REPORT TO THE STATEWIDE OPHTHALMOLOGY SERVICE (SOS) OF THE GREATER METROPOLITAN CLINICAL TASKFORCE (GMCT)

The Orthoptist and the management of visual problems in inpatients with stroke: A pilot study to compare existing models of care

Short title: Stroke Patient Care and Visual Defects

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1 EXECUTIVE SUMMARY

The Statewide Ophthalmology Service (SOS) is a clinician-led network of the Greater Metropolitan Clinical Taskforce (GMCT), a health priority taskforce of NSW Health. The SOS aims to facilitate equitable access to high quality public ophthalmic services for residents of NSW.

In 2006/07 the SOS approved funding of $11000 for the Orthoptic Standing Committee (OSC), a committee of the SOS, to investigate the detection of ocular conditions and management strategies for patients in the inpatient setting who had suffered a stroke.

The project evaluated three different service delivery models to determine whether patients diagnosed with a stroke and admitted to a designated stroke unit had equitable access to eye care. Collaboration with the GMCT network, Stroke Services NSW, facilitated access to the inpatient stroke units at the study sites.

All inpatient stroke units were in metropolitan hospitals in Sydney South West Area Health Service (SSWAHS). There were 150 participants across three different locations, 50 for each service delivery model. The service delivery models were:

- Service Delivery Model 1 (SD1) - access to an outpatient eye clinic and or an orthoptic clinic, but no specific ocular assessment in the inpatient stroke unit;
- Service Delivery Model 2 (SD2) - no ophthalmology services in either an outpatient eye clinic or in the inpatient stroke unit;
- Service Delivery Model 3 (SD3) – an ocular assessment by an orthoptist in the inpatient stroke unit with referred access to the outpatient eye clinic.

The study disclosed that at the time of the assessment 129 (86%) of the participants had at least one ocular condition that caused a decrease in vision response or function. Some conditions e.g. field loss, arose directly from the stroke but many ocular conditions e.g. glaucoma and dry eye, were pre-existing and either caused a direct problem or complicated patient responses and co-operation.

As well 22% of patients required some form of optical care, 20% of patients required orthoptic intervention and whilst both groups identified the need for new medication, the continued use of medication was more frequently identified by the orthoptist.

The major outcomes of the study are:

1. It has been clearly demonstrated that the presence of an orthoptist in the inpatient stroke unit to assess ocular function (SD3) enabled greater detection of eye conditions (100%, $p<0.001$), increased intervention and increased understanding of eye functions. If stroke-affected patients are to be assisted with good eye care the inclusion of an orthoptist in the inpatient unit will achieve this goal.
2. The data suggest that orthoptic involvement also enhanced staff, patient and relative feedback and facilitated appropriate and timely onward referral.
3. Where there was access to an outpatient eye clinic in the hospital (SD1) analysis showed that despite this access, the number of ocular problems detected was similar to the site where no eye clinic exists (SD2). This would suggest that other health care professionals with limited experience in the

detection and management of ocular conditions in both SD1 and SD2 were not identifying the need for onward referral.

Under normal operation, patients in designated inpatient stroke units, without access within the inpatient stroke unit to a detailed ocular assessment received limited or no access to eye care.

This report clearly shows that an orthoptist on site is best practice in management of eye conditions for stroke patients. In order to improve eye care for patients recovering from stroke it is **recommended** that:

- Increased attention is paid to the detection of ocular conditions - both pre existing and acquired - as part of the acute stroke management process
- Ocular findings are managed with treatment or onward referral
- Documentation is provided for each patient of ocular conditions that arise from either an ophthalmic or neurological cause
- Communication of ocular status to staff, patients and relatives is undertaken

Strategies to achieve this include:

- Provide the services of an orthoptist to undertake detailed ocular assessment and intervention in inpatient stroke units. The study indicates that this is the most effective method of ensuring adequate vision care
- Provide education to inpatient stroke unit staff about the importance of ocular assessment and intervention
- Provide education to enhance the ocular assessment and intervention skills of inpatient stroke unit staff
- Develop standard eye assessment tools for inclusion in the Acute Stroke Care Clinical Guidelines, use in the stroke unit and in the patient medical record
- In the absence of orthoptic services refer to other eye care medical professionals for a detailed ocular assessment

THE ORTHOPTIST AND THE MANAGEMENT OF VISUAL PROBLEMS FOR INPATIENTS WITH STROKE: A PILOT STUDY TO COMPARE EXISTING SERVICE DELIVERY MODELS

2 BACKGROUND

The Statewide Ophthalmology Service (SOS) is a clinician-led network of the Greater Metropolitan Clinical Taskforce (GMCT) a health priority taskforce of NSW Health. The SOS aims to facilitate equitable access to high quality public ophthalmic services for residents of NSW. It works across the continuum of care to consider issues of concern to the ophthalmic community including screening and surveillance and treatment for eye conditions.

The Orthoptic Standing Committee (OSC) is a committee of the SOS. Its membership comprises orthoptists, a nurse and an ophthalmologist. Its work has included issues as diverse as vision surveillance and screening, paediatric ocular injuries, ocular assessment of stroke patients with visual defects and the relationship between vision and falls.

The SOS provided funding of $11000 in 2006/2007 to investigate eye care in patients who had suffered a stroke.

Collaboration with the GMCT network, Stroke Services NSW, facilitated access to the inpatient stroke units at the study sites.

3 INTRODUCTION

Stroke is the third greatest cause of death and the leading cause of disability in adults in Australia[1]. The rising incidence of cardio-vascular disease and stroke is linked to increased life expectancy and the increased number of older people in the population. In addition, improved medical management is linked to increased survival from stroke so that care and recovery is becoming more important. Consequently rehabilitation for many patients commences soon after admission and is most effective when the patient has the best possible input from all sources.

Stroke impacts on both the sensory and motor systems. A major sensory-motor area that is involved is vision, with a reported 60% of patients having ocular defects [2]. Ocular defects can affect patients in several ways and can either be a consequence of stroke or a pre-existing condition. Ocular problems that occur as a direct consequence of stroke include peripheral visual field loss (hemianopia, quadrantanopia), visual neglect, visual discomfort linked to diplopia (double vision), dry eye (related to facial palsy) and decreased visual skills such as gaze palsies and nystagmus.

Ocular problems that occur independently of a stroke are more common in people over the age of 60 years. This is the age group in which stroke mostly occurs[4]. With advancing years, ocular changes occur. The reliance on spectacles to achieve clarity of vision increases and ocular pathology such as cataract, glaucoma, macular degeneration and dry eyes [4] develop independently of any stroke condition. In particular, the existence of glaucoma in a patient, which is often asymptomatic, requires both immediate and ongoing treatment to prevent permanent loss of vision. In the stroke patient this condition needs to be identified to ensure that ongoing treatment is provided. Pre-existing ocular conditions can be complicating problems if a patient suffers a stroke.

Whatever the source, ocular defects can complicate the patient's abilities to respond to rehabilitation. For instance, blurred vision (caused for example by lack of or inappropriate spectacles or inability to look directly at an object) and diplopia (double vision caused by eye movement disorders) can make it difficult for a patient to see objects easily and accurately interpret information. Independent of the direct impact of these two symptoms on performance, they have also been reported to be a common warning sign that a stroke is imminent, so their presence should be a cause for concern in patients with these conditions[3].

Vision defects, either acquired from the stroke or pre-existing, can result in a patient not seeing and responding to a health care professional's instructions, or being unable to see and respond to tests or rehabilitation strategies. Affected patients may attempt activities but because of vision impairment, be slow or faulty in their response and increase the risk of a fall when attempting to mobilize. It is known that decreased vision in one or both eyes is associated with multiple falls[5, 6]. Additionally multi focal spectacles[7], uncorrected refractive errors, not using spectacles[8] and the presence of glaucoma, diabetic retinopathy, cataracts [9] and diplopia[10] have also been linked to an increased risk of falls.

The relief of ocular symptoms has been reported to improve comfort, restore confidence[11] and influence patient cooperation[12].

Management of ocular defects can assist rehabilitation. For acquired vision problems, this includes such interventions as hemianopia training, neglect training, prism therapy, occlusion and other coping strategies for the patient. For pre-existing eye conditions an understanding of the vision standard of the patient, correct use of spectacles and ocular medication can assist patient rehabilitation and comfort.

These issues demonstrate the importance of informing health care professionals and relatives about the abilities or limitations of the visual skills of the patient with a stroke so they can adapt their interaction with the patient.

