International Centre for Allied Health Evidence

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Strengthening the Orthoptic Workforce, ACT Health Directorate

A Systematic Review of the Role, Effectiveness & Training of Orthoptists

Prepared by:
The Review Team
International Centre for Allied Health Evidence
University of South Australia
Adelaide
South Australia 5000

Prepared for:
MaryAnne Gregory
Project Officer
Office of the Allied Health Adviser
ACT Health Directorate

International Centre for Allied Health Evidence
School of Health Sciences
City East Campus
University of South Australia
Adelaide
South Australia 5000
Website: www.unisa.edu.au/cahe

Centre Director
Professor Karen Grimmer
Phone: (08) 8302 2769
Fax: (08) 8302 2766
Email: karen.grimmer@unisa.edu.au

Project researcher
Ms Jess Stanhope
Email: Jessica.stanhope@unisa.edu.au

Project administered by
Ms Madeleine Mallee
Business Services Officer
Business Development Unit
Division of Health Sciences
University of South Australia
Phone: (08) 8302 2121
Fax: (08) 8302 1472
Email: madeleine.mallee@unisa.edu.au

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Abbreviations

ALSPAC: Avon longitudinal study of parents and children
CINAHL: Cumulative Index to Nursing and Allied Health Literature
DR: Diabetic retinopathy
NA: Not applicable
NHMRC: National Health and Medical Research Council
NPDR: Nonproliferative diabetic retinopathy
NPV: Negative predictive value
NR: Not reported
RCT: Randomised controlled trial
UK: United Kingdom

Executive summary

Background

This review sought to answer the following questions:

1. What is the role of orthoptists in managing patients with eye disease?
2. Are there advanced practice, extended practice or assistant/ support roles for orthoptists?
3. What is the evidence regarding the effectiveness of orthoptic roles in terms of process, cost and health outcomes?
4. How is orthoptic practice described and organized?
5. What training and supervision is reported for orthoptists?

Methods

A comprehensive database search (OvidSP Embase, OvidSP Medline, EbscoHost Cumulative Index to Nursing and Allied Health Literature (CINAHL), EbscoHost Health Source, Scopus, Web of Science, ProQuest Nursing and Allied Health Source and Informit Health Collection) was conducted using the terms orthoptic OR orthoptics OR orthoptist OR orthoptists. This search was limited to studies published in English, from 2003 to 2013. The reference lists of included studies were screened for other relevant studies. Government, Orthoptics Australia and Australian Orthoptic Board websites were searched for relevant data.

Data pertaining to the review questions was extracted, along with the study designs. Studies were assigned to the National Health and Medical Research Council (NHMRC) hierarchy of evidence and studies of level III_1 or higher were critically appraised.

Results:

127 peer-reviewed studies were included, and the data supplemented by Australian grey literature. This evidence is summarised below.

Question 1

Types of patients seen: Orthoptists see a range of patients from neonates to geriatrics, who present with, or are being screened for a wide variety of eye or vision disorders including macular degeneration, amblyopia, cataracts, poor visual acuity, diabetic retinopathy, glaucoma and visual neglect. These patients may also have a range of other conditions, which may be congential, like Down or Angleman Syndromes, or acquired like diabetes, or stroke. Orthoptists may also play a role in pre- and post-operative assessment of patients. [Australian peer-reviewed literature (not ranked) n=24, Australian grey literature n=10, international literature (not ranked) n=68]

Tasks performed: Orthoptists detect, diagnose and manage eye and vision problems. This may involve assessing vision (e.g. visual acuity, visual fields, stereoacuity), assessing intraocular pressure, administering drugs, prescribing lenses or occlusion, educating patients, their families, teachers and other allied health staff. [Australian peer-reviewed literature (not ranked) n=21, Australian grey literature n=9, international literature (not ranked) n=65]

Question 2

Advanced or extended practice roles: There appears to be an emerging advanced practice role in Australia for orthoptists working in a triage capacity, however no peer-reviewed literature was identified. Whilst reference to specialist roles was made in some of the literature, this term was not defined; hence it is unclear whether this is a recognised level of practice. [Australian peer-reviewed literature (not ranked) n=3, Australian grey literature n=2, International literature n=2]

Assistant roles: There appears to be no current assistant orthoptic roles, however an Australian report discussed the potential for such a role. [Australian grey literature n=1]

Question 3

Effectiveness: There were a range of studies, predominantly international, which reported the effectiveness of screening programs, and management interventions, involving orthoptists, and some reporting their accuracy in diagnosis, however no study actually investigated the effectiveness of the role itself. [Australian peer-reviewed literature (NHMRC level III_2 to IV) n=5, International literature n=15 (NHMRC level II n=2, NHMRC levels III_2 to IV n=11, not ranked n=11)]

Question 4

Work setting: Orthoptists work in a range of settings, including hospitals, schools, clinics and community settings. [Australian peer-reviewed literature (not ranked) n=14, Australian grey literature n=6, International literature (not ranked) n=33]

Colleagues: Orthoptists may work independently or alongside other health and medical professionals including ophthalmologists, nurses, ophthalmic surgeons, rehabilitation workers and physiotherapists. [Australian peer-reviewed literature (not ranked) n=10, Australian grey literature n=6, International literature n=6]

Referrals: Referrals are received from optometrists, stroke teams, GPs, neurosurgeons, eye casualty departments or child health care centres, or before or after surgery. Orthoptists may refer to a range or professionals and services including optometrists, eye casualty departments, hospitals, physicians, ophthalmologists, low-vision rehabilitation services and support groups. [Australian peer-reviewed literature (not ranked) n=4, International literature (not ranked) n=16]

Question 5

Training: In Australia, there are two universities offering entry level degrees, whilst overseas other models of training exist. There is no evidence of post-registration training in Australia for orthoptists, and little discussed in the international literature. [Australian peer-reviewed literature (not ranked) n=3, Australian grey literature n=3, International literature n=4]

Supervision: No evidence was identified regarding supervision of orthoptists.

Discussion

The paucity of high-level evidence informing the review questions limits the conclusions which can be drawn from this review. In particular the opportunistic nature of many of the case studies provides little guidance for workforce redesign. The differences in the role and training of Australian orthoptists compared with those overseas limits the usefulness of the international literature in informing workforce redesign in Australia. The evidence regarding the effectiveness of orthoptists is predominantly low and difficult to interpret. The literature was lacking in information on effectiveness of orthoptist versus other eye health disciplines, cost effectiveness of their roles, processes of care and innovative models of care.

This review of Australian and international literature identified that orthoptists working in the ACT could expand their current practice to include a broader range of conditions and undertake a broader range of tasks, without the need to expand scope of practice.

1. Introduction

Orthoptists are involved in the detection, diagnosis and management of a range of eye and vision disorders/ problems.[1-3] To improve the utilization of these professionals it is important to first consider their current role, as well as their role overseas. This systematic review aims to provide this information.

This review sought to answer the following questions:

6. What is the role of orthoptists in managing patients with eye disease/ disorder?
7. Are there advanced practice, extended practice or assistant/ support roles for orthoptists?
8. What is the evidence regarding the effectiveness of orthoptic roles in terms of process, cost and health outcomes?
9. How is orthoptic practice described and organized?
10. What training and supervision is reported for orthoptists?

2. Methods

2.1 Peer-reviewed literature

2.1.1 Systematic search

A systematic search of key library databases (OvidSP Embase, OvidSP Medline, EbscoHost Cumulative Index to Nursing and Allied Health Literature (CINAHL), EbscoHost Health Source, Scopus, Web of Science, ProQuest Nursing and Allied Health Source and Informit Health Collection) was conducted in January 2013, using the terms orthoptic OR orthoptics OR orthoptist OR orthoptists. Where possible these terms were searched in the title, abstract or keyword fields, and searches were limited to peer-reviewed studies, published in English, from 2003 to 2013 where permitted by the databases (see Appendix 1 for details).

