Orthoptic Interventions in Stroke Patients

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ABSTRACT

Patients admitted to hospital following a stroke, as part of the recovery process may require active intervention to relieve visual symptoms. The interventions include therapy, correct use of or modification to spectacles (including use of prisms), appropriate occlusion or the adoption of compensatory strategies to support ocular comfort.

This paper falls into two sections. It initially provides an overview of the strategies currently used for vision problems found in patients who have had a stroke. It refers to the general indictors for intervention and the possible strategies that can be used. The second part of the paper looks at outcomes citing patient responses from a 2008 report to the Statewide Ophthalmology Service of the Greater Metropolitan Clinical Taskforce.

The strategies reported include therapy, correct optical use, occlusion and diplopia relief and strategies to maximise ocular comfort. Approaches used are often simple and very effective in terms of patient comfort or educating other team members about the need to support a compensatory strategy. Some strategies require active follow-up with variable outcomes. The outcomes support the benefits of orthoptic intervention in the care of patients recovering from stroke.

Keywords: orthoptic intervention, therapy, stroke

INTRODUCTION

Stroke is the third greatest cause of death and the leading cause of disability in adults in Australia.[1] As stroke is a neurological condition, the likelihood of causing visual deficits is great because of the high representation of sensory and motor ocular areas within the brain.[2] Its impact includes visual field loss,[3,4] visual neglect, and ocular motility problems associated with diplopia (cranial nerve palsies, loss of convergence), nystagmus and gaze palsies.[4] The population who are most likely to suffer from a stroke are in the age group where other ocular conditions can also affect their visual status. These conditions include glaucoma, cataracts, age-related macular degeneration and vascular conditions such as diabetic retinopathy and hypertensive retinopathy. Both acquired and pre-existing vision defects can decrease the patient's ability to see clearly and so decrease their ability to participate in and maximise the rehabilitation process, and conversely their newly acquired impairments from stroke may hamper their ability to benefit from orthoptic intervention.

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Stroke rehabilitation commences once the patient's condition is stable. Several health care practitioners can be involved in rehabilitation through ongoing therapy. This may include speech therapists who assist in swallowing and communication skills; physiotherapists who assist motor skill enhancement and mobility training; and occupational therapists who support activities of daily living. Therapeutic strategies relating to hemianopia[5,6,7,8] and neglect training[8,9] are well documented in the literature, however there is no mention of convergence training or adaptations to assist patients to manage their ocular conditions.

A report of the Statewide Ophthalmology Service of the Greater Metropolitan Clinical Taskforce titled "The orthoptist and the management of visual problems in inpatients with stroke"[10] has revealed that ocular conditions both pre-existing and as a consequence of the stroke, have a significantly higher detection rate when tested by an orthoptist ($p<0.001$) compared to the detection rate by other health professionals in the inpatient setting of a stroke unit. The study was conducted across three sites where there were three different models of eye/orthoptic care (Model 1 – eye outpatient clinic and inpatient orthoptic assessment; Model 2 – eye outpatient clinic only; Model 3 – no eye clinic available). One unplanned outcome from the study was the identification and where possible, management of patients with vision problems that could benefit from intervention.

Patients requiring interventions could be identified across the whole study, but in only one hospital within the study was an orthoptist employed and available to provide follow-up for therapeutic interventions.

The first aim of this paper was to report on those cases within a study population of 150 people admitted to hospital following a stroke who required intervention strategies to assist them with their ocular problems and to enhance their response to the rehabilitation process. The second aim of this paper was to provide case studies as examples to illustrate outcomes.

PROCEDURE

A total of 150 randomly selected patients who had been admitted to one of three stroke units (50 from each unit) because of a vascular incident were included in the study. This study had ethics approval from the Sydney South West Area Health Service Ethics Committee and the University of Sydney Ethics Committee. At the time of invitation into the study the visual status of the participants was unknown. All participants were made fully aware of the purpose of their involvement and signed a consent form. The relatives of two patients refused participation and they were not included in the study.

After initial assessment by the orthoptist, those patients with ocular conditions requiring intervention were identified. The basis for their selection was that due to their ocular condition they would benefit from intervention such as convergence training, scanning for visual field loss, neglect training, optical intervention, occlusion, or training for compensatory strategies.

As a precursor to specific treatment strategies a clear explanation was given using a variety of approaches to ensure that the patient understood their deficit and its cause. This was achieved by written information, diagrams and demonstrations through miming and role play, which were used as appropriate for the patients' communication ability. An ocular care plan was developed and implemented with the assistance and consent of the patient.