In designated inpatient stroke units across NSW, a range of service delivery models operate that provide basic screening of cranial nerve function by medical staff as an integral part of a neurological assessment. This includes a screening of the ocular specific cranial nerves II, III, IV & VI. Assessment of cranial nerves V, VII and VIII also tests some eye-related functions such as corneal sensitivity, lid closure and vestibular induced eye movements.

Anecdotal evidence suggests that formal ocular assessment and detailed measurement and documentation of visual function, apart from the limited assessment in the screening of cranial nerve function, are not routinely performed on stroke patients. Thus management of stroke patients with ocular defects is potentially less effective than if full visual assessment had been performed by an orthoptist.

The National Stroke Foundation's Clinical Guidelines for Acute Stroke Management 2007' [13] is silent on the management of ocular defects in this acute phase other than to note that ophthalmologists and orthoptists may be members of an expanded stroke care team. One of the key messages of the guideline however is to recommend early mobilization, which would suggest that a detailed ocular examination prior to this may be informative and aid patient safety and recovery. Visual function and its relationship to functional difficulties including driving are however discussed in the Clinical Guidelines for Stroke Rehabilitation and Recovery [14].

Existing stroke service delivery models include different levels of ocular assessment and can include:

- The provision of an extensive assessment of vision and ocular function by an orthoptist for every inpatient capable of responding. At the completion of the test, the patient, staff and relatives are advised of the vision status including pre-existing and acquired conditions, particularly those which may impact on their rehabilitation. When a visual condition that requires ophthalmic management is disclosed, the patient is referred to the eye clinic for assessment by an ophthalmologist. There is only one inpatient stroke unit in NSW where this situation exists i.e. Bankstown/Lidcombe Hospital. Stroke patients in stroke units in Blacktown Hospital and Royal Rehabilitation Centre Sydney can be seen by an orthoptist following referral.
- Ocular assessment is limited to the neurological assessment by medical staff or observation by nursing and allied health staff. Patients with obvious eye problems are referred to an outpatient eye clinic, if available. In the absence of an eye clinic, patients with significant eye problems are referred for private ophthalmic or optometric eye care. Detection and appropriate referral are based on the accuracy of the observer. Staff may rely on their own direct observation or the report of relatives or the response of the patient who may complain of a visual problem.

In the presence of a high incidence of ocular defects that are either pre-existing or resulting from the stroke, the current service delivery models may not ensure equity of access to adequate vision services for all stroke patients.

This study evaluated:

(i) Whether a detailed ocular assessment conducted by an orthoptist can provide more information about the ocular status of a stroke patient than assessment by other health care professionals

(ii) Whether an increase in information about ocular status can increase the number of appropriate interventions

(iii) Whether the existence of eye care services, provided in the inpatient stroke units versus the outpatient clinic or an offsite clinic, has an influence on the detection of ocular defects in inpatients who have had a stroke.

4 METHODOLOGY

Three service delivery models of ocular care for stroke patients were compared to determine the level of detection of ocular defects and the consequent intervention strategies. All inpatient stroke units were in metropolitan hospitals in Sydney South West Area Health Service (SSWAHS). These were:

(i) Service Delivery Model 1 (SD1) - access to an outpatient eye clinic and/ or an orthoptic clinic but no specific ocular assessment in the inpatient stroke unit

(ii) Service Delivery Model 2 (SD2) - no ophthalmology services in either an outpatient eye clinic or in the inpatient stroke unit

(iii) Service Delivery Model 3 (SD3) – an ocular assessment by an orthoptist in the inpatient stroke unit with access to refer to the outpatient eye clinic.

Table 1: Available staff by service delivery model

Staff Type	SD1	SD2	SD3
Inpatient medical, nursing & allied health	√	√	√
Inpatient Orthoptist	×	×	√
Outpatient eye clinic/ orthoptist clinic	√	×	√

Ethics approval was sought from and granted by Sydney University and SSWAHS.

The project was conducted by a team of four experienced orthoptists who sought approval of each patient to participate in the study, explained in verbal or written form the purpose of the study and sought completion of an ethics form. Each patient was advised that he /she could withdraw at any time.

The orthoptist reviewed the medical record to retrieve information that had been recorded by any health professional about the patient, their vision or ocular function, and interventions that had been undertaken or recommended. If an assessment was not recorded it was assumed it had not been done. The orthoptist also undertook a detailed ocular assessment, reported the results verbally and in the medical record and recommended interventions where appropriate.

The results were recorded in a data collection sheet (Appendix 1) which was divided into four sections – basic data, ocular information, ocular diagnosis and intervention. In each section, headings were used to identify test procedures with subsections for the results retrieved firstly from the medical record before the orthoptic assessment (or “all inpatient staff”) and secondly, the results gained by the orthoptist.

Sections:

(i) **Basic data**: this was a general section which identified patient information about age, gender, place of assessment (bed, bed side chair) patient responsiveness (Glasgow coma scale) vascular episode (s) date, site of lesion, and driver status.

Information from sections (ii), (iii), & (iv) was retrieved from medical records where it was recorded before the orthoptic assessment and separately following the orthoptic assessment.

(ii) **Ocular information**: tests included history, information about spectacles, observation of the eyes, pupillary function, near and distance visual acuity, ocular motor system function, convergence, peripheral vision and visual neglect.

(iii) **Ocular Diagnosis** as recorded by other clinical staff and then the orthoptist.

(iv) **Intervention** (identified by other clinical staff as well as by the orthoptist) which included feedback, orthoptic care, optical management, ocular medication and eye specialty referral for further investigation or treatment; referral to an agency such as Vision Australia for further help.

4.1 Test Rationale

A detailed ocular assessment will enable the detection of ocular conditions in the presence of stroke so that the health professionals can interact with the patient more appropriately and so that correct treatment can be undertaken.

4.1.1 Ocular history

An ocular history details information about ocular function, both recent and long term. This includes ocular symptoms, diseases, ocular medication and spectacles. It provides insight into need for continued ocular treatment and potential problems with vision-based tasks during recovery and rehabilitation

4.1.2 Visual Acuity

Assessment of visual acuity using a range of tests provides quantitative data to facilitate an ocular diagnosis The visual acuity level is most likely to be affected by factors that arose prior to the stroke. The measurement provides information about the ability of the patient to see and to cope with tasks required in the ward and subsequent discharge environment.

Acuity of less than 6/12 at distance prevents a person from holding a driver's license and indicates problems with seeing detail and with discriminating differences in information in decreased light levels. This level of acuity can also cause decreased ability to perform vision-based tasks such as eating and cooking, reading, mobility involving avoidance of obstacles, coping with stairs, and mobility in reduced light levels.

Patient performance that shows decreased acuity may suggest stroke-based decreased skills rather than visual complications. Similarly, knowledge of the ability of spectacles to improve the acuity may improve vision-based skills and patient performance.

4.1.3 Pupillary Responses

Testing of pupillary function is part of a basic neurological assessment. Pupillary responses provide information about pathology occurring in the visual pathways. In the presence of dilated pupils, problems with glare become an issue. Horner's

syndrome is important to note because its presence can suggest abnormalities in the unaffected eye and lead to unnecessary assessments for a dilated pupil.

4.1.4 Visual Field Defects

Visual field defects provide evidence of neurological deficit and the development of ocular disease. Segment losses are most likely to be caused by a stroke and are a routine part of a neurological assessment. An orthoptist will not only look for neurological defects but also perform a detailed assessment of peripheral vision which can indicate non-vascular chronic disease development. For example, a scotoma can suggest glaucoma development or other pre-existing conditions.

4.1.5 Visual Neglect

Visual neglect is clinically noted to cause major problems for the affected person because of the inability to relate accurately to the environment. Detection of neglect is complicated by the possibility of the co-existence of field loss. It may also be mistakenly diagnosed when it is in reality only field loss or an eye movement disorder that prevents a person from looking in all directions and therefore results in the patient missing information. Neglect is also a condition that is linked to spontaneous recovery.

4.1.6 Ocular Posture

This relates to the position of the eyes within the orbits and is specific to the detection of strabismus (turned eye).

In the stroke patient strabismus may be caused by a vascular condition and is most likely to present as a cranial nerve palsy. Many people have pre-existing strabismic conditions which can cause complications following a stroke. First there is the identification of whether it is pre-existing or acquired. Second a pre-existing condition can change as a consequence of the stroke e.g. change from full control to partial control with associated symptoms and difficulty coping with test procedures, rehabilitation and daily living skills.

4.1.7 Eye Movements

Eye movement dysfunction is most likely to be related to vascular defects.

