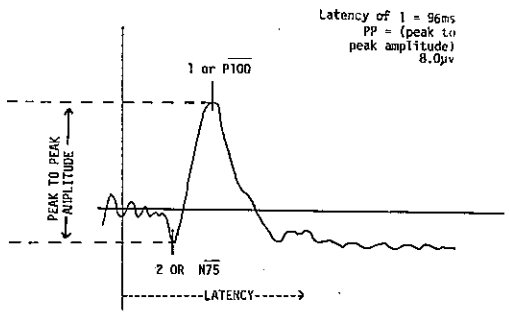

Figure 3: The normal V.E.R.

The amplitude or intensity of the stimulus reaching the visual cortex is measured in microvolts (μv) or 1/100000 volts. In the normal subject the amplitude of $\overline{P100}$ is 8.0 μv for the check VER (see Fig. 3) and 4.8 μv for the flash VER.

Point "2" or $\overline{N75}$ is also generally marked. It is the major negative point which occurs prior to point "1" (see Fig. 3).

METHOD

Two groups of patients were examined.

Group 1: Consisted of 10 normal subjects. Each of the patients were ophthalmologically normal with full visual fields and corrected VA of 6/6 or better. Only the right eye was tested.

Group 2: Consisted of 11 patients with field defects detected on the Goldmann perimeter or Bjerrum screen.

This group included:

3 hemianopic patients
7 patients with tunnel vision
1 arcuate scotoma.

For the purpose of detecting field defects an occipital electrode is placed on the occipital lobe 5 cms above the inion (over the calcarine sulcus). This electrode mainly detects the maximal response of each occipital lobe with the largest contribution coming from the macular fibres (see Fig. 4).

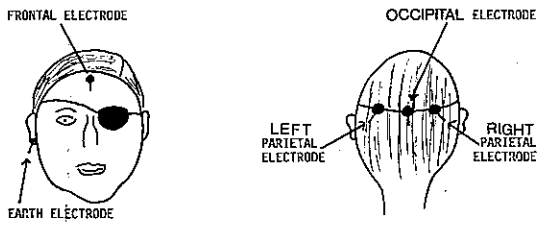

Figure 4: Electrode placement used.

Two parietal electrodes were also used; each placed 5 cms horizontally on either side of the occipital electrode. Recordings from the temporal and nasal halves of the retina were taken individually from these two electrodes thus detecting responses from both nasal and temporal half fields.

The reference electrode was placed on the forehead 6 cm above the nasion and an earth electrode was placed on one ear (see Fig. 4). Once in place these electrodes were not moved throughout the course of testing.

The same arrangement was used for both the normal group and the group with field defects. All patients had both check and flash VER's performed.

For the patients in group 1 field defects were simulated by blocking the appropriate areas of the screen (see Fig. 5) for the check VER. The subjects were instructed to look straight ahead all the time so that they did not overcome their simulated defect.

Simulation of field defects for the flash VER was attempted by blocking out the appropriate area on a lens placed in front of the eye to be tested. This proved unsuccessful as the lens distance (1 cm) from the cornea allowed light to reach all parts of the retina. Thus the only effect was to decrease the intensity of stimulation from one part of the field. Accordingly no VER flash results from normal patients with simulated field defects are recorded.

RESULTS

The results are divided into groups according to the field defect. Each group is further subdivided into normals and patients with actual field defects.

Because of patient to patient variation in VER recordings, an average of responses for normal subjects is taken and referred to in the following figures.

The amplitude in the figures is a peak to peak amplitude, (P to P), i.e. the difference in the height of the tracing between points "1" and "2" (see Figure 6).

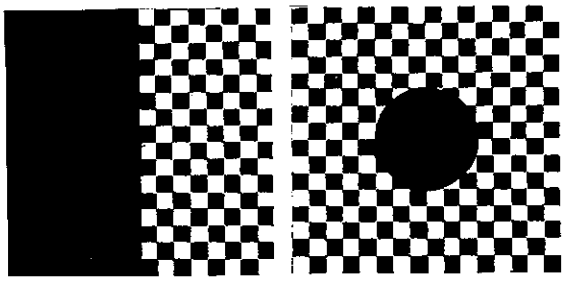

Figure 5: (a) Simulated hemianopia; (b) Simulated central scotoma.

All the results were compared to the average whole field stimulation of normal individuals. (The averaged curves for normal subjects were smoother due to filtering and averaging.)

Check VER-Whole Field Stimulation: The averaged whole field stimulation of normal subjects showed the latency of point "1" to be 94.0 ms for the occipital electrode and 96.0 ms for the parietal electrodes (see Figure 6). The amplitude recorded from the occipital electrode was 8.0 μv, while 3.2 μv was recorded from the parietal electrodes.

Flash VER-Whole Field Stimulation: The average latency recorded from the flash VER was 77.0 ms from the occipital electrode, 76.0 ms from the right and 78.0 ms from the

left parietal electrode. (See Figure 7). The amplitude recorded from the occipital electrode was 5.2 μv and 4.6 μv recorded from the parietal electrodes.

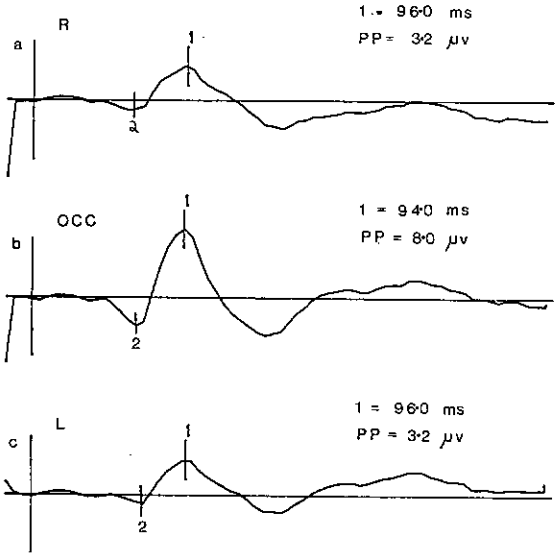

Figure 6: Tracing of check whole field stimulation. (Normal subject: Right eye). Symbols 1 = . . ms, in this and subsequent tracings represent latency of first positive peak.

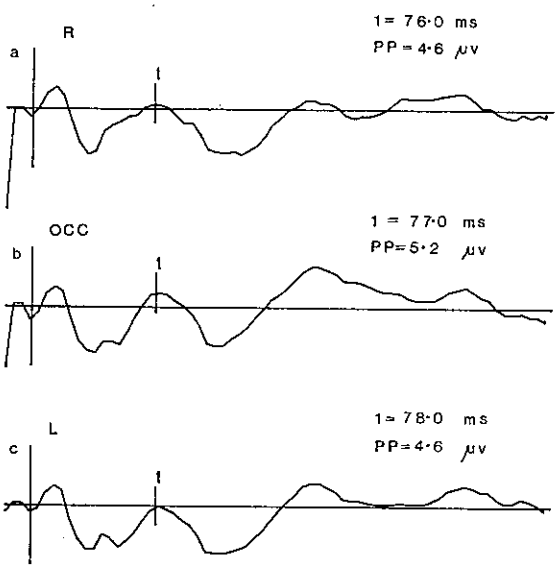

Figure 7: Tracing of flash whole field stimulation. (Normal subject: Right eye.)

Hemianopia

(1) Normal Subjects — The greatest difference between the averaged whole field tracing and the averaged hemianopia was seen in the electrode ipsilateral to the side of the field defect where there was an increase in latency to 110.0 ms and a decrease in amplitude to 0.6 μv (see Figure 8). There was a decrease in amplitude to 4.8 μv recorded from the occipital electrode while the latency remained unchanged (Figure 8b). The tracing from the electrode contralateral to the side of the defect remained within normal limits (Figure 8c).

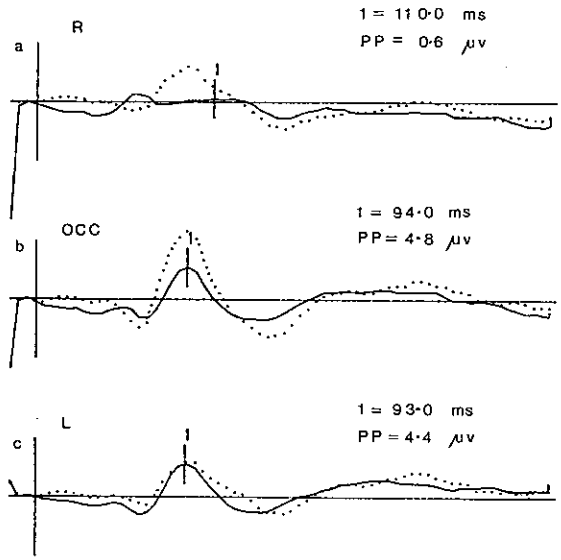

Figure 8: Check VER tracing of simulated right hemianopia. Right eye.

The fact that the greatest change occurred in the tracing recorded from the electrode ipsilateral to the side of the field defect is to be discussed.

The averaged responses for both the simulated right and left hemianopias on the check and flash VER demonstrate the above.

Simulated hemianopias with 5° macular sparing produced tracings with characteristics similar to the above, however, the changes were not as marked.

(2) Hemianopic Patients — When tested with the check and flash VER's they also demonstrated results similar to the above (Figure 9). As with the normal subjects there has been an increase in latency and decrease in amplitude recorded from the electrode ipsilateral to the side of the field defect (Figure 9a).

The amplitude is decreased in the recording from the occipital electrode (see Figure 9b) and the recording from the electrode contralateral to the side of the field defect is essentially unchanged.

These changes were not nearly as consistent with the flash VER as with the check VER.

(NB. — All tracings have the averaged whole field for the normal subjects superimposed in a dotted line.)

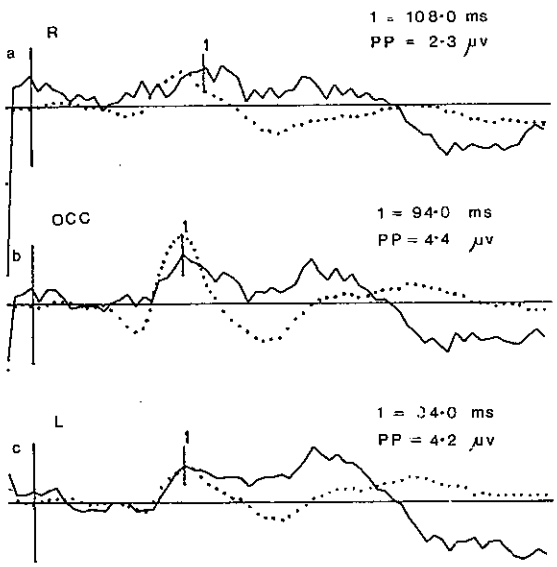

Figure 9: Check VER tracing of actual right hemianopia: Right eye.

Quadrantinopia

(1) Normal subjects — The average of the results recorded from the simulated quadrantinopic field defects tested with the check VER demonstrated the following changes. Firstly, in the tracing from the electrode ipsilateral to the side of the field defect there is a slight decrease in amplitude (1.3 μv) and an overall flattening of the curve. Also, there is a reversal in polarity of point "2" or $N\overline{75}$ i.e., it became a positive peak rather than a negative peak (Figure 10c — left quadrantinopia). The recording from the occipital electrode shows a loss of point "2" (Figure 10b). The recording from the electrode contralateral to the side of the field defect is within normal limits (Figure 10a).

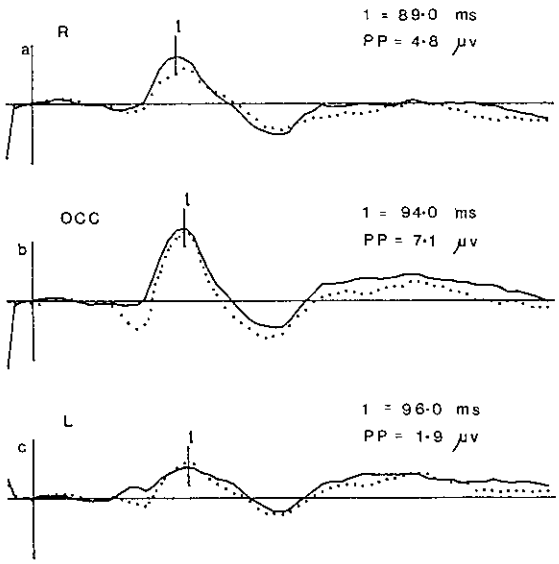

Figure 10: Check VER of simulated left superior quadrantinopia. Normal subject: Right eye.