Following a post-hoc request from the Project Reference Group, an additional search was conducted to specifically identify any studies regarding orthoptists roles in organ donation. This search was performed in Google Scholar as this search engine searches within the main text. The terms searched were orthoptist organ donation, and this search was limited to 2003-2013.

2.1.2 Study identification

All studies obtained were exported into EndNote X6 where duplicate studies were excluded. The title and abstract of all remaining studies was screened, before the full texts were obtained and screened. Studies were excluded if they were not published from 2003-2013 in English, were not available in full text (e.g. conference abstracts), or were not published in peer-reviewed journals. Studies were also excluded if they did not include any information pertaining to the five review questions. Due to the broad nature of questions for this review, studies of any design were included. Furthermore, any paper reporting any relevant data was included even if this was not investigated in the study (e.g. relevant information for this review was reported in the background). Where this relevant information was citing another reference, the original study was identified to ensure it (the original study) met the inclusion criteria. Where all relevant information was cited from other references, the study was excluded.

To widen the search, the reference lists of all included studies, and any systematic reviews identified were manually screened to identify any studies investigating orthoptists.

2.1.3 Assigning levels of evidence

Where the findings of a study informed the review questions (i.e. not solely background information) the study design was identified, and assigned to the National Health and Medical Research Council (NHMRC)[4] hierarchy of evidence (see Appendix 2).

2.1.4 Critical appraisal

Critical appraisal was only conducted for studies identified as level III_1 or higher. Systematic reviews were appraised using the Centre for Evidence Based Medicine Systematic Review Critical Appraisal Sheet[5], and PEDro scale[6] (see Appendices 2 and 3) was used for level II and III_1 studies. Lower level studies were not appraised due to the biases inherent in their designs.

2.1.5 Data extraction

Relevant data was extracted from all included studies, according to the headings reported in Table 1.

2.1.6 Analysis

Due to the nature of the questions posed, all data is reported descriptively.

Table 1: Data extraction

	Headings
General	• Country in which the study was conducted* • Type of study (i.e. observational or experimental) • Type of research question (e.g. intervention, diagnostic) • Study design
Question 1: What is the role of orthoptists in managing patients with eye disease/ disorder?	• Population • Eye conditions • Screening/ assessment/ diagnosis tasks • Management tasks
Question 2: Are there advanced practice, extended practice or assistant/ support roles for orthoptists?	• Extended practice • Advanced practice • Assistant/ support roles
Question 3: What is the evidence regarding the effectiveness of orthoptists in terms of process, cost and health outcomes?	*Intervention studies* • Intervention • Outcome measures • Results *Diagnostic studies* • Diagnosis technique • Comparison measure • Results
Question 4: How is orthoptic practice described and organized?	• Work setting • Who they work with, and their relative position • Who they receive referrals from
Question 5: What training and supervision is reported for orthoptists?	• Pre-registration training • Post-registration training • Supervision in the workplace

**Unless otherwise stated within the study this was assumed to be the same country as the author's affiliation*

2.2 Australian grey literature

2.2.1 Search

Relevant Australian grey literature was identified through searching the Orthoptics Australia (www.orthoptics.org.au) and Australian Orthoptic Board (www.australianorthopticboard.org.au) websites, in addition to government websites (www.health.gov.au/, www.sahealth.sa.gov.au/wps/wcm/connect/Public+Content/SA+Health+Internet/, www.health.wa.gov.au/home/, www.health.nt.gov.au/, www.health.qld.gov.au/, www.health.nsw.gov.au/Pages/default.aspx, www.health.act.gov.au/c/health, www.health.vic.gov.au/, www.dhhs.tas.gov.au/) .

2.2.2 Data extraction

The data extraction for the grey literature was performed using the same headings as outlined in Table 1.

3 Results

3.1 Overview of the literature identified

1352 studies were obtained through the database search, 127 of which were included (see Figure 1 for the flow chart).

The Google Scholar search conducted to specifically identity studies regarding the orthoptists role in organ donation yielded 53 results, however none of these were relevant.

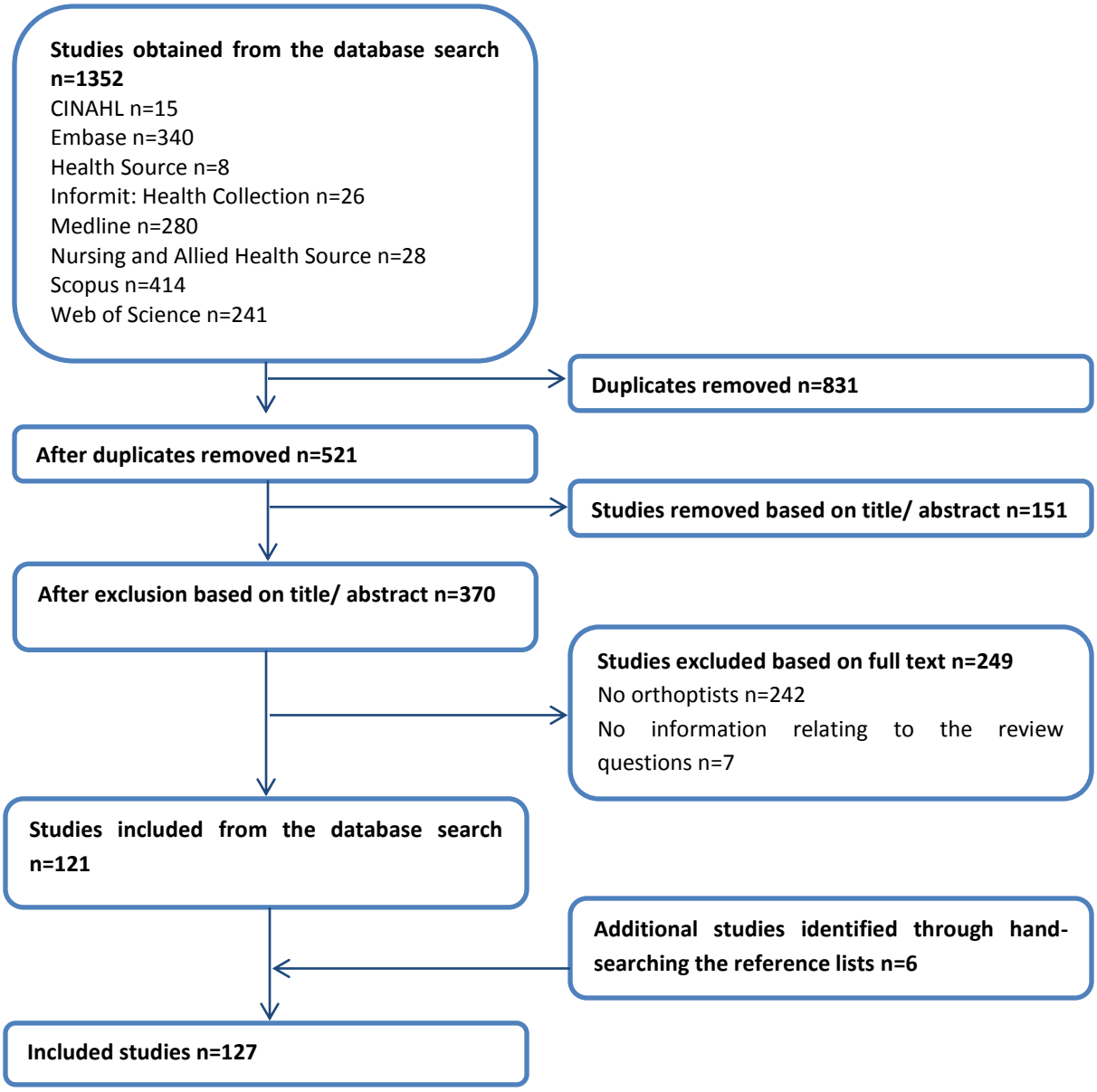

Figure 1: Flow chart for the database search

CINAHL: Cumulative index to nursing and allied health literature

3.2 Findings

3.2.1 Question 1: What is the role of orthoptists in managing patients with eye disease/ disorder?

No studies investigating the types of patients seen or tasks performed by orthoptists were identified; however background information, grey literature, and populations seen or tasks performed in intervention studies provided information regarding the types of patients orthoptists may see.