Disturbances of eye movements will impact on a person's ability to perform tasks such as reading, writing and driving[5]. Such problems include loss of place with reading, the use of head movements to compensate for reduced eye movements or to attain single vision. Nystagmus can affect visual acuity and can be interpreted as "double vision", particularly when it occurs on lateral gaze. These responses will slow patients' ability to undertake rehabilitation strategies.

4.1.8 Convergence

Convergence is a dynamic condition that is affected by fatigue, long working hours and health changes such as occur in stroke. Defective convergence will impact on the ability to undertake near activities associated with tests or rehabilitation requirements. It can lead to disturbed binocular vision with diplopia, blurred vision and headaches. None, apart from the orthptist, screened this function.

4.1.9 Facial Palsy

Both this condition and the following condition, lid defects, are likely to be related to the vascular lesion and will impact on ocular function in different ways.

Facial palsy can be associated with inability of the lid to close to protect the cornea from drying. This introduces the possibility of the development of corneal ulcers. As this problem is linked to involvement of the upper face, particular attention is paid to facial function and the differentiation between a full facial defect with lid closure problems and an upper motor neurone defect which has no lid closure problems.

4.1.10 Lid Defects

Lid defects included four conditions: poor lid closure not related to facial palsy but leading to concern about dry eyes and possibly to corneal ulcers; proptosis which may lead to poor lid closure and which will require the practitioner to find the reason for the ocular protrusion; problems with opening the lid(s) i.e. ptosis which can obscure a clear view of the environment and cause problems with depth judgment if the droop makes a patient monocular; and ectropion i.e. failure of the lid to sit against the globe which can lead to excessive tears and consequent facial discomfort from exposure to the tears. Each of these conditions has the potential to cause discomfort for the patient and to decrease co-operation during rehabilitation. Ptosis can impact on depth judgment and therefore may affect mobility and increase the risk of falls.

4.2 Role of the Orthoptist

Orthoptists work closely with ophthalmologists and, as part of the eye care team, specialize in the assessment of eye conditions and, where appropriate, therapy and rehabilitation for people with vision defects. They have particular expertise in assessing patients who have difficulty with communication and have adapted test procedures to gain results by objective methods. Their therapeutic and rehabilitation role enables them to advise about adaptations to assist patients to achieve best-vision based skills in daily tasks.

In this study the orthoptist possessed the skills to assess ocular function in detail. Both inpatient staff and orthoptists undertook the same assessments for some functions. In particular orthoptists:

- have a broad experience in ocular history-taking e.g. they are aware that patients do not include eye drops used for glaucoma or dry eyes when asked about medication thereby potentially missing the existence of glaucoma
- Measure visual acuity standards and field defects
- Assess eye movement function and detect ocular posture defects
- Determine the need for spectacles and variations that can help patient comfort and co-operation
- Provide interventions to assist the patient to use existing ocular function to the best possible level
- Recognize the need for and referral to other eye specialists and agencies to ensure best eye care.

4.3 Population details

A total of 150 patients (50 from each of the 3 inpatient stroke units) who had been admitted to hospital because of a vascular incident (stroke 69%, TIA 20% or unspecified 11%) were included in the study. Of the total group, 49 (32%) had had

one previous incident, 9 (6%) had had 2 previous incidents, 3 (2%) had had 3 previous incidents and 60 (40%) had had no previous incidents. The lesion locations are shown in Table 2 below.

The age range was 24-95 years (mean 73 yrs) with 72 males (48%) and 78 females (52%). Each participant underwent visual screening including assessment of sensory function (visual acuity and peripheral vision) and motor function (ocular posture and eye movement skills).

Table 2: Vascular injury – lesion location

Lesion location	Participant number	%
Frontal	7	5
Parietal	34	23
Occipital	6	3
Brainstem	13	9
Cerebellum	10	7
Fronto-parietal	5	3
Multiple sites	11	7
Vascular – general	8	5
Nil / unknown	56	37

5 RESULTS

In order to address the aims of the study the results are reported in four sections:

(i) **Ocular conditions** - the first aim was to 'evaluate whether assessment by an orthoptist could provide more information about the visual status than assessment by other health care workers'. To achieve this aim, both the ocular conditions found in all 150 participants by orthoptists and those found by other health care workers are presented. The relevance of the findings is related to the overall care of affected patients.

(ii) **Intervention strategies** - the second aim was 'to evaluate whether an increase in information about ocular status can increase the number of appropriate interventions'. To address this aim the number and type of interventions are discussed and linked to their effect on the patient and their rehabilitation.

(iii) **Comparison of three service delivery models** - the third aim was 'to evaluate whether the different service delivery models have an influence on the detection of ocular defects in participants who have had a stroke'. This is addressed by analyzing the outcome for detection of ocular conditions, and intervention following detection, in the three service delivery models.

(iv) **Feedback from inpatient staff** - section four presents results from verbal feedback from inpatient staff at the hospitals where the study was conducted.

5.1 THE OCULAR CONDITIONS

It was found that 129 (86%) of the participants had at least one ocular condition that affected visual performance (e.g. visual acuity less than 6/12 N12, or diplopia), or affected function (e.g. ocular disease, field loss, eye movement disorder that is causing problems) or that required follow up (proptosis). If the outcome included ocular conditions of any type then only five participants (3%) had no demonstrable ocular defect.

Table 3: Participants with Eye Conditions which may affect performance

No. of conditions	0	1	2	3	4	5	8
Total participants	21 (14%)	33 (22%)	39 (26%)	40 (27%)	13 (8%)	3 (2%)	1 (1%)

Table 3 shows that many of the participants had more than one ocular condition, either stroke related or pre-existing, that caused problems or required attention and follow up. This result indicates that there is a high incidence of ocular conditions in stroke patients and raises the need for a full ocular assessment.

To evaluate whether detection of the ocular defects by an orthoptist would reveal more information, the ocular defects found in the 150 patients are presented in tables 4-15 in two groups. The first group is the reported defects found by all health professionals in the inpatient setting excluding orthoptists. All health professionals included triage nurse, interns, registrars, specialists, occupational therapists & physiotherapists. The second group reported defects found by the orthoptists.

The results are shown in the following categories: symptoms, spectacles, ocular diseases / pathology, ocular medications, visual acuity, pupillary response, visual fields, visual neglect, ocular posture, eye movements, convergence, facial palsy and lid function.

5.1.1 Ocular symptoms

Ocular symptoms are grouped into ten conditions and the number found by the inpatient staff and the orthoptists is presented in Table 4. The major problems were diplopia and blurred vision.

The remaining symptoms occurred less frequently but indicated that there was discomfort which required management. Again the implications of this discomfort on patient cooperation can affect the rehabilitation process.

Table 4: Summary of number of ocular symptoms found in 150 participants

Symptoms	Reported by all inpatient staff	Reported by Orthoptists
Diplopia	3	16
Blurred vision	5	21
Visual disturbance	-	7
Sore / painful eye(s)	1	5
Watery eyes	-	5
Oscilopsia	-	2
Spectacles no good	-	2
Shuts an eye	-	2
Blind	1	-
Face numb	1	-
Total	11	60

The orthoptist reported ocular symptoms in 40% of the participants whereas inpatient staff only detected symptoms in 7% of the participants (i.e. in less than 1/5 of the patients who had symptoms). It should be noted that many of these symptoms may have been present prior to the stroke or may have been aggravated by the stroke.

5.1.2 Spectacles

The spectacles were prescribed before the stroke occurred and are not related to the stroke. Table 5 identifies the observations of each group of health professionals, the type of spectacles that have been prescribed for use by each patient and whether they were available at the time of testing.

The orthoptic findings provided greater information about the need for spectacles and indicated that 127 participants required spectacles, with 114 having them with them and 13 having left them at home. Some of the participants whose spectacles were at home went from legally blind to fully sighted once the spectacles were brought from home and used by the participant.

The inpatient staff recorded the need for spectacles in only five participants of which two of these had left the spectacles at home.

Table 5: Report of type and availability of spectacles used by participants

Spectacle type	All inpatient staff	Orthoptists
Nil required	2	21
Bifocals	1	48
Multi-focal		17
Trifocals		1
Separate near and distance		14

Spectacle type	All inpatient staff	Orthoptists
Near only	2	28
Distance only		5
Prisms		1
Spectacles not available (left at home)	2	13
Not recorded	141	
Not specific	2	2

Knowledge of the different type of spectacle prescription (single focus, multi-focal etc) noted by the orthoptists in almost all cases enabled guidance about the need to use spectacles in specific situations, for instance:

- In the presence of tri, bi or multi-focals the participant should look through the top segment of spectacles when walking to ensure the images are clear
- The orthoptists provided guidance about the range of clear vision available to each participant
- Where separate spectacles for different distances were required the orthoptic findings provided information about the need to change spectacles for different tasks.