Results obtained from simulated quadrantinopias with 5° macular sparing were similar to the whole field tracings.

(2) No quadrantinopic patients were tested.

Central Scotoma

(1) Normal subjects — The simulated 5° and 10° central scotomas tested with the check VER demonstrated latencies equal to the whole field latencies recorded from all channels (Figure 11). There was also a significant reduction in amplitude recorded from all electrodes with the most significant reduction of 5.1 μv being recorded from the occipital electrode (Figure 11b).

This reduction in amplitude was greater from all electrodes in the averaged 10° scotoma than the averaged 5° scotoma, i.e. the larger the scotoma, the more obvious the change.

(2) No patients with actual central field defects were available for testing.

Tunnel Vision

(1) Normal subjects — All cases of simulated tunnel vision showed an increase in latency of point "1" and a decrease in amplitude from all electrodes (Figure 12).

The amplitude decrease was again more marked in the gross field defect, i.e., the smaller tunnel of vision caused more obvious changes in the tracing.

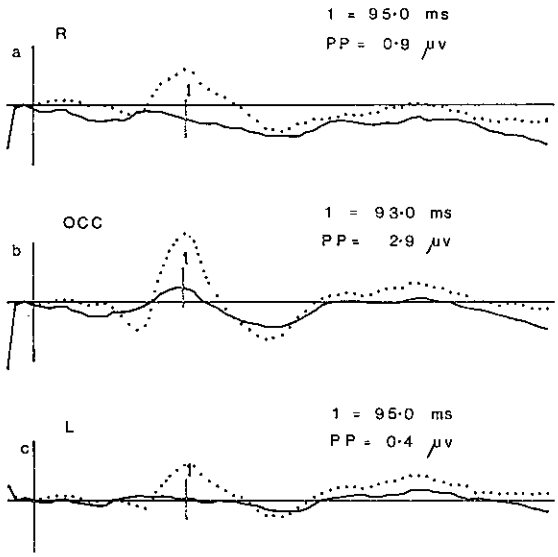

Figure 11: Check VER tracing of simulated 10° central scotoma: Right eye.

(2) Patients with tunnel vision — Seven patients with tunnel vision were tested. Three of the patients had 20° tunnel vision. For these three patients the results of the check and flash VER results are almost the same as the whole field tracings.

The other patients all had more marked tunnel vision (up to 5° tunnel in three cases). They all showed an increase in latency and a decrease in amplitude in a manner similar to the above (Figure 13).

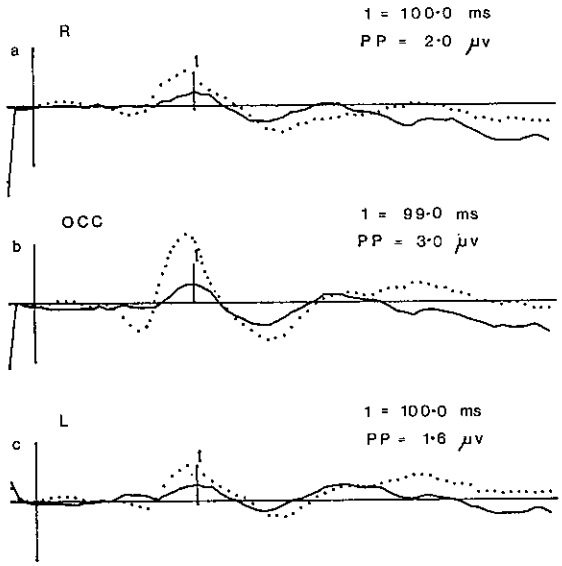

Figure 12: Check VER of simulated 5° tunnel vision: Right eye.

Arcuate Scotomas

In both normals and the patient tested with an arcuate scotoma, there was no detectable difference between the tracings obtained and the whole field tracings for both check and flash VER's.

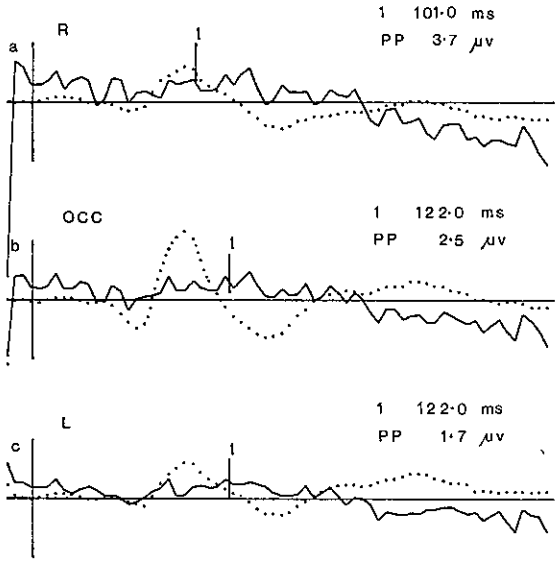

Figure 13: Check VER tracing — patient with 5° tunnel vision. Right eye.

In all cases in this study the defects recorded from the checkerboard covering 32° of the visual field showed more marked trends than those recorded from the 16° checkerboard.

DISCUSSION

Studies by Blumhardt *et al.*[1] who investigated half field stimulation with the check VER demonstrated that point "1" or $\overline{P100}$ in the VER tracing "actually arises in the hemisphere contralateral to the stimulated half field but are recognised from the ipsilateral scalp due to the orientation of generator neurones on the posterior-medial aspect of the visual cortex".

Records obtained in this study are similarly paradoxical. For instance, in the case of a right hemianopic defect (figure 9) the recording from the ipsilateral (right) parietal electrode shows a marked decrease in amplitude. However, the left visual cortex would in fact be receiving the decreased input and is showing a normal tracing. Thus the recording from the electrode ipsilateral to the side of the field defect shows the marked changes.

In this and other studies hemianopic defects were most easily detected and, the author has found that the VER can successfully be used in the diagnosis of such defects. This is so because no response is generated in the occipital lobe ipsilateral to the field defect except duplicated macular representation.

Quadrantinopias require extremely careful analysis of results to be detected, however the reversal in polarity of point "2" or $\overline{N75}$ coupled with the flattening of the ipsilateral parietal tracings are characteristic.

Macular sparing was almost impossible to detect as there was very little appreciable difference between the tracing with macular sparing and the whole field tracings. However, it may well be the case that subtle changes in $\overline{N75}$ may illustrate macular sparing.

In this study central scotomas were easily detectable on the check VER. It was shown that the larger the scotoma, the greater the decrease in amplitude of $\overline{P100}$, especially from the occipital electrode. (This is due to the larger representation of central fibres at the occipital pole.)

At this stage only gross tunnel vision can be detected (less than 15° tunnel) on either check or flash VER. Check results are again more consistent than flash results.

Arcuate scotomas were undetectable in this study.

CONCLUSION

This study has shown that field defects can be demonstrated using the VER, but in order to do this the limits of the normal range of latency and amplitude must be known (through testing a large population of normals).

Careful analysis of the results in cases of small field loss is necessary. Gross defects on the other hand require little effort in interpretation.

So far the check VER has proven more valuable than the flash VER in the detection of field defects. With further careful analysis of the flash VER recordings and many more recordings from patients with field defects, defect trends may become more apparent with the flash VER.

For any particular patient, if a response can be gained by conventional methods of perimetry, such a patient should not be considered for field assessment with the VER as conventional methods give an accurate assessment of the size of the defect. However, the VER definitely has a place in field assessment for those patients unable to have conventional perimetry.

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THE VISUAL EVOKED RESPONSE AND STEREOPSIS

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Abstract

Although the visual evoked response (VER) has been used as a tool in research and clinical practice for many years, it has only recently become possible to use the VER to achieve an objective measure of stereopsis. This method of evaluation has great potential, particularly for use with patients who have limited ability to communicate visual impressions to the examiner. The authors are using dynamic random dot stereotests in association with VER recording and analysis to evaluate stereopsis comprehensively. Methods and results are considered.

The visual evoked response (VER) has been used as an aid in the diagnosis of such conditions as optic neuritis,[1] retrobulbar neuritis,[2] multiple sclerosis,[3] progressive spastic paraplegia,[4] compression of the anterior visual pathways[5] and colour blindness.[6] The aim of this paper is to introduce another area of application of the VER which should be of particular interest to the orthoptist: the objective evaluation of stereopsis.

Methods of evaluation which use the VER have several advantages over more subjective techniques. The method gives an objective measure of patient response as it is not necessary to rely on verbal report to determine the result of a trial. It is also possible to use one channel of the electrophysiological recording equipment to check for eye movements. This allows eye fixation to be monitored, a necessary precaution if stimulation is occurring in peripheral visual fields. It is very instructive to record VERs to stereoscopic stimuli presented at the visual periphery, as it is sometimes found that a patient with normal response to a central stimulus will fail to respond to a stimulus which lies in, for example, the right visual field.[7]

Dynamic random dot stereograms have been used as a stimulus for visual evoked responses since 1978[8] and several studies have presented results since that time (e.g.,[9-13]). Each of these studies used computer generated dynamic random-dot stereopatterns in conjunction with display systems which had relatively limited ability to cope with patients who had significant ocular deviations. The authors of the present study have developed a display system which is intended to be used with orthoptic patients as well as normals. The system is built around a Clement Clarke Synoptophore and has been described in some detail elsewhere.[7]

Reprint requests: Associate Professor B. Fenelon, Department of Psychology, The University of Newcastle, N.S.W., Australia, 2308.

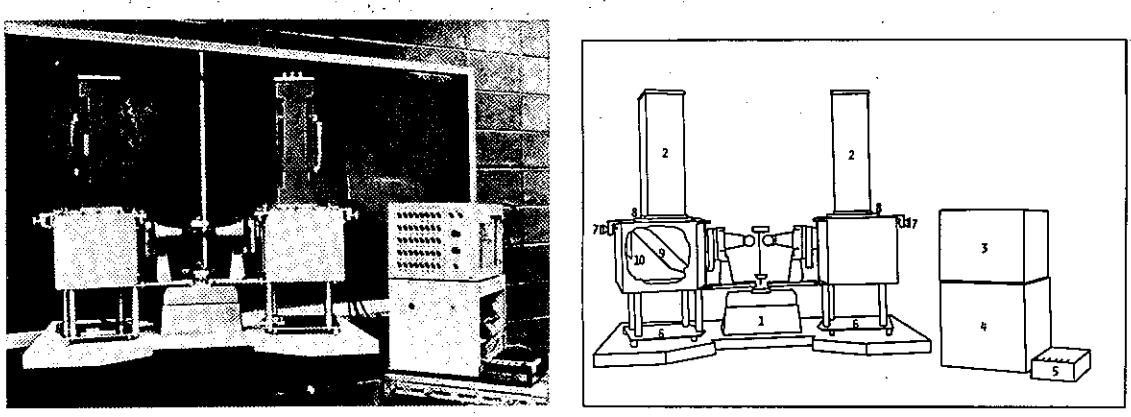

Figure 1: Photograph (a) and Schematic (b) of test instrumentation. Components are as follows: (1) Clement Clarke Synoptophore; (2) Display units; (3) Hardwired display generator; (4) Microcomputer; (5) Cassette unit for storage and retrieval of programs; (6) Support trolleys; (7) Height adjustment; (8) Torsion adjustment; (9) Half-silvered mirror; (10) Fixation matrix.