ORTHOPTIC INTERVENTION STRATEGIES

Prior to presenting specific outcomes and patient responses the following provides an overview summary of the strategies generally employed in a stroke unit to assist in attaining the best possible ocular function.

1. Therapy is defined as a clinical strategy in which there is a program of structured active ocular procedures designed to bring about change in ocular function and to alleviate symptoms. This could include:

Convergence training: In patients with stroke, defective convergence affects the patient's ability to manage daily ward activities such as reading instructions, menus and for leisure. In addition, good convergence is needed in order to undertake fine motor tasks required by other therapists, for example games and activities involving cognition, object detection, location, placement and manipulation of objects. Table 1 identifies the triggers that prompted a need to treat the convergence and the action undertaken. Therapy was provided to enhance the extent and comfortable use of binocular single vision (BSV) so that tasks were easier to perform and the patient could be more comfortable. The orthoptist identified the exercises to be practised and these were carried out by the patient or supervised by another health care practitioner, for example the physiotherapist whilst undertaking their physiotherapy program. The orthoptist regularly checked progress and modified the exercises.

Table 1. Convergence deficiency features

Indicator - Patient symptoms	Clinical treatment (*when applicable)
Diplopia, words overlapping Asthenopia Problems reading	Involuntary convergence - target to nose. spot card Voluntary convergence* Stereogram cards*

Scanning to compensate for visual field loss: Visual field loss has a profound effect on the patient's ability to orientate in their environment,[6,7] either at the hospital or at home (Table 2). This is a serious issue that requires risk minimisation to prevent trauma occurring, such as falls or burns. Social skills such as initiating and maintaining eye contact whilst conversing are another problem.

Table 2. Visual field loss features

Indicator	Clinical treatment
Bumps into objects - doorways and furniture Knocks over objects Fails to make eye contact on affected side Reading does not make sense, eg left hemianopia - starting point half way across the page, right hemianopia - reads only first part of large words	Educate patient to be aware of loss and explain reason Position bed so stimulation occurs on hemianopic side, ie avoid a blank wall on hemianopic side Teach full field awareness by using a synchronous body and ocular adjustment, eg with left hemianopia when walking, look left as moving left foot Teach to scan – using light stimuli, then clock, pictures on wall, and objects on tray Left hemianopia – use red strip to locate beginning of line; right hemianopia – use an "occluder" to expose letter-by-letter the entire word to be read Coordinate with the physiotherapist to make an obstacle course to teach mobility with scanning

Essential tasks like reading become problematic with loss of place, missing parts of long words, difficulty locating the end of a line and beginning a new line. The impact of the field loss increases frustration levels with reading, results in a loss of contextual meaning and can lead to a reluctance and avoidance to attempt the task.

Therapy includes making the patient aware of their field loss and teaching strategies, especially scanning training, to minimise the effects. One such early scanning method uses a series of paired coloured stimuli equally and symmetrically distributed along a horizontal plane. The patient is asked to locate lights or dots of the same colour on each side of the central fixation stimuli as a means of raising the sensory visual awareness in both the seeing and unseeing peripheral areas.

Visual neglect training: Visual neglect is a failure to transmit information perceived by the visual cortex so that it is not appreciated by the visual association areas. It presents as inattention/awareness of one side of the body and or visual environment. Visual neglect is caused most commonly by damage to the parietal lobe. It may or may not be associated with a field defect.[8] Indicators of the presence of visual neglect are outlined in Table 3.

Table 3. Visual neglect features

Indicator	Clinical treatment
Head and eyes turned away from the side with the neglect, to the unaffected side Failure to realise someone is present Lack of ownership of self (face and limbs) or environment (meals) Bumps into objects as in Table 2	Bed position (as for visual field loss) Exercises/tests – line bisection, letter crossing Exercises – for left loss use a red strip to read; for right loss expose a few letters at a time Use a picture scene to locate separate entities including wall mural Use a clock face, house features, paragraphs with random indentations, mazes, word games, adapted Diller-Weinberg apparatus Encourage tasks which require matching from one side to opposite side, ie food on tray

Therapy for visual neglect differs from visual field training in that the neglect has the capacity to resolve as the area of the brain involved is more diffuse than the tract of the visual pathway which has limited boundaries.[9.] Therefore, constant stimulation of the side with the neglect gives rise to brain adaptation to receive the visual information.