Documentation by inpatient staff of the type and availability of spectacles was poor – only 6% of participants had information recorded.

5.1.3 Ocular diseases / pathology

A wide range of ocular conditions was reported. The information is summarized in Table 6. It should be noted that many of the eye conditions were unrelated to the stroke condition but may affect participant comfort and co-operation. Some of the conditions, specifically corneal ulcer, blepharitis, ophthalmitis and conjunctivitis required immediate treatment to relieve pain or discomfort. In the case of one participant with a corneal ulcer and another with blepharitis, the treatment that had been initiated was ineffective prior to the correct identification of the condition by the orthoptist.

Table 6: Ocular diseases / pathology detected in participants

Disease / pathology	All inpatient staff	Orthoptists
Glaucoma	7	15
Corneal ulcer		2
Diabetic retinopathy		2
Hypertension		1
Cataract	1	11
Ophthalmitis		2
Dry eye	3	10
Corneal opacity	1	2
Blepharitis		1

Disease / pathology	All inpatient staff	Orthoptists
Thrombosis		1
Macular Degeneration (MD)	2	5
Retinal detachment		2
Melanoma		1
Conjunctivitis	1	1
Total	14	56

Orthoptists enabled the identification of 15 participants with glaucoma; inpatient staff identified less than half (7) of these participants.

Dry eye is another condition where ongoing treatment is important to prevent the development of secondary eye conditions such as corneal ulcers with the potential for corneal scarring and loss of visual acuity. Ten participants with the condition were identified by the orthoptists whilst the inpatient staff identified three, less than a third.

5.1.4 Ocular medications

A summary of the medications being used by the participants is presented in Table 7. 64% of the users of ocular medication were identified only by the orthoptists. This includes medications such as drops, particularly in the treatment of the pre-existing conditions of glaucoma and dry eyes.

Table 7: Ocular medications identified by staff

Medications	All inpatient staff	Orthoptists
Glaucoma	5	14
Antibiotics	3	2
Dry eye medication	4	16
Steroids	-	1
Total	12	33

5.1.5 Visual Acuity

Table 8 summarizes the visual acuity results for all participants.

The orthoptist provided quantitative results for the distance acuity of 143 of the participants and near acuity for 134 of the participants. The failure to gain a response from all participants was due to poor cooperation at the time of the test. The inpatient staff used numerical visual acuity tests for only 5 patients and identified two of the 34 participants with decreased distance acuity (6%) and three out of 109 (3%) with good vision. As well, they noted 36 participants to have good vision or to be blind but numeric visual acuity tests were not undertaken for these patients.

The orthoptists identified that 34 (24%) of the participants had a distance acuity response that placed them in the category of visually impaired (6/12 or worse) and 34 (24%) participants also had the same standard for near vision (less than N8) which also places them in the category of visual impairment.

Table 8: Visual acuity results for distance and near

Quantitative results for distance

Visual acuity response in best eye	All inpatient staff	Orthoptists
Distance 6/12 or better	3	109
Distance 6/12 -1 or worse	2	34

Descriptive results for distance

Described vision	36	-
Unable to test	2	7
Not recorded	107	-

Visual acuity results for near

Near N8 or better		100
Near less than N8		34
Unable to test		6
Not recorded	130	-

Documentation of visual acuity by inpatient staff is low – 71% of participants did not have it recorded for distance and 87% for near acuity. This may reflect skill levels of inpatient staff as well as lack of testing equipment.

5.1.6 Pupillary responses

Table 9 summarizes the outcome for testing of pupillary function. The detection rate for both groups was similar with the majority of participants having a normal response.

The orthoptist identified 13 patients with Horner's syndrome,12 more than the inpatient staff detected.

Table 9: Pupillary Responses

Pupil test response	All inpatient staff	Orthoptist
Normal	85	94
1 dilated	5	1
Horner's Syndrome	1	13
Both dilated	2	-
Sluggish response	3	-
RAPD	1	-
Other	3	1
Nil recorded	50	41

Pupil test response was not recorded by inpatient staff for a third of participants (33%) and by the orthoptist for 27% of participants. Testing of pupillary function is part of a basic neurological assessment, it is therefore of concern that this test may not have been undertaken. Any discrepancy in responses may be due to the

timing of assessment i.e. in some cases the response may have returned to normal before the orthoptist assessed the patient.

5.1.7 Visual Field Defect

Table 10 shows the type of defect detected in the participants. There is agreement about the detection of hemianopias and quadrantanopias but the orthoptists detected 11 in the “other” category which included visual field restriction, decreased awareness of multiple test stimuli in one area and a plottable scotoma. Again the orthoptists detected ocular conditions that required additional follow up such as prescription of glaucoma medication, assessments for eligibility to continue to drive and referral to agencies for additional support.

Table 10: Visual Field Defects

Test outcomes	All inpatient staff	Orthoptists
Hemianopia	15	12
Quadrantanopia	5	7
Other	-	11
No defect	39	103
Not recorded	84	9
Not specific	3	3
Unable to determine	4	5
Total	150	150

Visual field defects were not recorded by inpatient staff for 56% of participants.

5.1.8 Visual Neglect

In this study the inpatient staff identified 15 patients with visual inattention or neglect whilst the orthoptists identified 8 patients with neglect - almost 50% less. The difference in the numbers reported could be related to difficulty identifying neglect in the presence of peripheral vision and the fact that there was a time lapse between test procedures conducted by the two groups which allowed for recovery from the neglect to occur.

5.1.9 Ocular posture

This relates to the position of the eyes within the orbits and is specific to the detection of strabismus (turned eye).The deviation may be constant, intermittent or latent. All forms can be associated with disturbed binocular vision and loss of depth perception with symptoms such as diplopia, blurred vision, headaches and general ocular discomfort.

Table 11 reveals that the orthoptists recorded 16 times more defects than the inpatient staff who only noted vertical deviations. Orthoptists found that 15 of the participants had a constant strabismus, ten had an intermittent strabismus and two had a combination of horizontal and vertical deviations. 16 of the 65 participants found to have a deviation had diplopia confirming that strabismus is not always linked to symptoms.

Table 11: Ocular Posture Deviations

Deviation	All inpatient staff	Orthoptists
Esotropia (convergent strabismus)		3
Exotropia (divergent strabismus)		12
Intermittent esotropia		8
Intermittent exotropia		2
Vertical strabismus	3	-
Heterophoria (latent strabismus)		38
Combination horizontal & vertical deviation	1	2
Total	4	65

5.1.10 Eye movements

The distribution of eye movement defects can be seen in Table 12. It includes specific ocular motor cranial nerve palsies, eye muscles patterns (A& V) ocular motor system defects (saccadic defects; pursuit defects, gaze palsies) and nystagmus. Eye movement problems may be incorrectly interpreted as inattention or neglect and result in inappropriate management.

The identification of eye movement disorders by the two groups shows that the orthoptists recorded more saccadic defects and nystagmus. The difference may be related to more attention being paid by the orthoptists to reporting minor defects of eye movement function. However subtle defects can cause stress to patients and decrease their co-operation.

Table 12: Eye Movement Defects

Eye movement defects	All inpatient staff	Orthoptists
Nystagmus	10	19
A & V patterns	-	5
Cranial nerve III	1	-
Cranial nerve IV	3	2
Cranial nerve VI	2	2
Saccadic defect	1	18
Pursuit defect	2	7
Combination saccadic & pursuit defect	1	2
Gaze palsy	8	4
Total	28	59

5.1.11 Convergence

This skill was only tested by the orthoptists. There were 61 participants who had decreased convergence which was further from the eyes than 6 cms (normal) and

14 participants had convergences that were10 cms or worse. Thus 75 of the participants had the potential to experience disturbed binocular vision, particularly the 14 who had a more remote convergence standard.

5.1.12 Facial Palsy & Lid Defects

Table 13 shows the inpatient staff identified more participants with facial problems such as a face droop, whilst the othoptists, with attention to preventing dry eye / cornea problems, classified participants into upper motor neurone palsies and VII nerve palsies. Based on the orthoptic results 12 participants (11 VII nerve palsies and one with poor lid closure) required follow up. This is similar to 13 requiring follow up in the same categories identified by the inpatient staff.

Table13: Defects of Facial Function

Defect	All inpatient staff	Orthoptists
Face droop	35	4
UMN VII	3	17
LMN VII / Bells palsy	5	11
Poor lid closure	8	1
Total	51	33

Table 14 shows that only the orthoptists identified participants with ectropion which suggests that the inpatient staff may be unaware of the impact on the patient and of the need to refer to an ophthalmologist for management.