Types of patients seen

Orthoptists are involved in the detection, diagnosis and management of a range of eye and vision disorders/ problems.[1-3] These conditions are summarised in Table 2 (see Appendix 4 for full details). A range of conditions have been identified in which the evidence suggests that they are detected/managed by orthoptists overseas, but not in Australia.

Table 2: A summary of the conditions detected and managed by orthoptists

Disorder/ disease	Australia	Overseas
Acute acquired tropia		
Age-related macular degeneration		
Amblyopia (including strabismic)		
Ametropia		
Anisometropia		
Anterior and posterior segment injuries (combined)		
Aphakia		
Astigmatism		
Asthenopia		
Cataracts (including congenital)		
Chronic progressive external ophthalmoplegia		
Compressive optic neuropathy		
Convergence deficiency		
Corneal scarring		
Decompensating phoria (eso, exo, hyper)		
Decreased/ poor visual acuity		
Diabetic retinopathy/ eye disease		
Dilated pupils		
Diplopia		
Dry eyes		
Duane's retraction syndrome		
Dyslexia		
Ectopic lentis		
Eye & ocular problems		
Eye movement disorders (e.g. following a head injury or stroke)		
Flashes or floaters		
Fusion disruption		
Glaucoma		
Heterophoria		
Heterotropia		
Hyperopia		

Disorder/ disease	Australia	Overseas
Inferior oblique muscle overaction		
Inferior rectus underaction		
Intermittent exotropia (including distance)		
Internuclear ophthalmoplegia		
Macular pathology (including holes)		
Myopia		
Nystagmus		
Near reflex spasm		
Orbital cellulitis		
Orbital dacryoadenitis		
Orbital fracture		
Orbital metastases		
Orthophoria		
Phoria		
Presbyopia		
Ptosis		
Red eyes		
Refractive error/ symptoms		
Strabismus		
Superior oblique myokymia		
Vertigo		
Visual fields testing and management		
Vision impairment/ pathology		
Visual neglect		

Grey shading indicates that literature was identified relating to this condition

Orthoptists in Australia work with all age groups from neonates to geriatrics. [1,7-9]

Patients seen by orthoptists may also present with a range of comorbidities (see Table 3 for a summary, and Appendix 5 for details), with a potential role identified in the United Kingdom (UK) for orthoptists working with patients with Turner's syndrome.[10] Again, the literature indicates that the range of patients seen overseas is broader than in Australia. An area which was identified in the Australian literature, but not the international was orthoptists being involved in vision aspects of driving assessments for senior drivers.[11]

Table 3: A summary of the co-morbidities of patients seen by orthoptists

Condition	Australia	Overseas
Angelman Syndrome		
Blocked ventriculoperitoneal shunt		
Brain tumours		
Brainstem lesions		
Cochlear implant		
Cranial nerve paralysis		
Deaf		
Demyelination		
Depression		
Developmental disorders		
Diabetes		
Down Syndrome		
Hydrocephalus		
Hypertension		
Infants of opiate dependent mothers		
Intellectual disabilities		
Malignancy		
Migraine		
Miller Fisher syndrome		
Multiple disabilities		
Multiple sclerosis		
Myasthenia gravis		
Myositis		
Neurological conditions		
Neurosarcoid		
Psychomotor retardation		
Sinusitis		
Spina bifida cystica		
Stroke		
Temperomandibular joint dysfunction		
Thyroid conditions		
Trauma		

Grey shading indicates that literature was identified relating to this co-morbidity

Orthoptists may also be involved in pre- and post-operative assessment of patients, as summarised in Table 4.

Table 4: Orthoptists involvement in pre- and post-surgical assessment

Study	Country	Pre and/or post	Surgery
Ta[12]	Australia	Pre	Monovision laser vision correction
Kushner & Kowal[13]	Australia	Pre*	Refractive surgery
Mireskandari et al.[14]	UK	Pre and post	Macular hole repair
Shipman & Burke[15]	UK	Pre	inferior oblique muscle myectomy and recession
Schutte et al.[16]	UK	Pre	Surgery for strabismus

**It is unclear whether this was standard practice, however it was recommended, UK: United Kingdom*

Tasks performed

Orthoptists perform a range of tasks when screening, assessing and managing patients. These are summarised in Table 5 (see Appendix 6 for details). A number of tasks have been reported in the international literature, but not the Australian literature.

Table 5: A summary of the tasks performed by orthoptists

Task	Australia	Overseas
Administer drugs		
Assess accommodation		
Assess binocular vision		
Assess binocularity using 20 dioptre prism		
Assess colour vision		
Assess contrast sensitivity		
Assess corneal light reflex		
Assess diplopia		
Assess eye dominance		
Assess extraocular movements		
Assess fixation		
Assess head posture		
Assess lid function		
Assess intraocular pressure (including the use of air tonometer)		
Assess isotropia photorefraction		
Assess monocular fixation pattern		
Assess monocular logMAR acuity		
Assess motor fusion		
Assess ocular alignment		
Assess ocular motility/ movement (including smooth pursuit and saccadic movement, including with a Goldmann telescope)		
Assess pupils (e.g. direct and consensual pupil reaction to light)		
Assess reference eye		
Assess refraction (including cycloplegic, and autorefraction)		
Assess retinal correspondence		
Assess sensorial status		
Assess stereoacuity		
Assess stereo function		
Assess stereopsis		
Assess strabismus		
Assess suppression		
Assess the AC/A ratio		
Assess the angle of strabismus (near and far fixation)		
Assess the optic nerve head		
Assess the quality of fixation		
Assess vergence (convergence/ divergence, and fusional vergence)		
Assess visual acuity (corrected and uncorrected, including Snellen)		
Assess visual fields		
Assess visual neglect/ inattention		

Task	Australia	Overseas
Assist in surgery		
Conduct a prism test		
Conduct a mallet unit test		
Conduct a prism reflex test		
Conduct automated refraction test		
Conduct biometry		
Conduct perimetry (including computerised)		
Conduct corneal pachymetry		
Conduct corneal topography		
Conduct cover tests (including prism cover tests, near and distant, unilateral and alternating)		
Conduct cycloplegic retinoscopy		
Conduct a dilated fundoscopy		
Conduct functional investigations		
Conduct fundus photography		
Conduct Hirschberg test		
Conduct hole in card test		
Conduct ocular dominance testing		
Conduct on-road driving assessments (including eye movement patterns, and identification of vision-based information in the driving environment)		
Conduct optical coherence tomography		
Conduct photorefraction test		
Conduct the Maddox test (rod and cross)		
Conduct tonometry (including applanation)		
Conduct prism tests (near and distant)		
Conduct prism vergence testing		
Conduct stereo retinal imaging		
Conduct stereotests		
Conduct ultrasonography (A scans)		
Conduct uncover tests (near and distance)		
Conduct convergence training		
Correct refractive error		
Conduct visual training		
Dispense binocular vision corrections		
Detect amblyopia		
Detect heterophoria decompensation		
Detect hypermetropia		
Educate parents about hygiene and care of contact lenses		
Educate the family about the use and care of Bangerter foil		
Examine the cornea		
Examine the retina		
Explain diagnostic findings and/or management options with the patient, parents, teachers and other health and/or medical professionals		
Imaging the back of the eye		
Inspect the anterior eye		
Instillation of eye drops, including anaesthetic, dilating and fluorescent drops		
Measure eye pressure		
Measure fusion amplitude in synoptophore		