2. Optical Use and Intervention refers to ensuring that patients have their glasses available and use them whilst in the hospital environment. This includes strategies that lead to the prescription of glasses, the modification in the use of existing glasses, changing existing prescriptions or use of an optical appliance. Modification to glasses becomes necessary when vertical gaze defects are present and the patient cannot look down, preventing the use of previously prescribed bifocals. The patient thus requires single focus spectacles (Table 4). In addition, post stroke, many patients report not being comfortable with the small size of the reading segment of their bifocals and again, more effective reading segments may be required.

Table 4. Optical condition features

Indicator	Clinical treatment
Problems reading	If unable to look in depression, suggest separate readers and a reading stand to keep print level If reading glasses are poorly fitted and/or bifocal segment too small, suggest single vision glasses Use of magnifying device Increase light level
Diplopia	Prisms may be applied to glasses or loaned plano glasses, prism may be tilted to correct combined vertical and horizontal defect
Dilated pupil	Use of sunglasses for glare reduction

In the presence of diplopia, prism correction is highly beneficial.[11] In the presence of one or both pupils being dilated, the use of sunglasses to reduce the impact of glare is invaluable.

3. Occlusion. In the rehabilitation environment, diplopia as a result of a decompensating deviation or cranial nerve palsy results in uncertainty about object location and loss of balance.[11] It can result in many problems including misjudging position, leading to self-injury and falls. Occlusion of the most appropriate eye, according to the acuity, pathology and eye with the paretic muscle, is important to support the best response from the patient, particularly in active physical therapy sessions (Table 5).

Table 5. Occlusion features

Indicator	Clinical treatment
Diplopia	Evaluate which eye to cover - ie poor vision in one eye, lid closure with IIIN palsy Effect on proprioception if forced to use palsied eye Partial occlusion allows the use of BSV where possible with half-lens occlusion

4. Supporting Compensatory Strategies. Patients with visual problems linked to cranial nerve palsies who experience diplopia, or who have nystagmus with associated diplopia and images that are blurred and moving, often use a head posture to decrease the impact of the visual problem. Clinical experience has shown that in rehabilitation these patients may have physiotherapy involving posture control which is generally based on keeping the body vertically aligned to respect gravity, ie head and body held straight. If a compensatory head posture has been adopted by the patient to overcome diplopia, or place the eyes in the position of least nystagmus, straightening the head may cause the diplopia and or the vision to worsen. The orthoptist needs to advocate on behalf of the patient to retain the compensatory head posture (Table 6).

Closing an eye could be indicative of a problem such as diplopia. If the need to shut the eye is constant then occlusion or prisms may be required. Some patients may only shut an eye intermittently, for instance when looking into some positions of gaze. Segment occlusion may stop this need, or if the problem is minor, closing the eye may be supported to continue.

Table 6. Compensatory strategies

Indicator	Action
Presence of head posture – head tilt, chin position or face turn	Ascertain if ocular or due to stroke deficit
Closing an eye	Allow use if to join diplopia or to use null point of nystagmus
	Explain to other therapists the advantage gained by head posture
	Investigate reason

OUTCOMES

There were 150 participants with an age range of 24 to 95 years (mean age 75 years), 78 (52%) females and 72 (48%) males. All participants had been admitted because of a vascular incident which included stroke (70%), TIA (20%) or unspecified cause (10%).

Seventy-five participants (50%) were identified by the orthoptist as requiring intervention. As the investigation of the interventions was not planned as part of the original report, the outcomes were not followed in detail and are therefore provided as a broad description. The outcomes fall into two broad categories, the first where the participants were actively involved in therapy and the second, where the procedure was delivered to provide comfort but active participation was not required. Within the stroke population the acceptance of interventions was dependent on factors which included the cognitive and physical status of the participants. Such factors as refusal to cooperate, or discharge occurring prior to or during the treatment phase, also affect the ability to appropriately evaluate intervention outcomes.

Actual therapeutic strategies were only carried out at the hospital where the orthoptist was a permanent member of the inpatient team. Of the 50 participants seen at that hospital, eleven were given therapy, three for treatment of convergence insufficiency, five for visual field scanning and three for neglect training.

The identified non-therapeutic strategies were provided for the 150 participants across all three hospitals: four required occlusion; two eye-padding for medical conditions; five for compensatory strategies; forty-nine for optical strategies (30 referred for prescription, 13 left their glasses at home, three were not wearing their glasses, and three were asked to change their glasses from bifocals or multifocals to single focus lenses); and four were provided with Fresnel prisms. End-results are not known because of an inability to follow up the participants to determine the outcome.