Table 14: Defects of Lid Function

Lid defects	All inpatient staff	Orthoptists
Ptosis	5	3
Cannot close lid	2	4
Ectropion	-	5
proptosis	1	2
Total	8	14

5.2 INTERVENTION

Interventions for the 150 participants in the study were recommended by both the inpatient staff and the orthoptists. Table 15 outlines the type of intervention and frequency by either group. The interventions include feedback about the ocular conditions present (both as a consequence of the stroke or pre-existing); orthoptic management; optical care; ocular medication and referral for ophthalmic management.

Table 15: Summary of interventions

Interventions	All inpatient staff	Orthoptists
Feedback on Ocular Findings	Unknown	150
Orthoptic Intervention	Nil	30
Optical Care	4	33
Ocular Medication	16	23
Referral	20	108

5.2.1 Feedback on Ocular Findings

Feedback on ocular findings by inpatient staff was not consistently noted in the medical record and therefore it is not included in this report. The orthoptist however provided feedback to all patients in each of the three settings.

The feedback took several forms:

- Written report in the patient's medical record - all patients seen by the orthoptist had a report included in their medical record. This provided information about the visual acuity level, and any ocular problems present which were pre-existing and/or acquired. The report also included recommendations for staff about the specific ocular needs of the patient e.g. need for spectacles and their most appropriate use, variation in the form of spectacles, existence of field loss, presence of diplopia and strategies to assist management.

(It should be noted that the feedback that was recorded in the medical record from the hospital in SD3 where the orthoptic service has been operating for several years had more attention to remediation. For example the provision of a notice above the bed stating that the patient could not see; neglect training; hemianopia training; convergence training. This suggested that ongoing orthoptic services would lead to a greater range of interventions including therapeutic strategies. Medical records from SD1 and SD2 showed that referral was more frequent than therapy and any therapeutic strategies were delegated to other staff.)

- Verbal report to staff – this was provided directly to staff responsible for the care of the patient or during case conferences. It included the need for and urgency of referral to other health care professionals, how to attend to ocular toilet in cases of blepharitis; the impact of the visual standard on mobilization and vision based tasks; future support services following discharge e.g. to Vision Australia, Centrelink for a Vision Pension.
- Explanation to patient and /or relatives about existing ocular status and / or new ocular status of the patient to assist their care and management. Matters needing explanation included mobility at home and in new environments; the need to follow up with outside organizations such as Vision Australia where the patient had low vision or the Roads & Traffic Authority (RTA) where the vision standard meant that a driving license had to be cancelled.
- Recommendations to relatives about follow up to ensure that the patient would be assisted to manage with their vision level. Recommendations

covered the need to follow up with their ophthalmologist or optometrist or be newly assessed by an ophthalmologist; the need to cancel the driver's license when vision standards had not been met.

Feedback was extensive and provided information to all health care staff as well as the patient and the relatives.

5.2.2 Orthoptic Intervention

In addition to the general assessment of ocular function, orthoptists provided specialized vision tests and advice (8 interventions regarding driver's license requirements - items 2 & 3 in Table 16), and a therapeutic and a rehabilitation role. The therapy assisted in the restoration and strengthening of binocular function, as well as eye movements through participant self-directed exercise and regular clinical treatment (11 participants – Table 16 items 4, 5 &6). The rehabilitation included adopting actions that maximized the existing vision (6 participants – Table 16 items 7 and 8) and brought about ocular comfort (5 participants – Table 16 item 1). These interventions are most effective with weekly review for progress.

Table 16: Orthoptic Interventions

Orthoptic Interventions	No. Patients	SD Model
1. Occlusion/ tape lid closed for Diplopia /dry eye management	5	all
2. Visual field measurement – to test if driving requirement has been met	5	all
3. Driver standard management	3	all
4. Treatment to improve convergence	3	all
5. Treatment to improve scanning in the presence of visual field loss	5	SD3
6. Treatment to improve scanning for visual neglect	3	SD3
7. Recommendations for visual impairment care – large print, magnifying lens	1	all
8. Advice re low vision adaptations (use of head posture) and ocular comfort	5	all
Total	30	

In Table 16 there are 30 orthoptic interventions identified, all of which supported participant comfort and progress with rehabilitation.

The largest number of participants (11) for whom orthoptic interventions were recommended (items 4, 5 & 6), had therapy tailored to meet their specific needs. In the case of convergence, training is only undertaken by an orthoptist. Most of the participants who undertook the therapy were at SD3 where the orthoptist is a regular member of staff. This enabled design and supervision of the therapy sessions, provision of rapid feedback and modification of interventions to meet the participant's needs.

At SD1 and SD2, following orthoptic diagnosis and recommendation of a treatment regime, the participants were supervised by other allied health

practitioners e.g. the physiotherapists. In this situation the impact of the therapy and need to modify the actions was not monitored by an orthoptist.

The 'driver tests' measurements were undertaken in the stroke unit and then participants referred for further follow up. The low vision management was supervised at SD3 and at the other locations recommendations were made with a follow up referral to appropriate agencies following discharge.

5.2.3 Optical Care

Optical care included all actions that changed or modified the use of spectacles for the patient, namely identifying the specific need for spectacles because acuity was decreased when the spectacles were not worn or left at home; identifying the problems associated with the form of the spectacles available (bifocals versus single focus lenses); and fitting temporary prisms to correct the diplopia.

Table 17 shows that the optical requirements were identified in 33 of the 150 participants i.e. 22% required some form of optical management. This was identified more frequently by the orthoptists (33 times) than the other health professionals (4 times).There were 7 reasons the inpatient staff noted when glasses were not worn or needed changing; either because glasses were left at home and/or because the patient identified that he/she could not see clearly. The orthoptist identified the optical correction and related its role to other ocular conditions that were present. This included identifying the impact of lenses on visual acuity, identifying the reasons for blurred vision during specific activities and providing relief from diplopia by fitting temporary prisms onto existing spectacles.

Table 17: Optical Care

Optical Care	No. identified by inpatient staff	No. identified by orthoptists
Identifying that spectacles had been prescribed, that vision would benefit from their use but were at home	2	13
The application of a temporary prism to blend the diplopic images into one and restore comfortable use of the eyes together	-	3
Recommending separate forms of spectacles near & distance		2
Educating a patient on how to use / wear spectacles	1	4
Recommending new spectacles or reviewing spectacles	1	11
Total	4	33

5.2.4 Ocular Medication

Interventions for ocular medication were in two forms: prescription of drugs for recent onset ocular conditions i.e. new medication; and identification that there should be continued use of previous medication to manage existing eye disease.

Table 18 shows that the identification of the need for new medication was similar in both staff groups. Orthoptists identified the need for continued use of ocular medication, usually for glaucoma management, in 50% more cases than inpatient staff. In four cases the medications were added to the medical record chart to

ensure that they were regularly used to enable the ongoing management of chronic conditions (glaucoma and dry eyes).

Table 18: Use of prescription of ocular medication

Ocular Medication	All inpatient staff	Orthoptists
New drugs prescribed / requested	7	5
Existing drugs need identified and charted	9	18
Total	16	23

5.2.5 Referral Pattern

Following assessment participants were referred for the following reasons:

- *Specialist ophthalmic investigation*: participants were referred to the ophthalmologist for management of medical eye conditions (glaucoma, sudden loss of vision, dry eye, cataract, corneal ulcers, and investigation of proptosis). It should be noted that two participants were referred urgently by the orthoptist for the management of a corneal ulcer.
- *Prescription of spectacles*: referral to the ophthalmologist and optometrist for renewal of spectacles.
- *Orthoptic treatment*: referral to the orthoptist is outlined in section 5.2.2 Orthoptic Intervention. Follow up orthoptic reviews included review of prisms in the spectacles or orthoptic treatment e.g. for decreased binocular function, and to compensate for peripheral vision loss and neglect.
- *Community Support Organisations*: this category included referral to Vision Australia (previously Royal Blind Society) for support and management of severe vision impairment and to Guide Dogs NSW to assist mobility.
- *Other groups*: RTA for change of license status in the presence of vision defects such as acuity less than 6/12, visual field loss (hemianopia, quadrantanopia) and diplopia and the Social Worker for support to manage in the presence of marked vision impairment.