The unit is illustrated in Figure 1. It has adjustments for interpupillary separation (45-75 mm), vergence angle ($\pm 25°$ each side), torsion ($\pm 25°$ each side) and vertical vergence (± 1 prism dioptre each side). The range of adjustments is suitable for the majority of patients with the addition of accessory vertical prisms. The viewing distance is 400 mm and accommodation is relaxed to approximate infinity with eyepiece lenses (+2.25 dioptre). The images of the display units are reflected from half silvered mirrors. Red fixation lights lie behind the mirrors and are thus superimposed on the images of the display units. The vertical height adjustment acts on the fixation lights and the display units so that both remain aligned at all times. The fixation markers can occupy any one of eight positions. By changing the eyepiece lenses, the synoptophore can be used in standard form.

The random-dot displays normally subtend an angle of just over 10° (150 × 256 sec. of arc), but by inserting a lens combination into the slide holders and filter slot, the subtense can be altered to just over 2° (30 × 256 sec of arc). The instrument can therefore be used to test responses to either a foveal stimulus or a more peripheral stimulus.

As has been discussed elsewhere,[14] the authors' system does not use a computer to generate the displays as such, but rather uses a microcomputer controlled, hardwired display generator. This gives the system a far greater dot generation rate (up to 250,000 pairs of random dots per second) and releases the microcomputer for duties such as controlling the size, position and sense (crossed/uncrossed) of the disparate region. The microcomputer has also been interfaced with a PDP-12 laboratory minicomputer. This machine is responsible for the acquisition of data, the averaging which is generally necessary to enhance a VER and also for off-line analysis of data.

ELECTROPHYSIOLOGICAL RECORDING

The equipment consists of an eight channel EEG unit which has been interfaced with the PDP-12. Seven channels are used monopolarly with a common linked mastoid reference. The seven scalp sites used are illustrated in Figure 2.

The three active midline sites are located at Oz, Pz and Cz (vertex) in the International 10-20 system. A pair of electrodes (Channels 4 and 5 respectively) lie over the angular gyrus region and its homologue in the right hemisphere and the remaining pair of electrodes (channels 6 and 7) lie midway between the angular gyral electrodes and Oz. The eighth channel is reserved for bipolar recording of eye movements.

A typical trial consists of up to 32 presentations of a stereoscopic stimulus. The averaging

program processes segments of EEG into an average; the length of each segment is predetermined, normally a half second in these trials, and each segment is time locked to the onset of the test stimulus. In this way the (random) noise components of the ongoing EEG activity are averaged out leaving behind

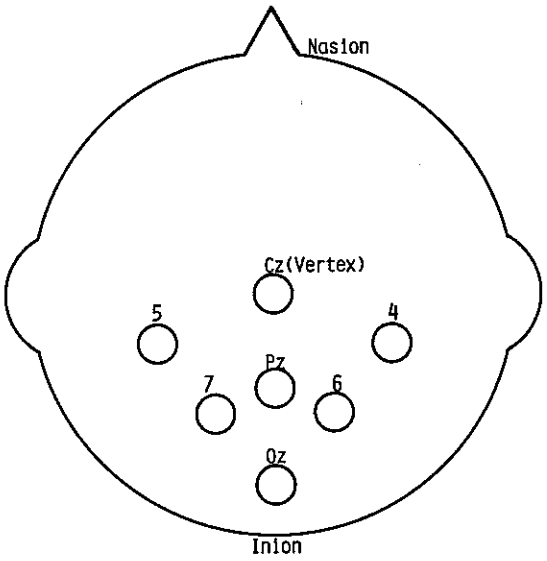

Figure 2: Location of the seven scalp electrodes. Electrodes 4 and 5 are sited over the angular gyrus. Electrodes 6 and 7 are located midway between the angular gyrus and Oz. A further pair of electrodes are used to monitor eye movements.

the evoked response signal. These VER averages are stored on tape for analysis and manipulation off line. The interstimulus interval can be set according to need, but in these trials it is normally either two seconds or a randomly changing interval in the range one to four seconds.

STEREOSCOPIC DISPLAY FORMAT

The random-dot test stimulus can take several forms. The most commonly used is a square stimulus in front of the background. When the display subtends approximately 10 degrees, the test stimulus subtends 3 degrees and is located either centrally or 3.5 degrees offset into left or right visual field. The disparity can be varied in steps of 150 sec. of arc (or 30 sec. of arc in the 2 degree field format), but has normally been set at 30 min. of arc to date. The subject views a red fixation light, usually in the centre of the display, and is presented with a plane background for a brief familiarization period. The disparate square then pulses on and off up to 32 times. The duration of presentation of the test square is typically 100 ms. An example of the VER of a normal subject to this stimulation sequence is seen in Figure 3.

USES OF THE STEREOSCOPIC VER

As the authors are still attempting to establish norms of performance for various age groups, it is too early to comment on the diagnostic effectiveness of the test. Nevertheless patients with visual defects do appear to give responses which differ from those of control subjects. This implies that it may be possible to use the

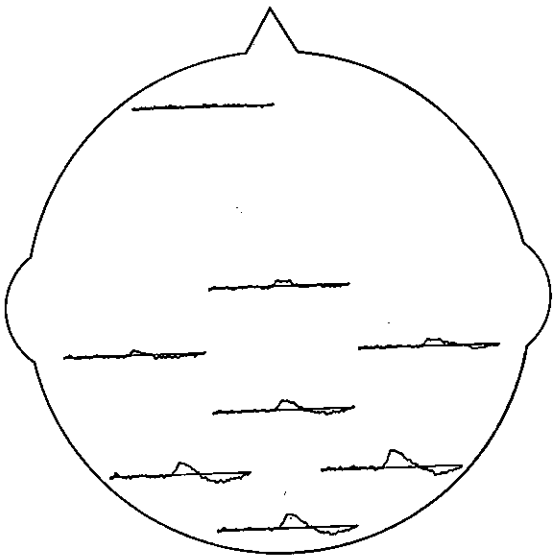

Figure 3: Visual evoked response of a control subject to a brief presentation of a central disparate region. Waveforms occupy a half-second. Onset occurred at 0.1s and offset occurred at 0.2s Interstimulus interval is approximately two seconds, n=64. Negative—UP.

equipment to achieve a detailed measure of the status of binocular vision. Figure 4 contrasts, at left, the evoked responses of control subjects, both of whom were visually normal, with at

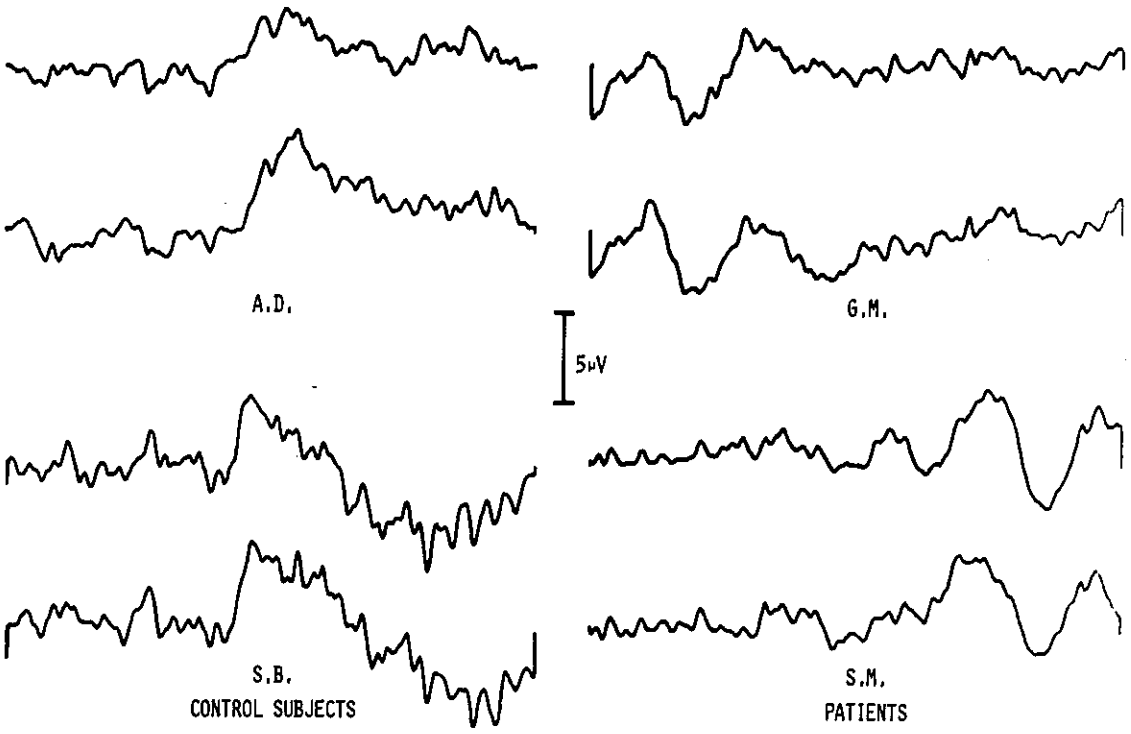

Figure 4: Visual evoked response of two control subjects, at left, and two patients, at right. For each subject the top trace is recorded from location 4 and the bottom trace from location 5. Recording and stimulus conditions are as for Figure 3.

right, the responses of two patients. All subjects are given a detailed screening test, including tests for visual acuity and ocular balance, traditional stereotests and the Stereo Wedge Test for stereoscopic vision.[15] The waveforms of Figure 4 occupy approximately 0.5 sec (512 ms) with onset of the stereoscopic stimulus at 0.1 seconds (100 ms) and offset at 0.2 seconds (200 ms). Interstimulus interval is about two seconds and each waveform is an average of 64 presentations. In this case the stimulus was presented in the central field. While the waveforms of the two control subjects are clearly not identical, they have common characteristics. For example there is a negative peak in the region 140 to 180 ms after stimulus onset followed by a positivity in the region 260 to 300 ms.

In comparison, the patient (G.M.) had an esotropia of very early onset. His eyes are now straight post-operatively and have equal visual acuity but he demonstrates no binocular function on routine orthoptic tests. This subject gave an abnormal response. While he had no subjective awareness of stereoscopic depth perception throughout these trials, the waveform indicates that there may be some limited residual binocularity. Preceding the onset of the stimulus is an apparently synchronised, alpha-like oscillation which is abolished shortly after onset. Possibly the brain is being activated by the stimulus. For this subject, it is difficult to detect an evoked response other than this activation. By contrast, patient S.M. at lower right is a child of better than average intelligence, slow reading speed and a mild grapho-motor problem.

Her visual status is good on routine tests: visual acuity R and L 6/5 with normal ocular muscle balance and good binocular function. However, reference eye tests show a very unsteady relationship of her reference eye to

her preferred right hand. Score on the Arden Gratings is several points better in the left eye than in the right eye.

For this subject the first negative peak occurs later than in the control subjects and the waveform terminates in an oscillatory build-up.

Further work is being done in an attempt to correlate visual status with the resulting visual evoked response.

CONCLUSIONS

Much work remains to be done if the evaluation of stereopsis using the VER is to take its place among standard clinical tests. It is the opinion of the authors that the methods and instrumentation touched on in this paper can be simplified and refined to a point where objective clinical evaluation of stereopsis using the VER can become a standard technique, at least for the larger clinics.

ACKNOWLEDGEMENTS

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SACCADIC VELOCITIES

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Abstract

Saccadic eye movements are controlled by the voluntary oculogyric system of the frontal cortex. Saccades are rapid and precise conjugate eye movements from one fixation point to the next. Saccadic velocities are discussed, together with case examples of oculomotor disorders and saccadic recordings.

Key words: *Oculomotor disorders, adduction saccades, abduction saccades.*

The study of saccadic movements to diagnose and treat oculomotor disorders is not new. In 1966 Von Noorden and Preziosi[1] demonstrated under and over shooting of saccades in patients with multiple sclerosis and spinocerebellar degeneration. In the 1970 New Orleans Symposium on Strabismus, Jampolsky[2] mentioned saccadic eye movements in evaluating extraocular muscle paresis. Since then the study of saccadic eye movements has assisted in the diagnosis and treatment of oculomotor disorders and aided in the understanding of their pathology. The following paper aims to describe, firstly saccadic eye movements and their importance, secondly techniques of recording, thirdly oculomotor disorders which have been studied using the saccadic velocity recorder and fourthly the significance of saccadic velocity records and recordings for the ophthalmologist and orthoptist.