Task	Australia	Overseas
Measure fusional vergence reserves		
Measure phoria (using Maddox wing)		
Measure strabismus		
Observation of misalignment		
Perform visual rehabilitative procedures		
Prescribe atropine		
Prescribe and modify glasses/ lenses		
Prescribe occlusion		
Provide advice regarding head positioning		
Provide advice regarding positioning of reading material		
Provide convergence therapy		
Provide ongoing guidance and counselling		
Provide pre-operative counselling		
Provide technical and clinical support to ophthalmic surgeons		
Provide visual aids		
Recommend exercises (including for fusion, convergence)		
Recommend prisms		
Take fundus photographs		
Take measurements prior to cataract surgery		
Teach parents to insert, clean and remove their infants contact lenses		
Teach scanning to compensate for visual field loss		
Test with synophtophore		
Train a nurse to conduct vision screening for children		
Training school teachers in eccentric viewing to assist students		
Trial contact lenses		
Use prisms bars		
Use Hess charts		
Use Plusoptix Vision Screener		
Use synoptophore technique		
Video refraction measurements		
Visual neglect training		

Grey shading indicates that literature was identified relating to this task

3.2.2 Question 2: Are there advanced practice, extended practice or assistant/ support roles for orthoptists?

No studies were identified which investigated advanced practice, extended practice or assistant/ support roles, however some insights were obtained from literature that provided background information, and the grey literature.

Advanced practice/ extended scope roles

Advanced roles for orthoptists were described in the Australian grey literature. The issues paper for *Bundaberg Hospital Commission of Inquiry, Enhanced Clinical Roles*[17] stated that there were opportunities for orthoptists to take on advanced practice roles in eye clinics, however no further detail was reported. A study is currently underway in Queensland, *Development and trial model of orthoptist triage and streamline of referrals for patients with Strabismus and/or Amblyopia and reduce the wait for ophthalmologist outpatient clinics,* which investigates advanced practice roles for orthoptists, however again no further information was reported.[18]

Reference was made to specialist roles in five studies, as reported in Table 6. None of the studies defined what was meant by 'specialised' or whether this term was formally recognized within the orthoptic profession, or whether these represent a niche area, or an area in which they believe they have advanced skills.

Table 6: Specialist roles for orthoptists

Study	Country	Specialist role
Fitzmaurice & Clarke[19]	Australia	Vision rehabilitation
Sendelbeck & Brennan[20]	Australia	Working with infants with contact lenses
Sim et al.[21]	Australia	*Anterior segment disorders, glaucoma, cataract & refractive surgery
Rowe et al.[22]	UK	Stroke
Rowe et al.[23]	UK	Stroke

**sub-specialised, UK: United Kingdom*

Assistant roles

Within the Australian grey literature a recent report by the Community Services and Health Industry Council[24] stated that there have been submissions regarding establishing a new role; an orthoptic assistant. To develop this role the following would have to occur:

> *"Examine development of competency standards, qualifications and/ or skill sets supporting an orthoptic assistant role. Establishment of this role is driven by increased demand for ophthalmic services and shortage/poor distribution of orthoptics"*[24] (p 38).

There was no mention of assistant roles within the peer-reviewed literature.

3.2.3 Question 3: What is the evidence regarding the effectiveness of orthoptic roles in terms of process, cost and health outcomes?

Due to the vast differences in the studies reporting health outcomes with orthoptics, these have been reported separately.

Screening / examination

The effectiveness of screening programs for children

Four studies investigated screening programs involving orthoptists for children. Thee country and study designs are reported in Table 7, with the population, conditions screened for and tests used reported in Table 8.

Table 7: Country, study design, level of evidence and critical appraisal results

Study	Country	Study design
Anker et al.[25]	UK	Screening was performed, and re-assessed one month later to confirm the condition
Barry & König[26]	Germany	Screening was conducted by an orthoptist, then a "gold standard" examination by an orthoptist and ophthalmologist was conducted 3-6 months later
Chui et al.[27]	Canada	Screening was conducted by an orthoptist, then a "gold standard" examination by an orthoptist and ophthalmologist was conducted within 3 months
Hu et al.[28]	UK	Screening was conducted, and these results were compared with the hospital assessment for the children who were referred

UK: United Kingdom

Table 8: Population screened, conditions screened for and the tests used

Study	Population	Conditions/ problems detected	Tests used
Anker et al.[25]	Infants aged 7-9 months	Visual function	Strabismus, ocular motility, videorefraction
Barry & König[26]	3 year old children	Amblyopia or amblyogenic risk factors	
Chui et al.[27]	Children aged 3-4 years	Vision screening	Orthoptist trained a public health nurse to conduct the screening which involved taking a history, visual inspection, assessing stereoacuity and visual acuity This was compared with a full "gold standard" examination involving orthoptic and ophthalmologic examinations
Hu et al.[28]	Children aged 3-4 years	Referral for amblyopia or refractive error	Visual acuity, ocular motility and alignment, and stereoacuity

Accuracy of screening

The accuracy of screening programs has been reported in Table 9. A range of results was obtained, which is likely to be because of the differences in procedures, conditions screened for, and populations. Nonetheless Barry & König's[26] screening tool showed excellent sensitivity and specificity.

Table 9: Summary of the accuracy of screening programs conducted by orthoptists

Study	Subgroups/ programs/ tests	Sensitivity (%)	Specificity (%)	Other
Anker et al.[25]	Screening program	67	96	
Barry & König[26]	Screening program	91*	94*	
	Inspection	4	100	
	Ocular motility/ head posture	12	99	
	Cover test sensitivity	16	99	
	Visual acuity	86	95	
Chui et al.[27]	<41 months of age	75	68	NPV 90% May miss refractive errors, and microtropia/monofixation syndrome
	≥41 months of age	50	95	NPV 96% May miss refractive errors, and microtropia/monofixation syndrome
Hu et al. [28]				13% of referrals were classified as false positives

**only for cooperative children, NPV: negative predictive value*

Costs

One study used existing data to model the cost-effectiveness of various screening options. Gandjour et al.[29] proposed four programs, (1) ophthalmologists screening high-risk children under the age of one year, (2) ophthalmologists screening all children under the age of one year, (3) a general practitioner or paediatrician screening all children aged three to four years, and (4) orthoptists screening children aged three to four years at kindergarten. They concluded that the most effective, and cost effective option was ophthalmologists screening all children under the age of one year.

Quality of fundus photographs taken by orthoptists

A French study[30] reported a screening intervention to detect diabetic retinopathy amongst individuals with diabetes, in which an orthoptist took the fundus photographs. The quality of photographs taken was rated, with 67% being rated as excellent or "good definition of most retinal detail, easy to assess", indicating that orthoptists may play a valuable role in the detection of DR through taking fundus photographs.

Diagnosis of diabetic retinopathy

Georgievski et al.[31] reported an Australian cross sectional cohort study (NHMRC level IV) of orthoptists which investigated their ability to diagnose diabetic retinopathy. A survey was distributed to orthoptists who were Victorian members of the Orthoptic Association of Australia. This included 36 digital fundus images which were obtained from a diabetic retinopathy screening clinic. Respondents were asked to state whether the image indicated pathology was present, and if it was, whether it was related to diabetic retinopathy. The results are summarized in Table 10.