Table 19: Summary of referral patterns

Referral To	All inpatient staff	Orthoptists
Ophthalmologist	12	68
Orthoptist	2	20
Optometrist	4	10
Other	1	6
Combination of Health Care Professionals & Groups	1	4
Nil	130	42

The ophthalmologist was the eye professional to whom most referrals were made by both groups suggesting the presence of ocular conditions that required medical care. 45% of all orthoptist referrals were to the ophthalmologist for the management of ocular conditions. This demonstrates the orthoptists' skills

enabled them to identify ocular conditions during the early stages of patient recovery from the stroke with consequent early and appropriate referral for care.

Two participants were referred by the inpatient staff to the orthoptist in SD2 where the staff identified that the participant could be assisted by the expertise of the orthoptist.

5.3 COMPARISON OF THREE SERVICE DELIVERY MODELS

In order to address the third aim of the project, to determine whether different service delivery models influenced patient care, two issues were considered across the three different hospitals/ service delivery models:

- the outcome for the detection of ocular conditions
- Intervention following detection.

As noted in Table 1 the models were:

(i) Service Delivery Model 1 (SD1) - access to an outpatient eye clinic and/ or an orthoptic clinic but no specific ocular assessment in the inpatient stroke unit

(ii) Service Delivery Model 2 (SD2) - no ophthalmology services in either an outpatient eye clinic or in the inpatient stroke unit

(iii) Service Delivery Model 3 (SD3) – an ocular assessment by an orthoptist in the inpatient stroke unit with access to refer to the outpatient eye clinic.

5.3.1 Detection of Ocular Defects

During the project fifty participants were assessed in each model. Statistical analysis of the proportion of cases seen in each model showed that the three models did not differ from each other in terms of the proportion of cases identified by the orthoptists to have vision defects, although a lower total number of participants were identified in model SD2.

Of the cases identified by someone, in SD1, 97% were identified by the orthoptist (95% CI = 90% to 100%). In SD2, 93% of cases were identified by the orthoptist (95% CI 86% to 100%). In SD3, 100% of cases were identified by the orthoptist (95% CI = 93% to 100%).

The results were analyzed to determine the effectiveness of detection of ocular defects for the conventional operation of each model. Thus SD1 and SD2 included only the results found by the inpatient staff and SD3 used the results found by the orthoptist. The outcome showed that the reporting of vision defects was greater for SD3 than either of the other models ($p<0.001$). It also showed that SD1 and SD 2 were found to have similar outcomes in spite of SD1 having greater access to eye care with an eye clinic operating at the outpatients department.

These results address the first aim and confirm that assessment by an orthoptist does provide more information about the presence of ocular conditions in stroke patients than other models of care where there is no assessment of ocular function in the inpatient setting.

5.3.2 Interventions

In this study feedback, orthoptic intervention, advice about optical care and follow up referral for ocular conditions were available in the stroke unit for each of the service delivery models. This meant that participants' responses were monitored and ocular interventions quickly implemented.

For models SD1 and SD3 where an outpatient eye clinic was available, referral was easy. The report from the orthoptist assisted referral as the condition was known and the participant could be organized for the most appropriate clinic. For SD2 where there was no eye clinic in the hospital, referral had to be to private practitioners outside the hospital. This usually meant that the consultation would not occur until after discharge of the patient from the hospital. Consequently any untreated eye condition would be left for some time as the median length of inpatient stay for stroke patients in an inpatient stroke unit is nine days [15].

Under normal operation across the models only SD3 has an orthoptist who assesses the participants in an inpatient setting and ensures appropriate interventions.

SD1 has access to an outpatient eye clinic in the hospital, however analysis showed that, despite this access, the number of ocular defects was similar to the site where no eye clinic exists (SD2). This would suggest that other health care professionals with limited experience in the detection and management of ocular conditions in both SD1 and SD2 were not identifying the need for onward referral.

Under normal operation patients in designated inpatient stroke units without access to a detailed ocular assessment i.e. SD 1 and SD2, have limited or no access to eye care.

5.4 FEEDBACK FROM INPATIENT STAFF

A survey of inpatient staff was not undertaken. However, anecdotal evidence suggests that the orthoptic service that was delivered as part of the project was valued by staff. At the two hospitals (SD1 and SD2) where the detailed ocular assessment of stroke patients was undertaken for the first time, inpatient staff:

- Were highly impressed by the information that was provided. Both sites have questioned how the services of an orthoptist could be established on a regular basis.
- Saw an advantage to having orthoptic input by identifying patients who staff felt had an ocular problem and seeking orthoptic assessment and feed back.
- Reported a need for education of the Stroke Team about the skills of the orthoptist to retrieve vision information from patients.
- Sought guidance about differential diagnosis of eye conditions e.g. field loss versus visual neglect, normal eye movements versus a IV cranial nerve palsy.
- Acted on the orthoptist's findings to appropriately refer participants that required urgent ophthalmological management. For example one had an untreated corneal ulcer and another had blepharitis.

- Were able to gain advice about the ability of a participant to continue driving.

The responses that were given were unsolicited and positive. A full evaluation would need to be conducted to gain accurate information about the value to staff of an orthoptic service in an inpatient stroke unit.

6 DISCUSSION

The primary focus of inpatient stroke unit staff is the survival and care of each patient in their recovery from the vascular event. The ocular status is not a priority until the patient is stabilized, unless the ocular defect is associated with the stroke and its diagnosis. Conventional assessment of ocular function is not performed so knowledge of pre-existing eye conditions and their impact on the patient is largely unknown by non-ophthalmic staff.

The study examines the value of detailed ocular assessment by an orthoptist for inpatients who have been diagnosed with a stroke through the identification of ocular conditions (visual defects), and frequency and type of intervention undertaken across three different service delivery models currently in operation.

6.1 Ocular Conditions

The results for a total 150 participants across all three service delivery models revealed that 86% of the participants had an ocular condition that affected their function in some way. Further, the orthoptists as specialized eye health professionals disclosed considerably more information about the ocular status of the participants than the inpatient staff (Table 20). Except for convergence, inpatient staff tested for all conditions to varying extents.

The orthoptists revealed:

- A greater range and a greater number of participants with ocular symptoms, some of which caused discomfort and also indicated the potential for other ocular diseases (82% of cases observed only by orthoptists.)
- More information about the existence of ocular diseases such as glaucoma and dry eyes through symptoms, a thorough ocular history including medication in the form of drops and in-depth assessment of visual fields.
- Greater information about the need for spectacles, the benefit of spectacles for acuity and the ability of the individual participant to capitalize on the appropriate use of spectacles to improve safety and mobility.
- Accurate measurement of visual acuity to provide knowledge of actual visual skills and differentiate co-operation problems due to acuity loss rather than cognitive factors.
- A more accurate differential diagnosis of ocular conditions from complex neurological conditions such as visual neglect and field loss; true lid closure problems from facial palsy or droop; and correct pupillary defects such as identification of Horner's syndrome versus a dilated pupil in the unaffected eye.

Table 20: Ocular Conditions - Comparison of Detection Rates

Visual Condition	IP Staff		Orthoptist		% Var.
	N	%	n	%	
Ocular symptoms	11	18	60	100	82
Information about spectacles	3	3	114	100	97
Existence of Ocular disease	14	25	56	100	75
Ocular medication	12	36	33	100	64
Visual Acuity – 6/12 or better	3	3	109	100	97
Visual Acuity – 6/12 or worse	2	6	34	100	94
Non-neurological field defects	3	21	14	100	79
Ocular posture and eye movements	32	25	124	100	75
Convergence	0	0	61	100	100
Lid function	8	57	14	100	43

It is assumed that the orthoptists identified 100% of the participants that had each condition. Although it was not the aim of this study to measure the impact of failure to detect ocular defects, several conditions had the potential to impact on the participant. The impact included the general well being of the participants, co-operation in the ward situation, ability to perform test procedures, safety with mobility and potential for falls. Affected patients could be exposed to delay in progressing to and through rehabilitation.

The ocular symptoms, for instance, are associated with discomfort and lead to difficulty in performing tasks e.g. diplopia, visual disturbances, blurred vision and dry eyes (section 5.1.1). The visual acuity, when less that 6/12 can impact on the ability of a patient to respond to detailed activities (section 5.1.5). Inappropriate or absent spectacles can lead to decreased vision which can affect the performance of tasks (section 5.1.2).The existence of undetected ocular disease can result in discomfort or lead to progression of vision loss (section 5.1.3)

The major symptoms were diplopia and blurred vision, both of which can make daily living activities very difficult and are reported to cause concern in the patient that another stroke is possible [3]. Diplopia, by presenting two images of an object, makes it difficult for a patient to orientate themselves to the environment, to get out of bed and walk safely without bumping into things, and to manage changes in level or steps. Blurred vision results in indistinct images being perceived which can cause affected patients to fail to respond to tasks including clinical tests, filling in forms and safe mobilisation.