In a voluntary saccade, signals from the retina pass via the optic nerve to the lateral geniculate body and then to area 17 of the occipital lobe. Connecting fibers carry the signal to areas 18 and 19. According to Scott[3] the signal then goes to the frontal eye fields. The saccadic signal descends via the corticobulbar tract to the mesencephalic reticular formation and ultimately to the appropriate oculomotor nuclei.

A saccade is the most rapid movement the oculomotor system is capable of making. Its object is to direct the eyes from one target in the visual field to another in the shortest possible time.

Saccadic eye movements have the following characteristics:

1. Velocity—200°/sec-500°/sec range.
2. Acceleration—17 000-35 000°/sec^2.
3. Accurate to 0.2°.
4. The reaction time or latent period between the stimulus and the initiation of the saccade increases with the magnitude of the saccade.
5. Once a saccadic eye movement is initiated its direction and velocity are not influenced by voluntary effort.
6. Saccadic speed is direction sensitive.

The velocity of adduction saccades is faster than abduction saccades. Saccades toward

primary position or centering saccades are faster than decentering saccades.

Saccadic eye movement involves a total inhibition of the antagonist and rapid contraction of the agonist muscle. The duration and velocity of these movements are therefore dependent upon strength of the agonist and show moderate changes easily. Reduction in saccadic velocity is an excellent index of qualitative reduction in muscle function. Conversely recovery of velocity is an index of recovery in muscle function.

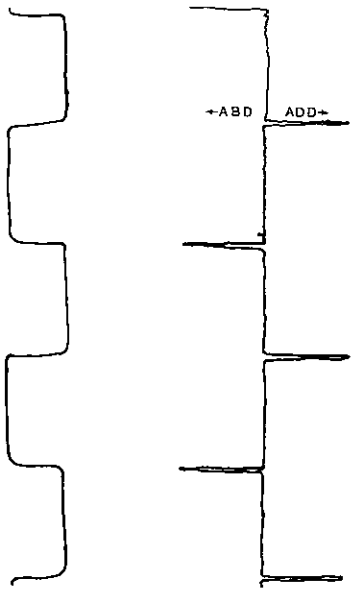

Figure 1: Tracing of normal subject. Right eye. Left tracing=eye position. Right tracing=velocity channel. Shows corresponding channels equal in abduction (ABD) and adduction (ADD).

There are various ways of studying saccades; i.e., observation, photography, after-images, transducers, photoelectric, electromyography and electrooculography. Currently in use at Westmead Centre is the saccadic velocity recorder (electrooculography). The recorder utilises five miniature electrodes. For horizontal measurements electrodes are placed temporally and medially at each canthus and a neutral centrally over the brow. For vertical measurements electrodes are placed above the brow and below the lower lid and a neutral at the lateral canthus. The eye is considered to be an electrical dipole, with the cornea as positive and the posterior pole negative. Any eye movement or change in position, changes the transorbital potential. The electrical changes are graphically displayed to indicate changes in eye position, velocity and acceleration.

Several important facts must be kept in mind when saccades are being measured. In patients with limitation of movement, the saccades are measured within the fields in which the eyes are able to move, except in patients with myasthenia gravis where the eye movement study must be made in the direction of the apparent ocular weakness before and after tensilon administration. To determine whether the saccadic velocity is abnormal, the examiner can compare it with—(1) established norms, (2) the saccadic velocity of the agonist, or (3) the saccadic velocity of the contralateral muscle (i.e., each eye independently).

A restriction can be differentiated from a weakness by comparing a duction to a version, by comparing forced ductions, or by measuring saccades. The velocity of a weak muscle will be slowed. If restriction is responsible for the limitation of the movement, the saccadic tracing will be of normal speed up to a point where the restriction quickly curtails the movement thereby causing trailing off (seen in Figure 2).

The velocity recorder is also designed to test pursuit or tracking movements, optokinetic movements, position maintenance, vergence testing and standard electronystagmography.

Saccadic velocities have aided in the evaluation of the following conditions: congenital myotonia, concomitant horizontal strabismus, double elevator palsy, Duane's syndrome, esotropia resulting from head injury, internuclear ophthalmoplegia, lateral rectus palsy,[4] mechanical restrictions and paresis following blow and fractures, Moebius syndrome, multiple sclerosis, myasthenia gravis,[5] nystagmus blocking syndrome, orbital tumour, retinal detachment, slipped muscle one

day after strabismus surgery,[6] senile ptosis, third nerve palsy and thyroid eye disease.

Various examples of the above conditions have been studied at Westmead Centre. The history, examination findings and velocity recordings of the following patients are reviewed.

1. *Mrs B.K. Left Lateral Rectus Palsy*

A 43 year old woman presented four months after a motor vehicle accident. She had a left esotropia of approximately 80$^{\Delta}$, in the primary position. Abduction of the left eye was 5° medial to the midline, visual acuity R 6/12 N5
L 6/9 N5

Forced duction showed restriction to abduction, saccadic velocities showed barely

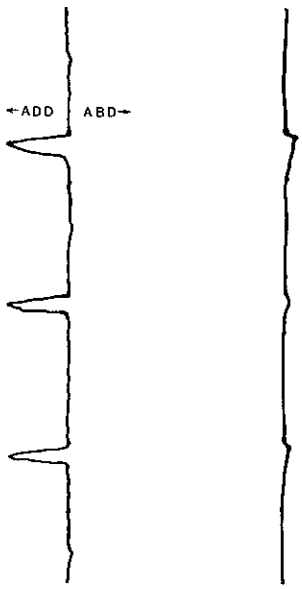

Figure 2: Patient 1. Mrs B.K. Left eye. Left tracing=velocity channel. Right tracing=eye position. Shows normal left adduction and trailing off on attempted left abduction.

measurable abduction saccades in the left eye. Right eye showed normal saccadic velocities. There has been no sign of resolution. Surgery has been planned. The saccadic velocity is less than 25% normal.

2. *Mr S.I. Bilateral Duane's Palsy*

A 21 year old male presented with a history of "straight eyes" until the age of 11 years. Photos and previous archives from eye tests at an early age confirmed this. He now has a 35$^{\Delta}$ alternating esotropia with some diplopia at times, fixing right.

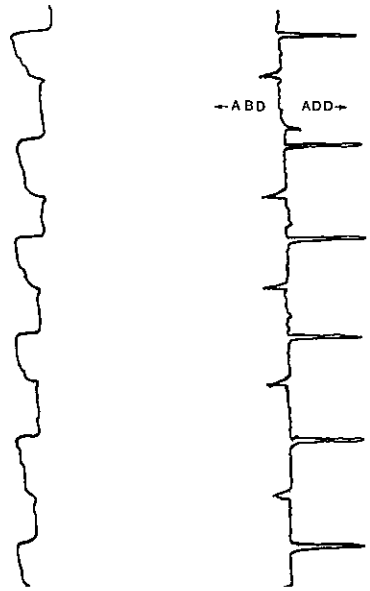

Figure 3: Patient 2. Mr S.I. Example of Right eye. Left tracing=eye position. Right tracing=velocity channel. Shows low velocity in right abduction and normal velocity in right adduction.

Visual acuity R 6/6 N 4.5
L 6/4-2 N 4.5

Ocular movements showed poor abduction and marked retraction right and left. (Adduction right and left was also reduced.) Saccadic velocities showed poor and slow abduction of both eyes. Surgery is being planned.

3. *Mrs T.B. Progressive External Ophthalmoplegia*

A 39-year-old woman presented with progressive ptosis over the past five years, worsening over the past 18 months. She had a moderate exophoria with very slow recovery in the near position and left esotropia for distant

fixation, with no diplopia. Visual acuity
R 6/6 N 4.5
L 6/12 N 5.

Ocular movements revealed limitation in extreme positions of gaze and reduced convergence to 10 cm. Tensilon test was negative.

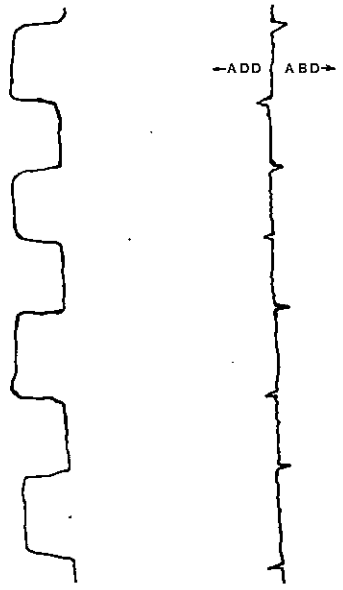

Figure 4: Patient 3. Mrs T.B. Example of Right eye—targets 10° amplitude. Left channel = eye position. Right channel = velocity channel. Shows marked reduction in abduction and adduction.

All other ocular and medical examinations were normal and electromyography of orbicularis, upper and lower limb muscles showed no signs of myopathic changes. Saccadic velocities were markedly reduced in both eyes for adduction and abduction and were more reduced for greater eye excursions.

Velocities were suggestive of tight antagonists. The findings were supportive of the diagnosis of progressive external ophthalmoplegia.

This patient has recently had lid surgery and is coping well. Her saccadic velocities will be repeated in the future to document any changes.

The study of saccadic eye movements has aided in the diagnosis and treatment of many oculomotor disorders. Saccadic velocities can become a useful diagnostic aid for the ophthalmologist and recording of eye movements and calculation of saccadic velocities can become a useful role for the orthoptist.

ACKNOWLEDGEMENT

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ABNORMAL HEAD POSTURES A REVIEW OF 116 PATIENTS

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Abstract

One hundred and sixteen patients with abnormal head postures (AHPs) were analysed from the aetiological viewpoint. Ophthalmological, neurological and orthopaedic causes of AHPs were identified in our group of patients. Intraocular lenses were found to be associated with an AHP in two patients, and this may be the first report in the literature of an AHP in association with intraocular lens implantation. An appeal is made to both ophthalmologists and orthoptists for a multidisciplinary approach to managing AHPs.

Key words: *Aetiology, intraocular lens implantation, multidisciplinary approach.*

INTRODUCTION

Since the days of isolation of specialist disciplines in medicine are now well past, the tendency of ophthalmology and orthoptics today should be towards a broad concept of medicine. The patient should now be regarded as a whole medical unit, with every medical specialty contributing to his management. Further, the patient with an AHP should no longer be regarded as having an isolated set of abnormal ocular rotations with a Hess chart report attached.

It is with this in mind that we reviewed a series of 116 patients who were observed to have an AHP. Initially, this sign was sought after an abnormality of ocular rotations was diagnosed. As the study progressed, we believe our clinical index of ability to observe increased, so that recognition of an AHP became an important feature of our primary, if unconscious, observation of the patient as a whole at the initial examination.

This paper attempts to show that

(i) AHPs are perhaps more common than ophthalmologists and orthoptists may previously have recognised.
(ii) There is almost always an organic cause for an AHP.
(iii) The cause is not always related to an abnormality of ocular rotations alone, but can often be related to one of the other medical or surgical disciplines.

The Normal and the Abnormal Head Posture

Description of an AHP first requires definition of the normal head posture. This is the situation

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when the body is erect and facing forwards, and the median plane of the head is continuous with the median plane of the body, and the retinal horizon coincides with the horizontal meridian of the eyes, cutting the median plane at right angles.[1] This normal head posture is maintained by anatomical structures (for example spinal column and neck muscles) and physiological functions (for example proprioceptive and cerebellar feedback systems).

The abnormal head posture, on the other hand, is an "abnormal position of the head", and has three components[2]

(i) Head tilt to the right or the left.
(ii) Face turn to the right or the left.
(iii) Elevation or depression of the chin.

Head postures may be normal in situations such as extending the neck for increased height gain for the eyes; in order to see through bifocals; or in infants who normally have poor neck support for their head.