Table 10: Sensitivity and specificity data reported by Georgievski et al.[31]

Task		Mean ± standard deviation (%)	95% confidence interval	Range (%)
Detecting abnormality in images with DR	Sensitivity	86 ± 11	83-90	62-100
	Specificity	91 ± 11	88-94	55-100
Detecting abnormality for minimal NPDR	Sensitivity	70*	NR	NR
	Specificity	91*	NR	NR
Detecting mild-moderate NPDR	Sensitivity	94*	NR	NR
	Specificity	91*	NR	NR
Detecting severe NPDR	Sensitivity	100*	NR	NR
	Specificity	91*	NR	NR
Detecting abnormality with non-DR	Sensitivity	93*	NR	NR
	Specificity	84*	NR	NR

**Standard deviation not reported, DR: diabetic retinopathy, NPDR: nonproliferative diabetic retinopathy, NR: not reported*

It was concluded that the sensitivity and specificity of orthoptists diagnosis of DR was good, however it was reported that the individual variation was wide, with no clear factors which explained this. They stated that "the need to implement cost-effective and efficient screening programmes for DR is growing and the orthoptic profession in Australia should contribute to this public health issue and be used in DR screening models"[31] (p 738).

The importance of pre-operative orthoptic examination

The importance of orthoptic examination before patients receive monovision laser correction was reported in an Australian study, by Ta[12], in two cases (NHMRC level IV). Following the orthoptic assessment the first participant was prescribed contact lenses, which he wore for seven years, prior to a bilateral LASIK procedure. Four months following this surgery the patient reported that without glasses his distant vision was "not so good". He had a LASIK enhancement for his left eye, and was pleased with the results six months later. The second participant was advised not to have surgery, despite having good potential vision at near and distance, as she had increased deviation size and diplopia. These cases highlight the importance of the role orthoptists play in such an assessment, considering the patients expectations of the surgical outcome, they understand monovision, and they experience comfort and have a favourable ocular motility examination during the monovision contact lens trial.

Competence in the use of Optical Coherence Tomography

Chan et al.[32] reported a UK study with no reference standard (NHMRC level IV) which investigated the competence of a range of eye care professionals in the use of optical coherence tomography. The participants (five of which were orthoptists) had to detect macular pathology on 10 scans. The mean score for the orthoptists was 1/10 (range 0-1/10), which placed them below all other professionals involved in the study (medical retinal consultants, vitreoretinal consultants, non-retinal consultants, vitreoretinal fellows, specialist registrars, senior house officers, and ancillary staff. This indicates that in the UK orthoptists do not appear to be competent in the use of optical coherence tomography.

Evaluation of the optic nerve head

The diagnostic case-control study (NHMRC level III_3) comparing the assessment of a glaucoma specialist and non-expert-certified orthoptist in evaluating the optic nerve head, using a stereo retinal imaging technique was reported by Asakawa et al.[33] With healthy participants there was good intra-examiner reproducibility for orthoptic assessments of cup area, disc area, rim area, area R/D ratio, average and maximum cup depth, and disc depth. The inter-examiner reproducibility was high for cup area, volume, average and maximum depth, disc area volume and depth, and rim area and volume. Furthermore, there was moderate consistency for vertical C/D ratio, area R/D ratio curve, lower rim width, and area C/D ratio. The only measure which was not reliable was the upper rim width in the healthy participants. It was concluded that orthoptists and glaucoma specialists were reliable, using this technique, for healthy participants with more than moderate myopia, as well as those with glaucoma.

Management

Orthoptic fusion exercises for intermittent exotropia or phoria

Pejic et al.[34] conducted a study in Singapore, investigating the effectiveness of at least 12 weeks (median duration 18 weeks, ranged from 12-36 weeks) of orthoptic fusion exercises in people with intermittent exotropia or phoria. It was a retrospective, case control study (NHMRC level III_2), involving 96 participants, ranging in age from 6 to 34 years. The intervention was compared with no treatment. Those in the treatment group experienced a significant improvement in binocular status six months following completion of the intervention. Whilst other improvements were reported, none were stated to be significant.

Brangerter foils

A prospective cohort study with no controls[35] (NHMRC level IV) was conducted in the United States of America (USA) to determine the effectiveness of Brangerter foils for children with strabismic amblyopia. Fifty-four children (mean age 5.3 ± 1.7 years) participated. They were prescribed enrolled Bangerter foils (0.1 density) for three to four hours a day to the fixating eye. Follow-up was a minimum of two years. The children who were classified as ‘converters’ (had developed motor fusion) were followed up for a further 18 months without Bangerter foils, unless the amblyopia recurred.

During the study[35] seven children were lost to follow up, and one had surgery, and was therefore excluded. 61% of children developed fusional vergence movements, and for the converters there was a significant decrease in the mean horizontal deviation. There was a statistically significant improvement in visual acuity for the converters, but not the non-converters. Motor fusion was maintained by the converters during the study period, however three (15%) had a recurrence of their amblyopia.

Occlusion therapy

Occlusion therapy, prescribed by an orthoptist, has been investigated in four studies from the Netherlands.[36-39] The study designs, levels of evidence and critical appraisal scores of these studies are summarised in Table 11, with the populations, interventions and key findings reported in Table 12. The Loudon et al.'s[37] study indicated that there was a relationship between occlusion therapy compliance and improvement in visual acuity. This indicates that occlusion therapy may be effective, whilst the other studies[36,38,40] provide evidence regarding how best to improve compliance.

Table 11: Study design, level of evidence and critical appraisal scores for studies investigating occlusion therapy

Study	Design	NHMRC level of evidence[4]	Critical appraisal score*
Loudon et al.[37]	Case series	IV	NA
Loudon et al.[36]	RCT	II	6/11^
Tjiam et al.[40]	Non-randomised (not concurrent) blocks	III_3	NA
Tjiam et al.[38]	RCT	II	9/11^

*NHMRC: National Health and Medical Research Council *see Appendix 7 for full details of the appraisal, RCT: randomised controlled trial, ^conducted using the PEDro Scale[6], NA: not applicable as it was a low level study*

Table 12: Population, intervention and results for studies investigating occlusion therapy

Study	Population	Intervention	Results
Loudon et al.[37]	Children aged 1-7 with amblyopia	Occlusion therapy	A statistically significant relationship was reported between compliance and the improvement in visual acuity
Loudon et al.[36]	Children with amblyopia who had no previous treatment	Intervention group: standard orthoptic care and an educational cartoon story, calendar with reward stickers and written information for the child's parents Control group: standard orthoptic care and a colouring book with no educational message	There was a significant difference in the compliance between the groups with the intervention group having greater compliance
Tjiam et al.[40]	Children aged 3-6 years with amblyopia, who had not previously had occlusion therapy	*Stage 1* (pre-intervention): standard orthoptic care *Stage 2* (post-intervention): standard orthoptic care and educational cartoon	There was no significant difference in mean compliance between the groups, however compliance was better with the educational cartoon. There was a significant difference in the speed of reduction in interocular-acuity difference between the groups, with greater improvements seen in the group with the educational cartoon.
Tjiam et al.[38]	Children aged 3-6 years with amblyopia, who had not previously had occlusion therapy	*Group 1:* Control group who were given colouring pictures and standard orthoptic care provided by their orthoptist *Group 2:* Educational cartoon story and standard orthoptic care provided by their orthoptist *Group 3:* Calender with reward stickers and standard orthoptic care provided by their orthoptist *Group 4:* Written information provided to the parents and standard orthoptic care provided by their orthoptist	Compliance was better in the three intervention groups, in comparison with the control, with this difference being statistically significant for Group 2. There was also a statistically significant difference between Groups 2 and 3.

Orthoptic management of diplopia in patients with neurological deficits

MacFarlane et al.[41] reported an Australian case series (NHMRC level IV) investigating the effectiveness of using prism, occlusion and head positioning strategies for people with neurological deficits and diplopia. Modified Likert scales were used to measure the severity and frequency of diplopia pre and post treatment. Overall, there was a reduction in the mean severity and frequency of diplopia following the intervention.