Visual disturbances that were detected included halos, spots before the eyes and words spinning; all of which cause problems for the participant and therefore impact on their ability to co-operate. Participants expressed concern that these disturbances had the potential to lead to loss of sight.

The use of and /or need for spectacles impacts on the ability of the patient to see and respond to inpatient staff and to undertake the tests and rehabilitation activities. The orthoptists provided guidance about the range of clear vision

available to each participant e.g. people who wear bifocals and multi-focals only have clear vision for near when the eyes look down. Often this area is small and restricted to the lower segment of the lens. Participants, who had had a stroke and were required to see test procedures involving details in the near position, were advised to either move the test to a lower position, adjust the spectacles to enable the information to be seen or get single focus lenses. When walking, participants were advised to look through the top segment of the spectacles so that images were clear and to reduce the risk of falling[7].

The orthoptist was able to specifically question the use of ocular medications including eye drops which are thought by many patients to not be classified as a medication.

Testing for visual field defect is part of a basic neurological assessment and it is therefore of concern that this may not have been undertaken by inpatient staff in over half of the participants (56%) (Section 5.1.7, Table 10).

In this study the inpatient staff identified 15 participants with visual inattention or neglect whilst the orthoptists identified eight participants with neglect - almost 50% less. The reason for the difference could be related to problems differentiating neglect from field loss or spontaneous recovery. As the orthoptic assessment was undertaken after the inpatient staff assessment, and in some instances weeks after admission and the stroke occurrence, spontaneous recovery could account for the decreased incidence of the neglect. However there is a strong possibility that accuracy in detection accounted for the difference. The need for accurate assessment is important and requires appropriate expertise by an orthoptist.

Specialized knowledge of patient responses in the presence of abnormal ocular function and the range of existing ocular management strategies available enabled the orthoptists to retrieve information from several sources to identify the presence of significant eye conditions.

For instance:

- Ocular symptoms such as
    - Sore eyes and the correct identification of use of ocular medication identified the presence of dry eyes which required ongoing treatment to restore comfort and prevent the development of complications occurring such as corneal ulcers.
    - Diplopia related to ocular posture defects, eye movement defects and convergence problems required identification of the reason for the diplopia and implementation of strategies to produce single vision (prisms, appropriate occlusion and use of spectacles to assist best use of the eyes to gain single vision).
- Visual acuity measurements and a report that a participants was unable to see enabled correct spectacles to be used, the identification of retinal problems and referral to the most appropriate specialist or group for assistance.
- A lack of understanding of spectacles in their various forms combined with ocular posture and eye movement defects resulted in patient discomfort and problems coping with rehabilitation.

The identification by orthoptists of significantly more ocular conditions in participants than documented by inpatient staff raises the need for increased awareness by inpatient stroke unit staff of ocular problems. As many of the ocular problems were present prior to the stroke (e.g. glaucoma, dry eyes, ocular posture defects) or have been complicated by the consequences of the stroke (eye movement defects and spectacles that are incompatible) a detailed ocular history including past eye care needs to be taken. Further ocular assessments can be recommended if required.

Lack of information about the patient's visual acuity and the type and availability of spectacles in study participants, given that the mean age of the group was 73 years, is also a concern. Some form of visual impairment would be expected in this age group and therefore should be considered in their management.

In two areas the orthoptist and inpatient staff detected a similar number of ocular conditions (Table 21).

Table 21: Specific conditions - Comparison of Detection Rates

Visual condition	Inpatient staff	Orthoptists
Neurological field loss	20	19
Pupil assessment	16	15
Facial function	51	33

These areas were the detection of neurological field loss and pupil assessment. The detection of neurological field loss relates to the stroke process and its detection is therefore important to the neurologist.

The orthoptist assesses the pupil for visual conditions. Pupil assessment whilst almost equally detected had a difference in the breakdown of conditions. The orthoptist identified more patients with Horner's syndrome whilst the inpatient staff identified a range of conditions. The variation in result is unexplained.

One response which was reported more frequently by the inpatient staff was facial function. The inpatient staff reported a greater number of general face droop whilst the orthoptists identified a range of specific facial functions. Again the variation in findings is unexplained and may be related to the two groups undertaking a more in-depth examination of subtle functions because of the significance in the management of the vision or the neurological conditions.

The study has also highlighted poor documentation by inpatient staff. This is of particular concern in the case of testing for pupil response and visual field defects which are part of a basic neurological assessment which would be undertaken for all stroke patients. It is assumed that if the result is not documented then the assessment was not undertaken.

It is not possible to identify whether poor detection rates highlight poor documentation or reflect incomplete assessment. It is also not possible to identify whether the lack of assessment was due to lack of skills.

6.2 Intervention

The ocular interventions across all 150 patients showed that a greater number were implemented by the orthoptists than the inpatient staff (Table 15). This

particularly related to optical care, orthoptic interventions and referral for further follow up.

The optical and ocular medication interventions were directed at improved vision function (spectacles and ocular drops) and patient comfort (ocular drops for dry eyes, prisms for diplopia management) to enable continued good vision plus comfort and co-operation in the rehabilitation process. The orthoptist identified more patients in need of modification to spectacles and were more likely to identify the need for continued use of ocular medication.

The continued use of medication for treatment of eye diseases is important to prevent progression of the diseases with associated long term vision loss and short term discomfort. The input from the orthoptist helped to ensure identification of medication and best management of eye diseases.

The orthoptic interventions were directed at specialized testing, therapy and rehabilitation. Each of these interventions addressed a particular problem (diplopia, scanning defect) experienced by the patient that if allowed to continue would have slowed the response to other treatment and recovery.

Some interventions (e.g. lid taping for diplopia) may have been undertaken by the inpatient staff. Experience however has shown that such occlusion is often organized for the wrong eye with poor patient outcomes linked to proprioceptive and depth-judgment problems, and consequent errors in locating objects and problems with mobility. The presence of the orthoptist enabled both appropriate and more rapid management of the conditions.

All referrals were for vision care and included specialist ophthalmic care (ophthalmologist, orthoptist & optometrist), and agency care (Vision Australia, RTA). 45% of all patients were referred by orthoptists to the ophthalmologist for the management of ocular conditions.

The specialized knowledge of the orthoptist led to the provision of effective, efficient and timely management of ocular conditions in the patient recovering from stroke. Many of the interventions could not be conducted without the input from an orthoptist.

Written feedback in the medical record and verbal communication with inpatient staff, patients and relatives by the orthoptists were comprehensive. Inpatient staff feedback was not surveyed therefore the extent to which vision information is relayed to participants and their relatives is unknown.

The orthoptist however provided feedback to all participants in each of the service delivery models. The Clinical Guidelines for Acute Stroke Management [13] recommend weekly multidisciplinary team meetings, family meetings and that information and education be provided to stroke survivors and their family. Inpatient staff may give feedback in these forums however this information was not collected as part of the study.

6.3 Service Delivery Models and Eye Care

The evaluation of the three models of stroke care revealed that:

- SD1, in which there was access to outpatient eye care (ophthalmic & orthoptic) but no inpatient eye care, and SD2, in which there was no

hospital eye care service available, produced similar rate of detection of eye defects.

- SD3, in which an orthoptist conducted a detailed ocular assessment in the stroke unit, with an outpatient eye clinic, clearly showed a greater detection of eye conditions and need for intervention.

This result suggests that SD3 which equates to the use of orthoptic services provides increased knowledge about the existence of ocular conditions. As well the need for intervention to support the patient and health team to understand more about the visual comfort of the participant is identified. Because of the regular attendance of the orthoptist on the ward, the capacity to initiate treatment and monitor visual interventions such as prisms, hemianopia and visual neglect training is available.

It also suggests that the ability to refer to an outpatient eye clinic (SD1) and therefore have some feedback about eye conditions has little effect on the detection of vision defects in the inpatient setting.

SD1 & 2 relied on inpatient staff for ocular assessment which was not always undertaken or documented and equates to no orthoptic service.

Interventions were recommended at some level in all three service delivery models. The inpatient staff interventions included optical care, ocular medication and referral. The orthoptists also recommended interventions in these areas but to a more detailed level, particularly in the area of referral. The orthoptists provided substantial feedback to staff, patients and relatives plus orthoptic care.

In SD3 described above, the orthoptic interventions showed a subtle change towards a more therapeutic mode of intervention. The regular orthoptist on the ward also undertook the data collection in SD3 as part of her normal role which accounted for the change noted above. In SD1 & 2, the orthoptist did not intervene in the participant's care.