The Importance of the Abnormal Head Posture

AHPs may result from a pathological condition, either organic or psychological. They are important for two main reasons. Firstly diagnostically, a VIth nerve palsy[3,4] and associated head turn may underly a previously unrecognised pathological condition for example raised intracranial pressure, diabetes, or vasculitis. Secondly therapeutically, since corrected the sequelae of neck pain, scoliosis and secondary arthritis may be avoided.[5,6]

The Purpose of an AHP

The work by Wesson[1] is still as valid as it was. However, it must not be forgotten that neurological and orthopaedic problems may result in AHPs, just as disorders of ocular rotations may also, for example, Duane's syndrome, which has now been recognised to be due to an agenesis of the VIth nerve nucleus.[7] The AHP may be valuable to the patient in order to:[1]

(i) Improve vision, for example nystagmus compensation or refractive errors.
(ii) Centralise visual fields, for example with one blind or absent eye, hemianopia or ptosis.
(iii) Improve binocularity, for example A or V pattern.
(iv) Increase visual comfort, for example diplopia, or chin up posture in presbyopia to increase physiological convergence.
(v) Protect the eyes, for example chin down and brows forward in photophobia.
(vi) Relieve pain, for example superior corneal foreign body.
(vii) Improve cosmesis, for example where a patient with a VIth nerve palsy trades off the lesser cosmetic evil of a turned face for heterotropic eyes.

Numerous authors in the past have mentioned other, non-strabismic, causes of AHPs. Haessler[8] gave "habit" as a major alternative cause, Hugonnier[9] emphasised "other pathology", von Noorden and Maumenee[4] mentioned "other conditions" while Walsh and Hoyt[10] gave an extensive and excellent classification (despite omitting refractive errors as a cause!). Walsh and Hoyt[10] emphasised a neuro-ophthalmological approach to AHPs, stating that

(i) If the AHP was not a pain compensation mechanism, then
(ii) The range of neck motion should be determined, to exclude contractures, bony obstruction or meningismus, then,
(iii) The neck should be palpated for cervical lymphadenopathy, and
(iv) The ears should be examined for inflammation or deafness.
(v) Diplopia testing should then be performed, and a
(vi) Complete neurological examination done.

However, even after all of this, they were sometimes forced to conclude that the patient had "just a head tilt".

Other workers have more recently described series of patients with AHPs. Urist[11] described 226 patients with a vertical muscle imbalance. 72 of these had a head tilt, and all of them tilted to the expected side. It was surprising that most of them did not have an AHP, as one would have expected. Kushner[12] described 188 patients

with AHPs, excluding all other than ocular causes for these. Most (62.7%) were due to incomitance, while 20.2% were due to nystagmus. Congenital esotropia, the requirement for foveal fixation, cosmesis, ocular motor apraxia, spasmus nutans and astigmatism were rare causes.

PATIENTS AND METHODS

Our series comprised 116 patients who were observed to have AHPs. Slightly less than half of these (53) were drawn from three general ophthalmic practices and one general hospital clinic, and slightly more than half (63) from the orthoptic department of Sydney Eye Hospital. The majority of patients drawn from the orthoptic department collection was seen by one of us and enough information was available from the files of this group of patients to give an adequate explanation of the mechanism of their AHP. Since this group of patients was seen in an orthoptic department, it undoubtedly skewed the causes of the AHPs towards disorders of ocular rotations. Each of the patients seen otherwise had a full ophthalmic and general history taken, and a complete visual system examination done.

RESULTS

The age range of the patients was 5 months to 73 years. The majority of patients had a tilt, 67 (58%) of 116 tilting, while 40 (34%) had a turn, and 9 (8%) had a chin up or chin down posture. We categorised these groups into their most obvious type of AHP rather than a combined type of AHP.

We categorised the aetiology of the AHP (see Table 1) into seven major groups. A brief description of each of these groups follows.

TABLE 1
Aetiological Categories of Abnormal Head Posture
116 Cases

(i) Disorders of ocular rotations	86
(ii) Visual improvement	13
(iii) Orthopaedic	6
(iv) Habit	4
(v) Deafness	3
(vi) Neurological	3
(vii) Idiopathic	1

(i) *Disorders of ocular rotations*

(a) IVth nerve palsy. Of the ocular motor disorders, 43 patients (51%) had a IVth nerve palsy, 30 tilted to the expected opposite side and 8 tilted to the same side, 4 had a chin down posture, 2 being unilateral IVth nerve palsies, and 2 were bilateral with V patterns, 1 had a turn, due to one eye being amblyopic, and we postulated that the turn may have increased the patient's visual field. The 8 who tilted to the same side may have tilted to increase image separation. On the other hand, Duke-Elder's explanation[3] of the tilt being to the same side may be valid — that is, the torsional effect of the overacting contralateral synergist may exercise the main effect. Hilton's[5] recent observation is pertinent, that "the literature reveals a lack of agreement" as to the direction of the head tilt that accompanies vertical ocular muscle paresis.

(b) Duane's syndrome — 21 had Duane's syndrome. As expected, 10 with eso-Duane's turned to the same side, and 5 with exo-Duane's turned to the opposite side, 4 turned to the unexpected side, and we wondered whether this was cosmetic on the basis of ptosis improvement. Finally, 2 tilted to the opposite side, and Duane's-associated deafness may have been causative here. We would agree with Isenberg and Urist[13] that if a patient has a tropia in Duane's syndrome, he will almost certainly have an AHP.

(c) Exotropia. There were 5 patients with exotropia. Even when intermittent, exotropia seemed to be associated with an AHP, and 3 turned to the expected opposite side. The 2 others turned to the same side for no reason we could determine.

(d) Esotropia. Esotropia produced an AHP in 5 patients, where 2 were cross-fixators, possibly preferring to look with a dominant eye, 1 had an esotropia with a turn to that side, 1 had an alternating esotropia with

no binocular vision and a chin down position possibly, cosmetic, and 1 other, for no obvious reason, turned to the opposite side.

(e) Orbital fracture — 4 patients had orbital fractures, 3 involved the orbital floor, and they tilted to the side of the hypotropic eye, presumably reducing tension on the entrapped orbital tissue, 1, with a pseudo-VIth palsy, due to a medial wall fracture, turned to the same side.

(f) VIth Nerve Palsy — 3 patients had a VIth nerve palsy, and turned to the expected ipsilateral side.

(g) Supranuclear Palsy — 1 patient had a vertical gaze palsy upwards, with his chin elevated, as did 1 other patient with the Steele-Richardson syndrome and defective upgaze.

(h) IIIrd Nerve Palsy — 1 patient with a IIIrd nerve palsy tilted to the side of the hypotropic eye.

(i) Orbital infiltration — 1 patient with orbital lymphoma in his left inferior orbit had a slight chin up AHP.

(j) Orbital Asymmetry — 1 patient had congenitally asymmetric orbits and a right hypophoria with a tilt to the expected right side.

(ii) *Visual Improvement*

(a) Visual Acuity — Of the 13 patients who gained visual improvement from an AHP, 3 did so in terms of improved visual acuity, 2 of these had intraocular lenses, and felt that vision was of better quality with an AHP. We wondered whether less pseudophakodonesis, fewer internal ocular reflections, or possibly even less astigmatism may have been responsible. We felt it unlikely that the AHP would produce any anatomical structural sequelae because of its transient nature; 1 myope with big brows saw better binocularly when the more myopic eye secured the pinhole effect by looking under its brow with that eye in adduction. (See Figure 1.)

(b) Ptosis — 2 patients had ptosis due to levator aponeurosis dehiscence, and had better vision with a chip up AHP.

(c) Field — 1 uniocular patient improved his field of vision with a head turn to the anophthalmic side, and another patient with unilateral amblyopia due to high myopia similarly improved his field; 1 patient with a monocular cataract was able to improve his vision by means of adopting an AHP, probably on the basis of increased field.

PATIENT WITH RIGHT MYOPIA AND AHP (see text)

FIGURE 1.

(d) Nystagmus — 5 patients had nystagmus, 2 with a face turn producing nystagmus compensation for congenital nystagmus; 1 had bilateral macular toxoplasmosis, and 1 had congenital cataracts. The final patient had a right lateral medullary syndrome, with skew deviation, and a right-beating nystagmus worse on right gaze. His AHP could, we felt, be explained in part by the ocular tilt reaction described by Rabinovitch.[14]

(iii) *Orthopaedic*

6 patients had AHPs, 3 having multiple sclerosis and secondary structural deformities, while 1 had a shoulder injury and 1 had a subluxated

atlas, 1 patient had polio with a scoliotic deformity, and a coincidental exotropia. The importance of not missing a disorder of ocular rotations in a patient who has also been traumatised from the orthopaedic viewpoint has recently been emphasised.[15]

(iv) *Habit*
4 patients had an AHP from habit. Often these AHPs were transient, and related to specific tasks (for example, reading), and no ocular motor or systemic abnormality was present. The patients were frequently unaware of their AHP, and said they just felt more comfortable with it when it was pointed out to them.

(v) *Deafness*
3 patients had an AHP used with a view to improving hearing.

(vi) *Neurological*
1 patient had cerebral palsy, with its own characteristic AHP. Another had superior oblique myokymia, with the left eye affected and intorting, and compensated by tilting to the right. AHPs would appear to be unusual in superior oblique myokymia.[16] 1 patient had what we felt was spasmodic torticollis.

(vii) *Idiopathic*
In only 1 patient of 116 could we find no cause for an AHP.

DISCUSSION

Of the 116 patients we have described, most did indeed have a disorder of ocular rotations as the cause of their AHP. Most of these patients had IVth nerve palsies, and a patient presenting with an AHP should have a IVth nerve palsy excluded early on, although of course not all patients with IVth nerve palsy have an AHP.[12] Duane's syndrome was also a common cause of AHP in our series, as were exotropia, esotropia, nystagmus and blowout fracture. The second largest group of patients was able to improve visual acuity, visual field or visual comfort by utilising an AHP, and some of these patients could easily be helped by simple measures such as correction of refractive error or ptosis surgery. This group included 2 patients with AHPs and intraocular lens implants. These patients had no evidence of any neurological, orthopaedic or ocular motor disorder, and both patients felt that vision was clearer with an AHP. We believe that these 2 patients may be the first patients described to have an AHP due to, perhaps, intraocular lens implantation. It was interesting that the intraocular lenses were of the Worst Medallion iris clip type. Orthopaedic causes were probably coincidental in our series, but better liaison between ophthalmologists and orthopaedic surgeons may prevent the complications of untreated AHPs associated with scoliosis due to IVth nerve palsy. However, it is fortunate that surgery for IVth nerve palsy has now advanced considerably.[17] Habit, deafness and purely neurologic lesions did play a small part in our series, and such causes should be kept in mind in assessing a patient with an AHP. In particular, spasmodic torticollis,[18] a difficult diagnosis, should be remembered, since the prognosis, probably without surgery, may be bad.[19] It was gratifying that in only 1 of our 116 patients could we not find a satisfactory explanation for an AHP. Nevertheless we think it will be a challenge for ophthalmologists and orthoptists to determine the cause of AHPs in conditions other than those explained by ocular motility defects.

In conclusion, O'Donnell's and Howard's observation[20] is pertinent. "While a careful eye examination is necessary to rule in or out an ocular muscle palsy, it is important that non-ocular causes of torticollis be considered and correctly identified."

ACKNOWLEDGEMENTS

We would like to thank Dr A. B. L. Hunyor, and Drs P. F. Hopkins and partners, for allowing us to describe some of their patients; Miss Judy Maundrell, Librarian at Sydney Eye Hospital, who obtained many of the articles involved in the preparation of this paper; and Miss Alison McKellar, who typed the manuscript.

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The scientific programme will include the following themes:

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- Control of ocular movements.
- Genetic aspects of strabismus.
- Early onset strabismus.
- Advances in neuro-ophthalmology.
- Nystagmus.
- Advances in electro-diagnosis.
- Computers in ocular motility problems.
- Non-surgical treatment of strabismus.
- Advances in surgical treatment of strabismus.