Orthoptic advice for a patient with triplopia

Fitzpatrick[42] reported an Australian case study (NHMRC level IV) of a patient with triplopia. In addition to orthoptic management, the patient was also managed by an ophthalmologist. The only management strategy which was clearly administered by the orthoptist (and not the ophthalmologist) was advice regarding positioning of reading material. The patient did not take this advice on board, hence no data regarding the effectiveness of this advice was reported.

Eccentric viewing training for children

An Australian case series (NHMRC level IV) was reported by Fitzmaurice and Clarke[19] regarding the effectiveness of eccentric viewing training for children, using the EccVue software. For both students their teacher was taught by the orthoptist about eccentric viewing principles and how to use the software. The outcomes were reading speed and print size, as well as information derived from an interview. Details of the case studies are reported in Table 13. The findings of this study indicate that orthoptists may have a valuable role in educating others, in this case teachers, about how to support their patients in improving their visual difficulties.

Table 13: Interventions and results reported by Fitzmaurice & Clarke[19]

Child	Intervention details	Reading speed and print size data	Qualitative data
B	13 sessions over an 8 month period After 9 sessions the orthoptist was consulted as the child was having "difficulty with words merging and became despondent about the training" and it was determined that he was not performing the viewing correctly, hence further instruction was provided	This was not assessed following the intervention	Following the additional session with the orthoptist there were no issues with the merging print and the child's frustration diminished. The child and his teacher reported that eccentric viewing and typing were his major successes for the year. He reported using eccentric viewing whilst watching television, cooking (as he could see measurements more clearly), playing video games (as his reaction times were better), writing and finding things in the garden, and during maths and English classes. He also reported that it helped him when using his closed-circuit television as the images were easier to identify and his fluency improved. It assisted him whilst playing sports, and he was able to inform his teammates of areas where he was able to see
C	11 sessions over a 7 month period	Pre-test: 24 point print at 97 words per minute Post-test: 12 point print at 108 words per minute, and 14 point print at 128 words per minute	This child stated that he used the technique everywhere, including whilst using his MP3 player, at school whilst using his laptop and Zoomtext, and at Junior Country Fire Authority. He was better able to cope if teachers had not enlarged his worksheets.
Both			Prior to training both were aware that there were viewing areas which were better than others, however they could not regularly find these, or find them when they wanted them, but both used these better areas automatically following training. The mother (or is this mothers) of both children stated that they were more confident at school and at home, that they no longer required Talking Books, and they were reading smaller fonts The orthoptist and teacher both felt that there were a number of benefits to the treatment. The teacher felt that the program made her more aware of the students difficulties, and that they boys vision had improved, allowing them to find information more quickly.

Orthoptic interventions following a stroke

MacFarlane et al.[43] reported an Australian case study (NHMRC level IV) regarding the orthoptic management of patients with a range of eye disorders following stroke. The orthoptist assessed a random sample of stroke patients in hospital, and determined the most appropriate intervention for them. The interventions are described in Table 14. There were no formal outcome measures, but rather a range of broad descriptions were reported. These are also reported in Table 14. They concluded 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 patients resulted in improvement… treatment for convergence deficiency was generally not effective…"*[43] (p 22).

Table 14: Interventions and results reported by Macfarlane et al.[43]

Intervention	Intervention description	Descriptions of outcomes
Convergence training	The orthoptist identified the exercises, and the patient performed these either independently, or whilst supervised by another health professional. The orthoptist conducted ongoing assessments and modified the exercises as appropriate.	1 "non-compliant, could not see the point of the exercises" 2. "No orthoptist to follow up" 3. "Lost to follow up"
Scanning to compensate for visual field loss	This involved making patients aware of the deficit, and to teach them strategies to diminish these.	1. "Improved mobility and awareness reported by therapists" 2. "Family aware of the patient's visual loss and take this into account when interacting with the patient" 3. "Improved ability to direct intact seeing area to support safe mobility"
Visual neglect training	This involved ongoing stimulation of the neglected side.	1. "Noticing objects on left; sees objects on both right and left presentation" 2. ""Huge improvement" reported by staff and patient, fully orientated to all parts of body and hospital environment and ADLs" 3. "Spontaneously looks to left occasionally, better response with physiotherapy, and eyes more in primary position"
Optical use and intervention	The orthoptist ensured that patients with glasses were able to use them whilst in hospital. Additionally they modified and prescribed glasses, or modified existing prescriptions or use of optical appliances.	1. "patient very happy" 2. "improved vision R and L 6/12" 3. "single vision with glasses" 4. "single vision in primary position"
Occlusion	This treatment involved occluding one eye.	1. "very satisfied" 2. "eyestrain, changed to prism"
Compensatory strategies	For example, advocating for the patient to retain compensatory head position although physiotherapy may be working on better head alignment	1. "patient expressed satisfaction" 2. "pleased to be advised to adapt glasses" 3. "patient expressed satisfaction"

3.2.4 Question 4: How is orthoptic practice described and organized?

There were no studies identified which investigated orthoptic practice, however any relevant information from the literature has been reported in this section.

Work setting

Orthoptists, both in Australia and overseas work in hospitals, schools, clinics and community settings, as summarised in Table 15 (see Appendix 8 for full details).

Table 15: Work settings for orthoptists

Task	Australian	Overseas
Baby clinics		
Community health centres		
General practitioner surgeries		
Hospitals (within general and special eye clinics, strabismus clinics, orthoptic departments, stroke units, ophthalmology departments and centre for vision independence)		
Health facilities		
Home clinic		
Low vision clinics		
Medical centres		
Ophthalmic/ophthalmology department		
Ophthalmology clinic		
Ophthalmology practices		
Orthoptic department		
Outpatient ophthalmology clinic		
Outpatient orthoptic clinic		
Primary care facilities		
Private practice*		
Rehabilitation clinics		
Research centres		
Research clinic^		
Schools/ kindergartens		
Special schools		
Specialist eye clinic		
Stroke service		
Tertiary referral centres		
University eye clinic (including eye and ophthalmological)		

Grey shading indicates that literature was identified relating to this work setting

**Rees et al [44] reported in their study that 36.4% of orthoptists worked in private practice making it the most common work setting within their sample, ^ALSPAC (Avon longitudinal study of parents and children) clinic*

Colleagues

Orthoptists in Australia may work independently[8], or alongside a range of professionals (see Table 16 for the summary, and Appendix 9 for the full details) within eye care,[7,8,45] multidisciplinary teams,[8,46,47] or a health service provision team. [48] In the UK, orthoptists may work as part of a stroke team[49,50] and within multidisciplinary teams.[51]

Table 16: Colleagues of orthoptists

Task	Australia	Overseas
Health professionals		
Neuropsychologist		
Nurse		
Ophthalmic nurses		
Ophthalmic surgeons		
Ophthalmologists (including registrars)		
Optometrists		
Paediatric ophthalmologist		
Physiotherapists		
Rehabilitation workers		
Special education teachers		
Support staff		

Grey shading indicates that literature was identified relating to these colleagues

Very little information was identified relating to the interaction between orthoptists and their colleagues. Macfarlane et al.[43] reported that within a stroke unit, the orthoptist would select and teach the patient convergence exercises, which the patient could then perform independently, or under the supervision of another health professional (e.g. a physiotherapist). In Fitzmaurice and Clarke's[19] study they reported that the orthoptist taught a special education teacher about eccentric viewing and the EccView program which their students were to use. They also provided support as required.

Referrals

The referral patterns to and from orthoptists is reported in Table 17, indicating that orthoptists work indirectly with a wide range of health professionals.