A number of eye conditions were undetected without an orthoptist on the ward (table 22). Consequently interventions were not undertaken.

Table 22: Undetected Visual Status, Eye Conditions & Interventions Not Undertaken

Undetected Eye Conditions	**No**	**%**
Patients with undetected ocular symptoms	49	33
Visual acuity not known	143	95
Visual acuity not known with visual impairment	32	21
Use of spectacles not known	122	81
No follow up about spectacles	11	7
Ocular disease not detected	41	27
Follow up about medical care for eye conditions would not have occurred	7	5
Use of ocular medication was not detected	21	14
Ocular deviation not detected	23	15

Undetected Eye Conditions	No	%
Orthoptic interventions not given	30	20
Referral for eye care not undertaken	88	59

The number of participants identified with undetected ocular conditions further highlights that an orthoptic assessment provides increased detection and intervention for patients. Many of these eye conditions had the potential to affect patient safety. Of particular note are the 32 participants with visual impairment and the 122 participants where use of spectacles was not known. Whilst this study did not evaluate any link to falls, many of these participants were in the age group at risk of falling. Identification of the problem and provision of ocular care can only enhance patient safety.

7 SUMMARY AND RECOMMENDATIONS

The study evaluated three different service delivery models to determine whether patients diagnosed with a stroke and admitted to a designated stroke unit had equitable access to eye care. Two of the three service delivery models, SD1 and SD2, provided no or limited access to eye care, either in stroke care units or in an outpatient setting.

In summary the study disclosed that at the time of the assessment 129 (86%) of the participants had at least one ocular condition that caused a decrease in vision response or function; 22% of patients required some form of optical care; and 20% of patients required orthoptic intervention. Whilst both groups identified the need for new medication, the continued use of medication was more frequently identified by the orthoptist.

It has been clearly demonstrated that the presence of an orthoptist in the inpatient stroke unit enables greater detection of eye conditions, increased intervention and increased understanding of eye functions. If stroke-affected patients are to be assisted with good eye care the inclusion of an orthoptist will achieve this goal. Only SD 3 provided access to stroke unit based eye care.

The data suggest that SD3 also enhanced staff/patient and relative feedback and facilitated appropriate onward referral. The study did not specifically collect data about inpatient staff feedback to patients and relatives.

Analysis of assessment and intervention across the three service delivery models has identified a preferred way to deliver eye care for patients in stroke units.

In order to improve eye care for patients recovering from stroke it is **recommended** that:

- Increased attention is paid to the detection of ocular conditions, both pre-existing and acquired, as part of the acute stroke management process
- Ocular findings are managed with treatment or onward referral
- Documentation is provided for each patient of ocular conditions that arise from either an ophthalmic or neurological cause

- Communication of ocular status to staff, patients and relatives is undertaken

This could be **achieved** in several ways:

- Provide the services of an orthoptist to undertake detailed ocular assessment and intervention in inpatient stroke units. The study indicates that this is the most effective method for ensuring adequate vision care
- Provide education to enhance ocular awareness of inpatient stroke unit staff about the importance of ocular assessment and intervention
- Provide education to enhance the ocular assessment and intervention skills of inpatient stroke unit staff
- Develop standard eye assessment tools for inclusion in the Acute Stroke Care Clinical Guidelines, use in the stroke unit and in the patient medical record
- In the absence of orthoptic services refer to other eye care medical professionals for a detailed ocular assessment

8 APPENDIX 1: DATA COLLECTION FORM

STROKE STUDY	**Patient Study Number:**					**Date:**		
DOB: / /		**AGE:**			**Sex: □ F**	**□ M**		
Assessment Performed:	**□ Bedside**		**□ Clinic Room**					
Patient Responsiveness:				**GCS:**	**Date:**			
Driver license:	**YES □**	**NO □**	**Drive:**	**YES □**	**NO □**			
Admitting vascular episode, date:								
Form:	**TIA**	**CVA**	**Stenosis**	**Other**				
Site of Lesion:								
Previous vascular episode(s):	**Date:**	**Form:**	**TIA**	**CVA**	**Stenosis**	**Other**	**Site of Lesion**	

	Date:	Form:	TIA	CVA	Stenosis	Other	Site of Lesion	
	Date:	Form:	TIA	CVA	Stenosis	Other	Site of Lesion	

Pt No	Neuro-rad	Ocular History	Med'n Ocular	Glasses	Dist VA	Near VA	Pupils	EOMs	Ocular Deviation in PP	CNP	Visual Field Loss	Visual Neglect	Nystag-mus	Facial Palsy
Pre Orthoptist	□M □ CT □ A	□ Triage Nurse □ I □ R □ S												
Orthoptist	**General Health** ♥	□ Nil symptoms	□ Nil □	□ Nil □ N	□ cgls	**BEO** □ cgls	**R L** D	□ NAD Pattern **A V X**	□ Ortho □ vert	□ Full	□ NAD **Test** □ CF	□ Nil SBPT	□ Nil □ PP	□ Nil □ UM

OBS:	**Meds:**	on day of assessment □ Symptoms in record	Glaucoma □ Dry □ AB □ Steroids	□ D □ B □ M □ left at home	□ sgls **R** ph **L** ph	□ sgls **N**	C N RAPD □ Nil	**Y** □ Eso □ Exo **Saccades** □ Horiz □ Vert □ Unable □ U/shoot □ O/shoot □ Hypo **Pursuits** □ Smooth □ Jerky	□ EP □ XP □ INT R L □ □ □ XT □ ET □ vert	□ <6cms □>6 cms	□ Bj **Loss** □ R □ L □ Hem □ Qua □Comp □ In □ Macspar □ Macsplit □ Fix	□ R □ L Other Tests	□ Gaze evoked □ Upbeat □ Downbeat □ Fastphase Right □ Fastphase Left	□ LM □ NAD □ Lid closure
Key: T=Test O=Not Tested X=Wrong C=Correct/Concur +=Additional Item -=Missed Item M=MRI CT=CAT Scan A=Angiogram XR=XRay I=Intern S=Specialist R=Registrar N = Nurse														
OCULAR DIAGNOSES	□ Normal													

	□ Otherwise :_____ _____ _____ _____
MR (pre orthoptist)	
- **Orthoptist**	

INTERVENTION **ACTION SUMMARY**	Satisfies vision requirements □ NO → Refer to eye clinic Suggest check- up with specialist on discharge □ Satisfies Visual fields □ NO -> Refer for Goldmann VF Satisfies Ocular Motility □ NO -> Notes for Rehab staff Satisfactory Ophthalmic APPEARANCE □ NO → Refer to eye clinic
- **MR (pre orthoptist)**	□ N/A □ **Optical** Gls Prisms Details: □ **Ocular Drugs** New Existing Details: □ **Referral** Ophthalmologist Optometrist Details: Agencies Social work RTA Driver rehab……

	Guide dogs	Vision Aust	Other		
ORTHOPTIST	□ **Patient Education** Current status: Next Step: □ N/A Details:				
	□ **Optical** Gls Prisms Details:				
	□ **Ocular Drugs** New Existing Details:				
	□ **Referral** Ophthalmologist Optometrist Details:				
	Agencies Social work RTA Driver rehab				
	Guide dogs	Vision Aust	Other		
	Patient Satisfaction Pre intervention	**1 dissatisfied**	**2**	**3 neutral**	**4** **5 very satisfied**
	Patient Satisfaction Post intervention	**1 dissatisfied**	**2**	**3 neutral**	**4** **5 very satisfied**

9 Glossary of Terms, Abbreviations & Definitions

Orthoptics: Orthoptics is an allied health profession specialized in diagnosis and management of disorders of eye movements and associated vision problems; performance of investigative procedures appropriate to disorders of the eye and visual system; and rehabilitation of patients with vision loss. Orthoptic Association of Australian definition

Ophthalmologist: a doctor who specializes in the study of the physiology, anatomy and pathology of the eye and diagnosis and treatment of disorders of the eye. Mosby's Dictionary of Medicine Nursing and Health Professions

Optometry: the practice of primary eye care, including testing the eye for visual acuity, diagnosing and managing eye health, prescribing corrective spectacles or contact lenses and recommending eye exercises. Mosby's Dictionary of Medicine Nursing and Health Professions

Inpatient Stroke Units: Stroke Care Unit

N8 is a standard near reading test where the number indicates the size of the letter i.e. the numbers range between 4.5 (smallest print letter) and N48 (largest print letter).

A & V patterns occur when the ocular posture alters between direct elevation and depression. The change in deviation can lead to a manifest deviation in one position with associated symptoms of diplopia.

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