Ten minute papers may be offered on these and other subjects. A team approach (collaboration between ophthalmologist and orthoptist) will be encouraged.

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MOORFIELDS EYE HOSPITAL
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ULTRASONOGRAPHY FOR ORTHOPTISTS

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Abstract

A general look at ultrasonography as used in diagnosis and management of certain eye conditions, namely cataract, foreign bodies, intraocular and intraorbital tumours and diseases and squint. The basic principles are described as is the equipment used. General methods of operation are outlined and artefacts discussed briefly. Attention is drawn to the possible use of ultrasonography in determining before surgery the amount of recession/resection necessary in the squinting eye.

Key words: *A-scan, B-scan, transducer, cataract, intraocular lens, squint surgery.*

About eighteen months ago I was confronted with a new piece of electronic equipment and told to get busy measuring eyeballs for intraocular lens implantations. Up until then, I had thought that the intraocular lens was the idiosyncracy of a few ophthalmologists and the only ultrasound I had heard of was used in performing antenatal checks. Therefore I felt that a brief discourse on basic ocular ultrasonography might aid someone else in the same position.

Ultrasonography works on the same principle as radar. The transducer sends out an ultra sonic beam which is reflected off any radio-opaque surface the resulting echo being picked up by the transducer again. Thus the distance of any object can be readily measured by the time taken. Excellent for submarines and night-flying aircraft, ultrasonography also provides a goldmine of information about the human body without recourse to invasive techniques such as X-rays and surgery.

Most ultrasonographic set-ups consist of a hand-piece containing the transducer which generates ultrasonographic waves when a voltage is applied to it; a recording device such as an oscilloscope with a vernier scale, and a permanent recorder, usually a polaroid camera which takes instantaneous black-and-white photographs. Often attached is a mini-computer for various calculations required in intraocular lens implantations.

The ultrasonic beam has a frequency between 5 and 20 MHz which is too low to cause any damage to the auditory system, yet high enough to be inaudible. This is the only difference between an ultrasonic and a sonic wave.

In its ocular application, the ultrasonic beam is delivered by means of two different transducers, one known as the A-mode transducer which gives a single continuous beam, while the other, known as the B-mode transducer gives a series of beams through an arc of about 75°, the resultant picture being fan-shaped. The beams produce echoes from the ocular structures at which they are directed, the resulting echoes being received by the transducer again and passed back to the oscilloscope for visual display.

The A-mode transducer is applied to the well-anaesthetized cornea in the same fashion as an applanating tonometer, and held there

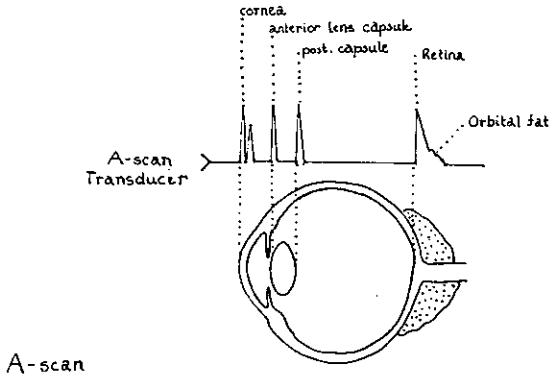

Figure 1a: A-scan correlation with eyeball structures.

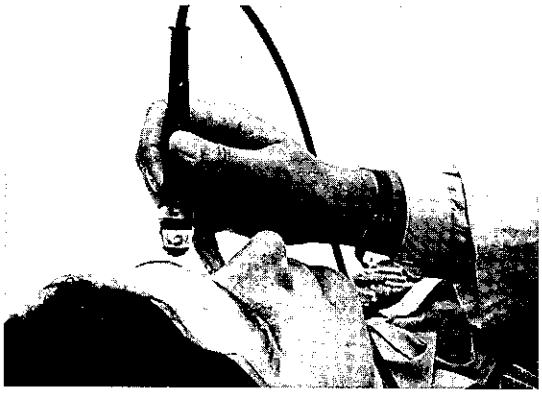

Figure 1b: Application of A-scan transducer.

until a steady reading is obtained from the oscilloscope. The A-mode can be used for measuring the axial length of the eyeball, this being a critical measurement when intraocular lenses are being considered. The average strength of an intraocular lens is about +21 DS, so very small increments can make a very large impact on the patient's ultimate refractive error. As we now have the technology to determine the correct lens strength for each eye, it is important that we use it.

Axial length is of importance in squint surgery also. Given some thought it would seem unreasonable to perform the same amount of recession/resection on an eye with a diameter of 26 mm and on an eye with a diameter of 20 mm. It has been found[2] that a smaller eye requires a lesser amount of recess/resect than does a larger eye. Perhaps A-mode measurements will make squint surgery a little more predictable in its outcome.

The B-mode is the mode most frequently used at the present moment. This is a series of beams radiating in an arc from the transducer giving a 2D picture of the object in view. The transducer used for B-mode is different to that used for the A-mode, being much larger and hand-held. The B-mode transducer is placed on the well-lubricated closed eyelid and gently moved around to obtain the best possible view of the object. Most often the B-mode is used to "see" the posterior pole of the eye when the ocular media are opaque. Cataractous eyes are noted for vitreous and retinal detachments and unnecessary surgery can be eliminated. A better prognosis can also be made. The basic B-mode picture can be enhanced by clever electronics to produce a 3D picture on the oscilloscope, allowing demonstration of certain pathological features not obvious by other means.

B-mode is also used in the following conditions:

- intraocular and intraorbital tumours and diseases;
- intraocular foreign bodies, particularly glass which is not detectable by other means, but is radio-opaque;
- retinal diseases and other abnormalities, including staphylomata and vitreous haemorrhage.

Ultrasonography is not difficult to perform; in fact, anyone who can perform applanation or indentation tonometry will have very few problems. As in all diagnostic testing however, the difficulty lies in the interpretation of results. Ultrasonography is subject to the same problems, sources of error and artefacts as any other form of electrodiagnostic equipment—that is, interference from other power sources. Once the basic principles of ultrasonography and electricity are understood, the various

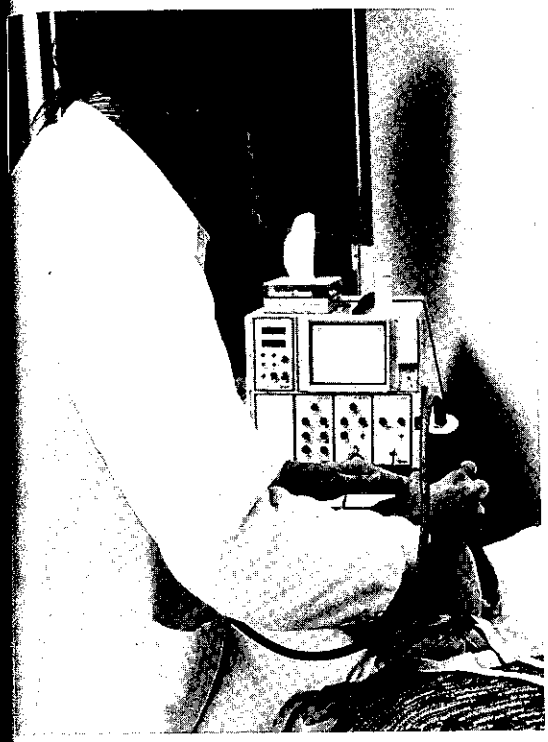

Figure 2b: Application of B-scan transducer, oscilloscope in background.

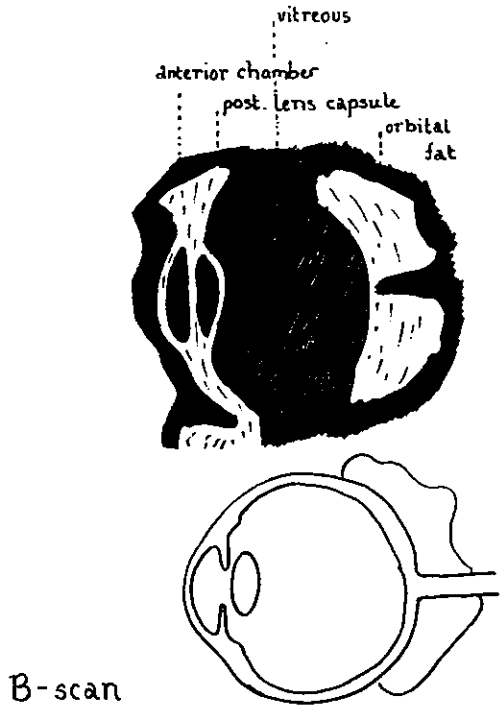

Figure 2a: B-scan correlations.

artefacts become less of a problem. Some of these artefacts are:

snow—produced by background electrical noise—the same as that on T.V. sets.

grass—the same as snow but only prod on the linear A-scan.

reduplication echoes—which occur when the transducer is perpendicular to a surface which will then reflect the beam back into the transducer and it will be reproduced. This causes a very fuzzy picture of little diagnostic value.

These are just a few of the artefacts produced and it is necessary to be able to recognise them and their significance. There are a number of others which are too complex to be discussed here.

Ultrasonography is a very important diagnostic tool and will play a larger and larger role in the diagnostic ophthalmic field. Orthoptists have already proved their value in many non-traditional areas and the use of ultrasonography is well within their scope.

ACKNOWLEDGEMENTS

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CAREER PATTERNS AND ATTITUDES OF RECENT ORTHOPTIC GRADUATES

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Abstract

A survey of 1979 orthoptic graduates from Cumberland College indicated that a third had experienced brief unemployment. All had now found professional employment in capital cities. Job satisfaction and professional commitment were high. Career plans frequently included specialisation and advancement but limited further study. Most work problems arose from stressful interactions with patients and other professionals.

Key words: *Orthoptics, health occupations, work satisfaction.*

While there has been considerable research into the career histories and attitudes of health professionals such as doctors and to a lesser extent nurses and dentists[1] there has been little investigation of the rapidly growing, allied health professions such as orthoptics and the various therapies. As Brown[2] points out, such research is vital for planning orthoptics courses and for gaining information on manpower within the profession. The rapid changes occurring within the profession are apparent in the very different results obtained by a survey in 1973[3] which found that only 52% of orthoptists who responded were practising, a survey in 1976[4] when 72% of respondents were working in the profession and a survey in 1979[5] which found that 79% of respondents were employed. Studies of graduates in other allied health professions such as physiotherapy, occupational therapy, speech pathology and medical records administration[6] have also found greater long term career commitment than had been forecast by the Department of Labor and Immigration[3] or The Committee on Health Careers.[7] The changing role of women in society, the worsening unemployment situation and new vocational programmes have all been factors which have contributed to changing work patterns in these professions.[6] It is important that members of a profession be aware of these changes and not make forecasts based on the work experiences of older members of the profession which may differ significantly from those of more recent graduates. As Wulff[5] comments, Orthoptics is a young profession with 60% of practising orthoptists being under the age of 30 years.

Knowledge of one's fellow professionals is necessary in developing a sense of professional identity and professional community. Mathewson[8] has argued that the predominantly female allied health professions tend to be perceived as occupations rather than professions and to have comparatively low status. She considers that members are frequently perceived as lacking the commitment, motivation and

autonomy of a profession. To help overcome such misperceptions she argues that allied health professionals need to develop a stronger sense of professional unity as have members of professions such as medicine. She believes that in this way members increase their awareness of each other's problems, are able to support each other and to work more effectively to achieve social changes supportive of their work needs.

The aim of the present survey was to investigate the career histories of a graduating class of orthoptists during the two years following the completion of their vocational training. The first objective was to discover whether orthoptists had had difficulty in finding employment; what type of employment they had found; how satisfied they were with their current work; what stresses they had encountered in their work and whether they anticipated changing their employment. Another aim was to examine orthoptists' longer term career goals; whether they intended to specialise or to undertake further studies and what their ambitions were. Finally the survey explored orthoptists' attitudes towards their profession: were they satisfied with their career choice; had their ideas of this profession changed since graduation; did they support their professional association and what were their attitudes regarding their profession and its role in the health care system?