1. Therapy Outcomes

Convergence training: Of the 150 participants, there were 61 (40.7%) whose convergence near point (CNP) was less than 6 cms, with 14 (9.3%) of those having a CNP of less than 10 cms. Each of these participants required questioning regarding near problems, particularly those with a near point further than 10 cms. The following case studies illustrate the clinical presentation of patients with convergence problems in a stroke unit and highlight the challenges faced when initiating a treatment program (Table 7).

Scanning for field loss: Of the 150 participants, 20 had either a hemianopia or quadrantanopia detected by confrontation or Bjerrum field test. These patients may benefit from orthoptic intervention to enable full and safe mobility and daily living skills. The following cases illustrate the clinical features and response of three patients, two of whom had reported that the field loss had an impact, and one where intervention was not actually sought by the patient (Table 8).

Visual neglect training: Eight patients were identified with visual neglect, confirmed by the patient's negative response to the "simultaneous binocular presentation test". In this test the patient is asked to fixate straight ahead and identify the total number of fingers presented separately and simultaneously on each side of the midline. The following cases illustrate the clinical features and responses of three of these patients (Table 9).

Table 7. Case studies for convergence deficiency

Age	CNP	Condition impact	Strategy	Outcome
91 years	10 - 15 cms	Intermittent diplopia when reading	Treatment undertaken for two days, a total of 10 minutes involuntary convergence training	Non-compliant, could not see the point of the exercises
49 yrs	10 cms, fatigues to 15 cms	Fuzzy vision	Treatment recommended	No orthoptist to follow up
48 yrs	6 cms	Mild headaches, uncomfortable when reading and doing close work	Exercises commenced for physiotherapist to follow up	Lost to follow-up

Table 8. Case studies for field defects

Age	Field defect	Condition impact	Strategy	Outcome
78 yrs	Left homonymous hemianopia	Aware of vision loss; no pursuit movements beyond midline	Three treatments with light-board and picture stimuli	Improved mobility and awareness reported by therapists
74 yrs	Right hemianopia, macular splitting	Nil	Discuss with family	Family aware of the patient's visual loss and take this into account when interacting with the patient
74 yrs	Left hemianopia, macular sparing	Blurred vision and transient vision loss	Four visits to teach compensation for field loss	Improved ability to direct intact seeing area to support safe mobility

Table 9. Case studies for visual neglect training

Age	Neglect	Condition impact	Strategy	Outcome
75 yrs	Left	Only looks to left if asked; fix and follows only from right to left	Block right stimuli, four light-board treatments	Noticing objects on left; sees objects on both right and left presentation
74 yrs	Left	Unaware of left arm for physiotherapy; with line-bisection test, only responds to extreme right	Seven treatments with the light-board; red strip; describing complex pictures	"Huge improvement" reported by staff and patient, fully orientated to all parts of body and hospital environment and ADLs
74 yrs	Left, associated with partial left hemianopia	Eyes and head constantly to right and unaware of environment on left	16 treatments with light-board; red strip; describing complex pictures	Spontaneously looks to left occasionally, better response with physiotherapy, and eyes more in primary position

2. Optical Use and Interventions Outcomes

There were 49 optical interventions, of which 30 were referred for a prescription or update of glasses, as illustrated in Table 10. An additional 13 had left their glasses at home and relatives were requested to bring the glasses to hospital, and a further three patients were advised to wear the glasses they had with them. Four patients were recommended to either change their existing glasses from bifocal or multifocal to two separate pairs of glasses or to use their existing glasses correctly to enhance their visual comfort. Four patients were fitted with Fresnel prisms to enable them to regain BSV.

Table 10. Case studies using optical interventions

Age	Issue	Condition impact	Strategy	Outcome
77 yrs	Bifocal segment too small	Glasses uncomfortable, had to be lifted to read	Two separate pairs of glasses	Patient very happy
90 yrs	Left glasses at home	Decreased distance vision RE 6/24, LE 3/60	Glasses brought from home	Improved vision R & LE 6/12
83 yrs	Not wearing glasses with pre-existing prism	Diplopia without glasses	Wear glasses full-time	Single vision with glasses
74 yrs	Diplopia	Vertical diplopia present	Prisms	Single vision in primary position

3. Occlusion Outcomes

Four patients were treated with occlusion to assist them to gain a single image and ocular comfort. The methods of occlusion used included a translucent filter, half-lens and total occlusion. The translucent filter was used because it was more cosmetically acceptable and for patients who

could tolerate the level of blockage provided by the filter. The half-lens occlusion was used on the lower segment of the spectacles where the deviation and diplopia were present, thus allowing the patient to capitalise on their binocular single vision when looking through the top of the glasses (Table 11). Total lens occlusion was used to overcome diplopia present in all positions of gaze.