Table 17: Referral patterns to and from orthoptists

Referred to orthoptists	Referred from orthoptists
• Child health care centre (Netherlands[52]) • Eye casualty department (UK[53]) • Following surgery (Netherlands[54]) • General practitioner (Netherlands[52,55]) • Neurosurgeon (Australia[56]) • Optometrist (Australia[57]) • Stroke team (UK[58]) • When referred for a cochlear implantation (Canada[59])	• Community health centre (UK[60]) • Eye casualty department (UK[53] - accounts for 19% of referrals to the department) • Hospital (UK[61]; Netherlands[61]) • Hospital eye service (UK[28,62]) • Low-vision rehabilitation service (Australia[63]) • Mental health services (Australia[44]) • Neuro-ophthalmic clinic (UK[53]) • Ophthalmologist (UK[10,64]; Germany[26,29]) • Optometrist (UK[60]) • Orthoptist (UK[61,60]; Netherlands[61]) • Other health professionals (Australia[44]) • Physician (Canada[65]) • Self-help/ support groups (Australia[44]) • Specialised institutes for the visually impaired (Netherlands[66]) • Specialist ophthalmic clinic (UK[53])

UK: United Kingdom

3.2.5 Question 5: What training and supervision is reported for orthoptists?

No studies investigating the training and supervision of orthoptists was identified, however some information regarding training has been reported in the peer reviewed and grey literature.

Pre-registration

Australia

There are two universities within Australia (La Trobe University, Melbourne, and The University of Sydney) offering programs which lead to registration with the Australian Orthoptic Board.[3,18] These programs are the four year full time Bachelor of Health Sciences/ Masters of Orthoptics double degree or the two year full time Master of Orthoptics (Graduate Entry) at La Trobe University, Melbourne and the Master of Orthoptics (Graduate Entry) at the University of Sydney.[45] [3] These programs provide students with clinical expertise through clinical placements in specialist clinical and hospital settings.[9]

Three peer-reviewed Australian studies[47,67,68]reported in the background information that there was an orthoptics course at La Trobe University. This was an undergraduate degree[47], in which training included conducting visual screening for secondary school students with mild intellectual disabilities[68], as well as placements which may be in a hospital setting in the students second to fourth years[47], and a university based orthoptic clinic.[67] No information was identified regarding supervision, or ongoing/ post-graduate training in any of the studies.

Pakistan

In Pakistan, there are four tiers of training for those working in vision sciences (optometrists, ophthalmic technologists and orthoptists) (see Figure 2).[69] This, unlike the Australian training, provides a clear training and career progression.

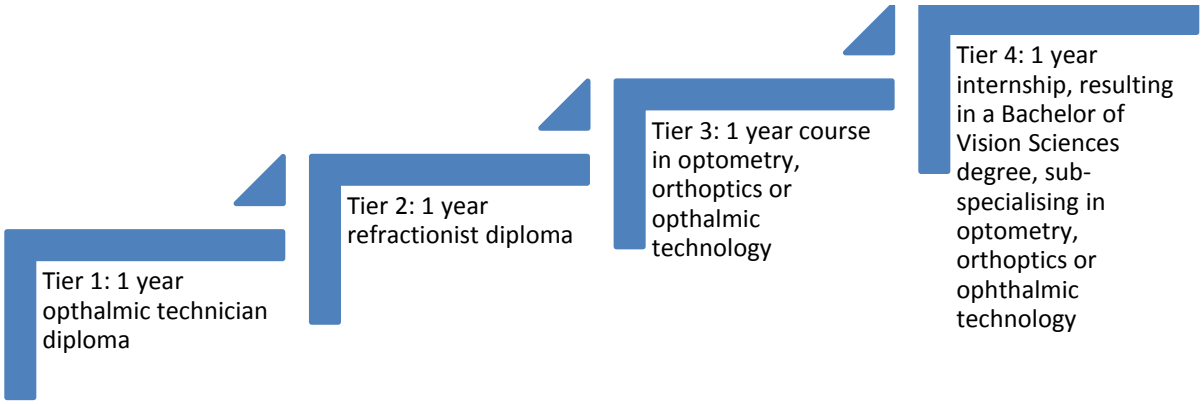

Figure 2: Four tier training for orthoptists in Pakistan[69]

Post-registration

Australia

There was no information regarding ongoing, or post-registration training identified which related to Australia.

Italy

Broggini et al.[70] reported a training program, implemented in Italy, for professionals working with patients with poor vision, including orthoptists. The program was developed to accommodate the needs of a range of professionals, and included modules on visual function, counselling and interpersonal skills, optics, light contrast and size, vision assessment and learning strategies and vision training. This incorporated both theoretical and practical aspects.

France

In France, orthoptists can undergo additional training and accreditation to screen for diabetic retinopathy, including taking retinal photographs,[30,71] however no detail regarding the training was reported.

Pakistan

In Pakistan, orthoptists can attend a refresher course, allowing them to share ideas and update their knowledge, every five years.[69]

Supervision

No Australian information regarding supervision was obtained.

4 Discussion

This is the first systematic review to investigate the role, effectiveness and training of orthoptists. It has revealed that there is little Australian literature published on the topic, and the majority of international studies have been about the effectiveness of treatments or accuracy of assessments performed by orthoptists, rather than investigating their role.

There were considerable differences in type of patients seen by Australian orthoptists in comparison with those overseas, as well as the tasks they perform. As none of the studies specifically investigated this topic, the findings are potentially more related to the types of conditions, populations and tasks investigated in research, rather than what is necessarily happening clinically. Despite this limiting the accuracy of any comparisons made between Australian and international orthoptists, it still identifies the scope of practice of orthoptists.

In terms of advanced or extended scope roles, or assistant orthoptists, no studies were identified which investigated this. Whilst there were references to specialist orthoptists in the literature,[19-23] this term was not defined; hence it is unclear whether this is a recognised advanced orthoptic role. It therefore appears that currently there is no advanced/ extended scope, or assistant roles for orthoptists, however the Australian grey literature indicated that these roles may emerge in the future.[17,18,24]

Studies conducted regarding the effectiveness of orthoptists were generally low level evidence and are therefore at high risk of bias. The two randomised controlled trials[36,38] (level II) identified investigated interventions to improve the compliance of patients with occlusion therapy. Whilst this involved an orthoptist, it does not directly investigate the effectiveness of their role.

Differences were reported in the work settings and colleagues of Australian orthoptists, in comparison with those working overseas. This may be due to the same reasons outlined regarding the patients and tasks performed, as no studies directly investigating this were identified. Additionally, this may be due to the way in which these settings, for instance, were described, rather than there being a substantial difference.

Within Australia there were two pre-registration university courses reported, however there was no information obtained regarding ongoing training, or supervision. Whilst there were reports of post-registration training in Italy, France and Pakistan this was minimal, and its applicability to the Australian context questionable given potential differences in the pre-registration training, as well as the roles performed by orthoptists in these countries.

The findings of this review are largely based upon low level research evidence, grey literature, or indirectly-related peer-reviewed literature from which the information used to inform the review question was not directly related to the research findings. This lack of high level research evidence limits the conclusions which can be drawn from this study, and highlights the need for more research into the roles of orthoptists, particularly their place in the health system, and the effectiveness of their roles in terms of cost, process and health outcomes.