METHOD

Questionnaires were posted to all the orthoptists who graduated from Cumberland College of Health Sciences in 1979, for whom addresses could be obtained. This sample consisted of twelve of the thirteen graduates. Nine orthoptists, 75% of the sample, returned their questionnaires. One letter was returned, "address unknown". The questionnaires were completed in July, 1980, two years after the orthoptists had completed their training.

The items in the questionnaire are listed in Table 1. Some items which appeared in the original questionnaire have been excluded from this report in the interests of brevity. A covering letter explained the aims of the survey. The questionnaire was anonymous. However, respondents were asked to include their addresses, if they so wished, so that a follow-up survey could be undertaken in several years time.

RESULTS AND DISCUSSION

Responses to questions which could easily be categorised are recorded beside the questionnaire items in Table 1. The demographic data (Questions 19-21) indicated that all the respondents were living in a capital city. Almost half the sample were married and one had a child.

All the respondents were currently employed in their profession and they had each occupied an average of 2.7 positions since graduation. In their initial employment after graduation seven were employed as orthoptists and two had worked in non professional positions although both of these were in health settings, e.g., clerical work in a pathology service. Two respondents were still employed in their first position.

Of the twenty-four positions held by the respondents since graduation only two had been non-professional positions. Of the twenty-two professional positions occupied, nine had been full time (over 35 hours a week) and thirteen had been part-time. On four occasions two part time jobs had been held concurrently but in only one instance did this bring the hours worked each week to over 35.

Five (23%) of the professional positions had been in private practices (two locums), eight (36%) had been in sponsored practices, and

TABLE 1

Questionnaire Items and Orthoptists' Responses

1. Are you currently employed in the profession you trained for? (Yes 100%)
2. Describe your work history since completing your college training. Include your current job if you have one. If you do not wish to specify the name of the institution where you work indicate a general category, e.g. large city hospital. For each position indicate the type of employment, the institution, the approximate number of hours per week and the length of the employment in months. (Number of positions held: Mean = 2.67, Standard Deviation = 1.25, Range = 1-5.)

3. Overall, how satisfied are you with your current job?

Very dissatisfied	(0)
Dissatisfied	(0)
Indifferent	(0)
Satisfied	(6)
Very satisfied	(3)

4. Do you anticipate any change from your current employment within the next five years?
Yes 6 No 1 Don't know 2

5. If you answered "Yes" to question 4, what change(s) do you anticipate? (e.g. stop working, change to part-time work, seek new position, etc.). What are the reasons for changing?

6. How many applications did you submit when attempting to obtain your first position?
M = 11.1 S = 11.93 Range = 1-40

7. Since completing your college course, have you had any periods of *involuntary* unemployment?
Yes 3 No 6

8. If you answered "Yes" to question 7, please indicate the extent of your *involuntary* unemployment, i.e. the number of periods of unemployment and length of each period.
Number of periods: M = 1, S = 0
Length of time: M = 2.67 months, S = .58.

12. What is the highest level position you aspire to achieve? (e.g. head of orthoptics department, lecturer, member of community health team).

13. All in all, I'm satisfied with my career choice.

Strongly disagree	(0)
Disagree	(0)
Slightly disagree	(0)
Neither agree nor disagree	(1)
Slightly agree	(2)
Agree	(6)
Strongly agree	(0)

14. To what extent have your ideas of what work in your chosen profession involves, changed since you completed your college course?
Not at all Very much
0 1 2 3 4 5 6 7 8 9 10
M = 3.44, S = 2.40, Range = 1-8.
If your ideas have changed at all, specify what these changes have been?

15. Have you enrolled in any study programme since graduating from Cumberland College? If "Yes", specify.
Yes 1 No 8

9. If you have been employed in your profession at any time since completing your college course, please rate how satisfied you are with these aspects of work as you have experienced them working in your profession. Circle your answers.

	Satisfaction						
	Very dissatisfied	Dissatisfied	Moderately satisfied	Satisfied	Very satisfied	Mean	Standard deviation
A. The respect you receive	1	2	3	4	5	4.00	0.87
B. The friendliness of the people you work with	1	2	3	4	5	4.33	0.87
C. The opportunities to develop your skills and abilities	1	2	3	4	5	4.22	0.83
D. The chances you have to accomplish something worthwhile	1	2	3	4	5	4.00	1.00
E. The amount of information you get about how well you are doing your job	1	2	3	4	5	3.78	0.67
F. The amount of pay you get	1	2	3	4	5	3.22	0.44
G. The amount of job security you have	1	2	3	4	5	3.67	1.22
H. The physical surroundings of your job	1	2	3	4	5	3.56	1.01
I. Your chances for getting a promotion	1	2	3	4	5	3.78	0.97
J. The chances you have to take part in decisions	1	2	3	4	5	4.11	0.60
K. The amount of freedom you have on your job	1	2	3	4	5	3.67	0.87
L. The resources you have to do your job	1	2	3	4	5	4.00	0.50
M. The kind of boss you have	1	2	3	4	5	4.11	0.78

10. What aspect(s) of your work in your profession do you find most stressful?
Number of aspects mentioned: M = 1.75, S = 0.71.

11. Do you intend to specialise in any area of your profession? If yes, specify.
Yes 4 No 5

16. Are you planning to enrol in any study programme?
Yes 1 No 3 Don't know 5
If "Yes", when do you intend to enrol? What study programme?

17. Have you joined any professional association?
Yes 9 No 0

18. Respond to each of the following statements by indicating your agreement with each statement.

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree	Mean	Standard deviation
A. I have a strong sense of professional identity	1	2	3	4	5	3.78	0.44
B. In general, members of my profession are clear about their role in the health care system	1	2	3	4	5	3.89	0.60
C. The role of my professional group is changing rapidly	1	2	3	4	5	4.00	0.71
D. Other groups of health professionals are confused about the role of my profession	1	2	3	4	5	4.44	0.53
E. People in my profession do not support each other enough	1	2	3	4	5	2.00	0.50

19. Where do you live?
Capital city (9)
Other urban centre (population over 1000) (0)
Rural area (population less than 1000) (0)

20. What is your marital status?
Single (5)
Married (4)

21. How many children do you have?
None (8)
One (1)

nine (41%) had been in hospitals. At the time of the survey six of the respondents were employed in full time positions. Thus there was a tendency for the group to move from part time to full time employment.

Answers to question 3 indicated that all respondents were satisfied with their current job but most anticipated changing their positions within the next five years. Of the six orthoptists, who definitely anticipated change, four planned to stop work (two to have children, two to travel) and two planned to seek other positions in the profession (one because she was in a temporary position and one because she wished to travel).

When obtaining their first position the average number of job applications made was 11. The number of applications made ranged from one to forty. Many orthoptists had written to prospective employers as well as applying for advertised positions. A third of the sample had experienced a period of involuntary unemployment which averaged 2.7 months.

Responses to question 9 indicated at least moderate satisfaction with all thirteen aspects of work experience listed. Highest satisfaction was expressed regarding the friendliness of the people at work, the opportunities to develop skills and abilities and the chance to take part in decisions. Respondents were also satisfied with their bosses. Least satisfaction was experienced regarding salaries, the physical surroundings of work, job security, and the amount of freedom on the job.

When asked to list the most stressful aspects of work as orthoptists, three of the respondents mentioned stressful interactions with difficult patients (e.g., "dealing with difficult patients who are rude and unfriendly"). A third of the sample experienced stress in some interactions with other health professionals (e.g., "confronting doctors when there are areas of disagreement"). Two practitioners said they became depressed because of their concern for their patients (e.g., "when a patient goes to surgery you worry"). Others (2) suffered from overload stress at work (e.g., "there are long hours with no break"), while others (2) experienced underload stress (e.g., "I suffer from boredom and routine"). One felt inadequate (e.g., "I find it difficult to gain the confidence of patients particularly children").

Almost half the sample planned to specialise. The areas of specialisation mentioned were children, private practice, reorientation therapy for people suffering from macular degeneration, and electro-diagnostic assessment. The highest ambition of the group were to be head of an orthoptics department (3), to lecture in orthoptics (1), to be a member of a health team (1),

and to work with an ophthalmologist (1). Two respondents were undecided about their goals and one hoped "to become as close as possible to being indispensable".

No respondents regretted their career choice (question 13) although one third had some reservations in spite of the fact that all orthoptists had expressed satisfaction with their current employment. Only moderate changes had occurred in the graduates' ideas of their professional work since they completed their studies (question 14). Five respondents described how their ideas had changed. One felt greater responsibility for patients than expected. Another's view of orthoptists had broadened as a result of working with other health professionals in rehabilitation. Another had encountered new instruments and methods of treatment. Two felt the need for more training in ophthalmology to equip them for their work situations.

Since graduation one respondent had commenced further study by training as an angiographer. Only one respondent had definite plans for further study. She hoped to extend her diploma at Cumberland College. More than half the respondents checked that they "didn't know" whether they would undertake further study.

All members of the sample had joined their professional association. This suggests a strong sense of professional identity which respondents tended to agree that they have (question 18). They also tend to agree that orthoptists are clear about their role in the health care system. They believe that other health professionals are confused about orthoptists' roles, that orthoptics is a rapidly changing profession and that orthoptists do provide support for their fellow professionals.

CONCLUSION

The results indicate that in spite of the initial problems of some orthoptists in finding professional or full time employment all graduates in the survey did find employment and two thirds were in full time employment with which they were very satisfied. They are strongly identified with their profession in terms of supporting their association. Many plan to specialise and have ambitions to hold higher status positions within their profession. A third anticipate withdrawal from the work force within five years to have children or to travel. These are common plans among recent graduates in the health professions and are almost invariably accompanied by plans to return to the work force when the trip is over or the children commence school.[6] One of the strongest beliefs of the group was that other health professionals are confused about the role of orthoptists. Interactions with other health professionals were a common source of stress possibly for this reason. Another strongly held belief of the group was that the role of the profession is changing rapidly. We hope that this survey will assist orthoptists in keeping abreast of some of these changes as reflected in the work experiences and attitudes of recent graduates.

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RESULTS OF SCREENING 672 KINDERGARTEN AGED CHILDREN

GRANT ORMEROD DIpO(Cumb), DOBA
Sydney

The following table represents the findings of a vision screening programme on 672 kindergarten aged children (3-5 years old) in the Engadine district of Sydney during 1981. The author wishes to thank the Lions Club of Engadine and Cumberland College of Health Sciences for their help in this programme.

	Number	% of children screened	% of referrals
Referrals	24	3.6	—
Reasons for referral			
(1) Significant exophoria with associated convergence insufficiency	3	1.6	45.8
(2) Intermittent squint	5		
(3) Constant squint	3		
(4) Reduced visual acuity			
(i) Unilateral	6	1.5	41.6
(ii) Bilateral	4		
(5) Extra-ocular muscle imbalance	2	0.3	8.3
(6) Significant convergence insufficiency	1	0.15	4
"Review cases"			
(1) Inability to comprehend or complete test	54	8	—
(2) Poor convergence, to be retested by the school nurse at a later date	11	20.4	—

ABSTRACTS OF STUDENT PAPERS

N.S.W.

The following are abstracts of research papers by third year orthoptic students at Cumberland College of Health Sciences, N.S.W. Copies of particular papers of interest may be obtained by writing to:
The School of Orthoptics,
Cumberland College of Health Sciences,
P.O. Box 170,
Lidcombe, N.S.W. 2141.

CHANGES IN COLOUR VISION WITH MACULAR DEGENERATION. **David Yates**
The colour vision of fifteen subjects with macular degeneration was assessed using the Farnsworth Munsell 100 Hue test. These subjects were found to have an overall decrease in colour sensitivity in all areas. Subjects of the same age without macular degeneration show a marked reduction in the blue/green area due to yellowing of the media. It is suggested that those with macular degeneration are relatively less affected in this area due to the low concentration of blue cones in the macular area.