Table 11. Case studies using occlusion

Age	Issue	Condition impact	Strategy	Outcome
74 yrs	Diplopia	No confidence in walking	Half-lens lower segment occlusion	Vary satisfied
82 yrs	Diplopia	Discomfort	Filter occlusion	Eyestrain, changed to prism

Two additional patients were treated as part of a medical procedure. One had a full ocular pad for a corneal ulcer and the other used tape to ensure lid closure in the presence of VII CN palsy with corneal exposure.

4. Supporting Compensatory Strategies Outcomes

There were five patients who required compensatory strategies, each of which took individual and different approaches. For instance, in two patients adaptations were used to allow visual comfort, and in one the patient was happy continuing as he had always done without clinical intervention (Table 12). Part of the management is this area links to observation and part to listening to the patient and their personal comfort issues.

Table 12. Case studies demonstrating compensatory strategies

Age	Condition impact	Strategy	Outcome
87 yrs	Nystagmus in primary position	Lift chin to have stable vision	Patient expressed satisfaction
70 yrs	Vertical gaze defect, could not use bifocals	Support to continue lifting glasses and/or get single focus lenses	Pleased to be advised to adapt glasses
83 yrs	Constant diplopia, which was present prior to the stroke	Leave alone	Patient expressed satisfaction

DISCUSSION

Patients post stroke have complex issues of physical defects such as hemiparesis, difficulty swallowing, communication issues and vision defects, as well as cognitive problems such as confusion and apathy. They have to contend with the changed environment of the hospital and respond to a variety of health care practitioners each with a different role to play in their recovery process. In this environment the best visual status will assist the patient to respond.

Based on the outcomes of the 2008 report "The orthoptist and the management of visual problems in inpatients with stroke",[10] fifty percent of the participants in the study had interventions recommended, which is a large number of people identified with vision problems. Strategies to achieve the best visual status may be as simple as bringing glasses from home and using them, using glasses correctly or seeking modification of the current lens format into two separate pairs of glasses. In addition an explanation to the patient about their vision problem, its impact and how to adapt, can empower the patient to use their eyes more effectively and achieve a better outcome from the rehabilitation process. It is often surprising that seemingly simple orthoptist-directed actions can change the patient's attitude and level of cooperation. There is also a strong sense of satisfaction to observe a patient with improved ocular function performing leisure activities such as watching television and reading. In addition, to receive feedback from other health care practitioners about improvement in participation in rehabilitation processes following eye care intervention is extremely rewarding.

This study has revealed that treatment strategies can be effective when they are orthoptist-directed, with supervision and follow-up by an orthoptist or other health care practitioner. This was demonstrated in the area of scanning for field loss and neglect where close and regular supervision of the patients resulted in improvement. Conversely, treatment for convergence deficiency was generally not effective, likely due to contributory factors including stroke-related dementia and cognitive damage preventing awareness of the purpose and benefits of the treatment, fatigue, lack of sustained concentration and patient discharge from the hospital before the completion of treatment. Therapeutic approaches therefore have variable outcomes. However, as can be seen in the case studies, patients do benefit and having some negative outcomes should not deter the orthoptist from implementing strategies. Consequently, it is important that the therapeutic interventions should be set at a level dictated by the capabilities of the patient.

Whilst there are studies that discuss the various approaches and outcomes for treating field defects and visual neglect, there are no reports on the other interventions. The outcomes in this study do have limitations because they are reported as either general subjective patient responses or observed improvements in patient behaviours and responses to other activities. There is a need for larger randomised controlled studies of patients undertaking active treatment strategies with objective measurement through tools such as quality of life questionnaires. There is also a need to measure the impact of improved vision responses on the patient's ability to interact with

other health care services, which may then decrease the length of stay in hospital and the impact on total health expenditure. Outcomes can then guide practitioners in their role in the area of intervention for eye care in the field of stroke.

CONCLUSION

The outcomes from the study do not measure the impact of orthoptic intervention in monetary terms but through the case studies have demonstrated increasing cooperation and decreased frustration from patients whilst performing daily tasks, therapy activities and their response to interpersonal interaction. The orthoptist is well placed to provide practical support directly to patients, in turn assisting the rehabilitation process in terms of service delivery and time management.

A future study into more objective measurement of outcomes plus time and cost savings is recommended.

ACKNOWLEDGEMENT

This study is part of a project that was funded by a grant awarded by the Statewide Ophthalmology Service, a network of the Greater Metropolitan Clinical Taskforce 2006/2007.

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