COMMUNITY AWARENESS OF OCULAR FUNCTION AND THE TREATMENT OF OCULAR CONDITIONS. **Andrea Desoe**
The general public's awareness of ocular function and the treatment of ocular conditions was assessed by a survey. A total of 268 people, including adults, Year 11 high school students, and primary school children gave their answers to a number of questions about the eyes and the treatment of ocular problems. It was found that the community has a limited comprehension of ocular function and treatment, and that certain age-old misconceptions concerning the eyes still exist. The relevance of these findings to the orthoptist is discussed.

THE EFFECT OF UNILATERAL INFERIOR OBLIQUE SURGERY ON THE CONTRALATERAL INFERIOR OBLIQUE. **Gail Martin**
The effects resulting from surgical weakening of one inferior oblique muscle in 84 cases is studied. These include the occurrence of further surgery to the contralateral inferior oblique, changes in horizontal deviation after surgery and differences in those requiring surgery to the contralateral inferior oblique and those who did not. The results showed that two out of every five patients required surgery to the contralateral inferior oblique muscle. There were no significant changes in horizontal deviation after surgery in those cases who had inferior oblique surgery alone.

THE EFFECT OF PERIPHERAL LIGHTING ON VISUAL ACUITY TESTING. **Alison Pryke**
A study was conducted on the effect of peripheral lighting on visual acuity testing in both amblyopic and normal subjects. 62 normal subjects were tested and in this group it was found that visual acuity decreased by 1% when tested in dim room illumination with only the light of the vision box. In the group of 14 amblyopic patients it was found that visual acuity improved by 8% when tested in dim room illumination. The relevance of the findings in this study on the testing of visual acuity is discussed.

HOW ACCURATE IS THE ØSTERBERG PICTURE CHART? **Jenny Treis**
The visual acuity level recorded on the Østerberg Picture Chart was compared with that found on the Sheridan Gardiner/Snellens chart, in 33 eyes of children aged from 3 to 11 years of age. It was found that 92% of children, 4 years and under obtained a higher visual acuity reading using the Sheridan Gardiner/Snellens chart than with the Østerberg. The average difference was a decimal value of 0.12. There was no significant difference between the charts in the older age groups. It is suggested that this may be due to the fact that younger children cannot interpret what the pictures are, and that the Østerberg may be more reliable if children are shown the pictures first.

THE AETIOLOGY OF V PATTERNS IN INTERMITTENT DIVERGENT SQUINT. **Venessa Smith**
The "V" pattern or phenomenon may sometimes be due to an abnormality in action, probably based on anatomical abnormality, of the horizontal recti, or it may be due to a bilateral underaction or overaction of vertically acting muscles. On examining 42 patients exhibiting a "V" exophoria it was found that overaction of the inferior oblique muscles was the commonest clinical finding. This tends to indicate that the cause of the V phenomena is this underlying overaction of these vertically acting muscles, however it seems certain that no single aetiological factor can explain all types of deviation.

STEREOACUITY IN ARC. **Lynette Paskin**
The size of deviation according to simultaneous and alternate prism cover tests in a group of 59 patients, is related to their ability to appreciate stereopsis in free space. The simultaneous prism cover test is

suggested as being the most appropriate measure for assessing this relationship. Stereopsis is shown to be more readily appreciated and of a higher quality in patients with a simultaneous prism cover test measurement of less than 10Δ. Nonetheless, appreciation of stereopsis in deviations of a greater size is also demonstrated, and stereoacuity is shown to be influenced by visual acuity and fixation, as well as the size of the deviation.

THE EFFECT OF HETEROPHORIA ON STEREOACUITY. **Cindy Watson**
The stereoacuity of subjects with heterophoria was assessed to determine whether those with esophoria, because of their uncrossed fixation disparity, have a better stereoacuity appreciation when the T.N.O. plates (which are designed with crossed disparity) were presented reversed. 36 esophorias and 20 exophorias, were tested by presenting the T.N.O. plates normally and then reversed. Their scores were recorded and an analysis of variance was conducted. It was shown that esophorias increase their stereoacuity when the T.N.O. plates were presented reversed, whilst exophorias do not.

STEREOACUITY IN ANISOMETROPIA. **Sue Brunner**
The stereoacuity of fifty anisometropic subjects and twenty subjects with simulated anisometropia was assessed by the T.N.O. stereo test to determine whether there was any relationship between stereoacuity and anisometropia. The anisometropia ranged from 0.50D to 4.50D. It was found that there is no direct relationship between stereoacuity and anisometropia and that other factors influence the level of stereoacuity appreciated.

OCULAR DEVIATIONS IN CEREBRAL PALSY. **Kathleen O'Donovan**
The incidence of ocular deviation among children with congenital cerebral palsy, has previously been found to be much higher than that within the normal population. 148 cases were examined to determine if any relationship was present between the types of cerebral palsy and the types of ocular deviations. Because of the disproportionate numbers within each type of cerebral palsy, it was found that conclusions could only be drawn for the spastic, athetoid and mixed groups. Within these groups, strabismus, amblyopia and complex refractive errors were common.

ABNORMAL HEAD POSTURES IN INCOMITANT SQUINT. **Elizabeth Bloxham**
A study of 41 patients with incomitant squints and abnormal head postures showed that the majority of those with single muscle weakness, and all of those with an ocular motor syndrome had the expected abnormal head posture and obtained binocularity by doing so. However 3 out of 7 cases of unilateral superior oblique palsy showed an unexpected yet advantageous head posture.

THE FLIGHT OF COLOURS TEST IN AMBLYOPIA. **Karen Fahl**
The flight of colours test was performed on a group of ten subjects with vision of 6/6 or better in each eye. The test was then performed on a further nine subjects who had unilateral strabismic amblyopia and the responses were compared between the normal and amblyopic eyes. It was found that an abnormal response occurred when visual acuity was less than 6/36.

VERTICAL FUSION. CAN IT BE IMPROVED BY TRAINING? **Tracey Russell**
The vertical fusion range was trained in eight normal subjects for a period of ten sessions. Comparison with a group of subjects who had not undergone such training indicates that the vertical fusion range can be improved by approximately four prism dioptres. and that this improvement was maintained one month after the treatment finished.

FACTORS INFLUENCING THE RECURRENCE OF SYMPTOMS IN CONVERGENCE INSUFFICIENCY. **Tanya Davis**
The long term success of convergence insufficiency treatment is examined. A group of patients with recurring symptoms is compared with a group where symptoms had not returned. Significant factors such as treatment of suppression, use of stereograms or training relative fusion, development of voluntary convergence and the completion of the course of treatment emerge as important factors in the long term management of this condition.

VICTORIA

The following are condensed abstracts of research papers undertaken by third year orthoptic students during 1981 at the Lincoln Institute of Health Sciences, Victoria. Interested readers may obtain copies of any of these papers by writing to
The School of Orthoptics,
Lincoln Institute of Health Sciences,
625 Swanston Street,
Carlton, Vic. 3053.

DIABETIC RETINOPATHY IN THE ELDERLY: A STUDY OF THE FACTORS LINKED WITH ITS DEVELOPMENT. **Susan Bull**
In an effort to identify which factors are associated with the development of diabetic retinopathy, the

medical records of thirty-three controlled, elderly diabetics were investigated. A relationship was found to exist between retinopathy and the duration and control of the diabetes, the patient's sex and presence of obesity. Diabetic patients with the greatest risk of developing retinopathy were those with a long duration of diabetes and a history of fluctuating control.

THE POSITION OF THE EYEBALL IN A THIRD NERVE PALSY. **Anita Egan**
A review is made of the anatomy of the oculomotor nerve and nucleus and the effect of a lesion in the infranuclear pathway. A discrepancy exists in the literature concerning the resultant eyeball position—that of pure abduction or the combined abducted and depressed position. Fifteen subjects with oculomotor palsy were reviewed and the resultant eyeball position was generally found to be divergent and hypotropic.

OCULAR MOTILITY DISORDERS IN THE CEREBRAL PALSIED CHILD. **Sus Brearley**
114 cerebral palsied children were examined and medical records investigated to determine the incidence of ocular motility disorders. The incidence of strabismus was the most common disorder of ocular motility at 55%, nystagmus was found in 22%, supranuclear disorders in 6%, alternating sursumduction in 4% and nystagmus blocking syndrome in 3%. Results suggest that the spastic type of cerebral palsy is the most commonly afflicted by strabismus.

THE EFFECT OF A PTERYGIUM ON THE REFRACTION OF THE EYE. **Catherine Devereux**
14 subjects with unilateral pterygia and 14 with bilateral pterygia were investigated through data from medical histories. The presence of astigmatism in all eyes with pterygia was evaluated. In the pterygium sample of 28, 12 showed astigmatism in the vertical axis and eight showed astigmatism in the horizontal axis. After pterygium removal, 18 showed no refractive change, five showed a decrease in the horizontal axis and five showed a decrease in the vertical axis.

A REVIEW OF 22 CHILDREN WITH LEARNING DIFFICULTIES. **Suzanne Tweedle**
This paper includes a discussion on current works relating ocular problems and learning difficulties in children. 22 were clinically assessed and a higher than normal incidence of strabismus (4) defective convergence (4), defective stereopsis using the synoptophore (7) and problems with laterality (13) were found.

A COMPARISON OF FRISBY, T.N.O., AND BRADDICK'S RANDOM DOT STEREOTEST IN SUBJECTS WITH DIFFERENT OCULAR DEFECTS. **Helen Wan**
37 subjects with known ocular defects were tested with Frisby, T.N.O. and Braddick random dot stereograms. There was generally low correlation amongst the three tests which is thought to be due to a restricted range rather than a true lack of correlation. However, there was a high correlation ($r=0.99$) between Braddick's and T.N.O. for intermittent esotropes. The Frisby induced least dissociation, but monocular cues could be utilized. T.N.O. dissociated deviations easily. Braddick's random dot stereogram could not be passed monocularly but was very dissociating. It is suggested that more than one stereotest should be used to determine the presence or absence of binocular functions.

NYSTAGMUS IN THE PRESENCE OF SPINA BIFIDA AND HYDROCEPHALUS. **Robyn Henley**
79 Spina Bifida case histories were investigated to determine diagnosis of medical and ocular conditions, and position of the lesion in the spinal cord. The percentage of Spina Bifida patients with nystagmus was greater when hydrocephalus was present also. (54.35% as compared with 39.4% Spina Bifida only.) Each type of nystagmus was of central origin and the position of the lesion in the spinal cord seems not to be related to the nystagmus.

INVESTIGATION OF THE STATE OF BINOCULAR VISION OF PATIENTS SUFFERING FROM KERATOCONUS. **Deborah Brookes**
18 patients suffering from bilateral keratoconus were randomly selected and clinically examined to determine the state of binocular functions. Visual acuity, cover test, fusion amplitude and stereopsis were performed. Three of the 18 demonstrated full binocular functions, whilst two demonstrated no binocular vision and the remainder had decreased use of binocular function. The effect of decreased visual acuity on binocular vision was not evident.

CONTACT LENSES AND APHAKIA. **Gabienne Tucker**
24 senile aphakic patients' responses to contact lenses (hard vs soft) were evaluated one week and four weeks after commencement of wear. Criteria used were visual acuity, appearance, comfort, wearing time, lens fit in terms of centration and movement, and any difficulties. Results showed hard lenses being the lens of first choice in the correction of aphakia in most instances as opposed to soft contact lenses.

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(See Vancouver Agreement*)

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Begin with a Title page giving a title which should be concise, followed by author(s) name, degrees or qualifications, name of place or institution where work was conducted, and an address for communication.

On a separate page give a brief abstract of no more than 150 words, giving specific facts, findings, conclusions or opinions. Key words (about 5) or short phrases to assist indexers in cross-indexing the article, should follow the abstract on the same sheet. Key words should not duplicate words in the title but should be mentioned in the abstract.

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Papers for publication in the Australian Orthoptic Journal may be submitted to the Editor at any time, but authors wishing to have their work published in the next journal must submit their manuscripts no later than *one month prior* to the commencement of the Annual Scientific Meeting.

* Refer Med J Aust 1979; 2 (August 25): 182-6.

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