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Appendices

Appendix 1: Details of the search strategy

Database	Fields searched	Date	English language	Peer-reviewed	Related words
Embase (OvidSP)	Title OR abstract OR keyword	2003 - current	✓		
Medline (OvidSP)	Title OR abstract OR keyword	2003 - current	✓		
CINAHL (EbscoHost)	Title OR abstract	2003-2013	✓	✓	✓
Health Source: Nursing/ Academic Edition (EbscoHost)	Title OR Author-Supplied Keywords OR Abstract OR Author-Supplied Abstract	2003-2013		✓	✓
Scopus	Article title OR abstract OR keyword	2003-2013	✓		
Web of Science	Topic (title OR keyword OR abstract OR author)	2003-2013	✓		✓
Nursing and Allied Health Source (ProQuest)	Document title OR abstract)	2003-2013	✓	✓	
Informit: Health Collection	Title OR abstract	2003-2013			

CINAHL: Cumulative Index to Nursing and Allied Health Literature

Appendix 2: National Health and Medical Research Council hierarchy of evidence[4]

Level	Intervention [1]	Diagnostic accuracy [2]	Prognosis	Aetiology [3]	Screening Intervention
I [4]	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies	A systematic review of level II studies
II	A randomised controlled trial	A study of test accuracy with: an independent, blinded comparison with a valid reference standard,[5] among consecutive persons with a defined clinical presentation[6]	A prospective cohort study[7]	A prospective cohort study	A randomised controlled trial
III-1	A pseudorandomised controlled trial (i.e. alternate allocation or some other method)	A study of test accuracy with: an independent, blinded comparison with a valid reference standard,[5] among non-consecutive persons with a defined clinical presentation[6]	All or none[8]	All or none[8]	A pseudorandomised controlled trial (i.e. alternate allocation or some other method)
III-2	A comparative study with concurrent controls: ▪ Non-randomised, experimental trial[9] ▪ Cohort study ▪ Case-control study ▪ Interrupted time series with a control group	A comparison with reference standard that does not meet the criteria required for Level II and III-1 evidence	Analysis of prognostic factors amongst persons in a single arm of a randomised controlled trial	A retrospective cohort study	A comparative study with concurrent controls: ▪ Non-randomised, experimental trial ▪ Cohort study ▪ Case-control study
III-3	A comparative study without concurrent controls: ▪ Historical control study ▪ Two or more single arm study[10] ▪ Interrupted time series without a parallel control group	Diagnostic case-control study[6]	A retrospective cohort study	A case-control study	A comparative study without concurrent controls: ▪ Historical control study ▪ Two or more single arm study
IV	Case series with either post-test or pre-test/post-test outcomes	Study of diagnostic yield (no reference standard)[11]	Case series, or cohort study of persons at different stages of disease	A cross-sectional study or case series	Case series

Appendix 3: Centre for Evidence Based Medicine Systematic Review Critical Appraisal Sheet[5]

SYSTEMATIC REVIEW: Are the results of the review valid?

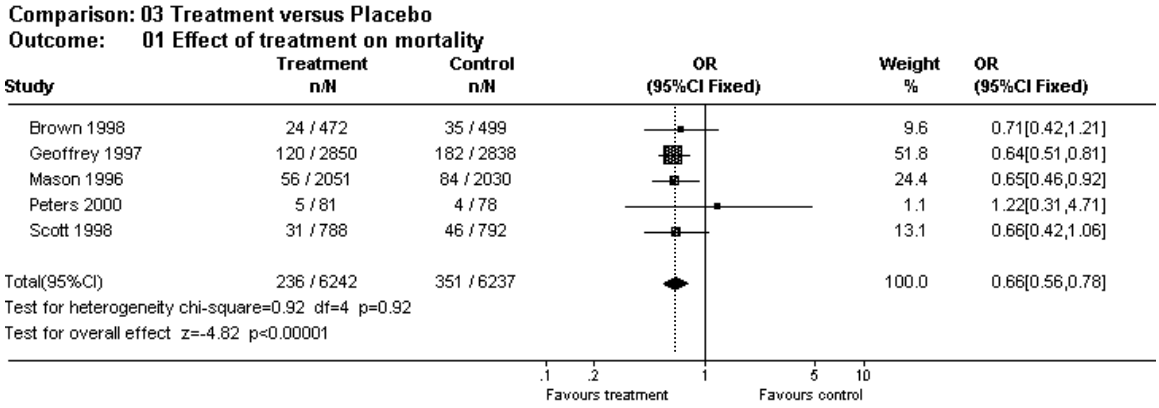
What question (PICO) did the systematic review address?	
What is best?	Where do I find the information?
The main question being addressed should be clearly stated. The exposure, such as a therapy or diagnostic test, and the outcome(s) of interest will often be expressed in terms of a simple relationship.	The ***Title, Abstract*** *or final paragraph of the* ***Introduction*** should clearly state the question. If you still cannot ascertain what the focused question is after reading these sections, search for another paper!
This paper: Yes ☐ No ☐ Unclear ☐ Comment:	
F - Is it unlikely that important, relevant studies were missed?	
What is best?	Where do I find the information?
The starting point for comprehensive search for all relevant studies is the major bibliographic databases (e.g., Medline, Cochrane, EMBASE, etc) but should also include a search of reference lists from relevant studies, and contact with experts, particularly to inquire about unpublished studies. The search should not be limited to English language only. The search strategy should include both MESH terms and text words.	The ***Methods*** section should describe the search strategy, including the terms used, in some detail. The ***Results*** section will outline the number of titles and abstracts reviewed, the number of full-text studies retrieved, and the number of studies excluded together with the reasons for exclusion. This information may be presented in a figure or flow chart.
This paper: Yes ☐ No ☐ Unclear ☐ Comment:	
A - Were the criteria used to select articles for inclusion appropriate?	
What is best?	Where do I find the information?
The inclusion or exclusion of studies in a systematic review should be clearly defined a priori. The eligibility criteria used should specify the patients, interventions or exposures and outcomes of interest. In many cases the type of study design will also be a key component of the eligibility criteria.	The ***Methods*** section should describe in detail the inclusion and exclusion criteria. Normally, this will include the study design.

This paper: Yes □ No □ Unclear □ Comment:	
A - Were the included studies sufficiently valid for the type of question asked?	
What is best?	Where do I find the information?
The article should describe how the quality of each study was assessed using predetermined quality criteria appropriate to the type of clinical question (e.g., randomization, blinding and completeness of follow-up)	The ***Methods*** section should describe the assessment of quality and the criteria used. The ***Results*** section should provide information on the quality of the individual studies.
This paper: Yes □ No □ Unclear □ Comment:	
T - Were the results similar from study to study?	
What is best?	Where do I find the information?
Ideally, the results of the different studies should be similar or homogeneous. If heterogeneity exists the authors may estimate whether the differences are significant (chi-square test). Possible reasons for the heterogeneity should be explored.	The ***Results*** section should state whether the results are heterogeneous and discuss possible reasons. The forest plot should show the results of the chi-square test for heterogeneity and if discuss reasons for heterogeneity, if present.
This paper: Yes □ No □ Unclear □ Comment:	

What were the results?

How are the results presented?

A systematic review provides a summary of the data from the results of a number of individual studies. If the results of the individual studies are similar, a statistical method (called meta-analysis) is used to combine the results from the individual studies and an overall summary estimate is calculated. The meta-analysis gives weighted values to each of the individual studies according to their size. The individual results of the studies need to be expressed in a standard way, such as relative risk, odds ratio or mean difference between the groups. Results are traditionally displayed in a figure, like the one below, called a **forest plot.**



The forest plot depicted above represents a meta-analysis of 5 trials that assessed the effects of a hypothetical treatment on mortality. Individual studies are represented by a black square and a horizontal line, which corresponds to the point estimate and 95% confidence interval of the odds ratio. The size of the black square reflects the weight of the study in the meta-analysis. The solid vertical line corresponds to 'no effect' of treatment - an odds ratio of 1.0. When the confidence interval includes 1 it indicates that the result is not significant at conventional levels (P>0.05).

The diamond at the bottom represents the combined or pooled odds ratio of all 5 trials with its 95% confidence interval. In this case, it shows that the treatment reduces mortality by 34% (OR 0.66 95% CI 0.56 to 0.78). Notice that the diamond does not overlap the 'no effect' line (the confidence interval doesn't include 1) so we can be assured that the pooled OR is statistically significant. The test for overall effect also indicates statistical significance (p<0.0001).

Exploring heterogeneity

Heterogeneity can be assessed using the "eyeball" test or more formally with statistical tests, such as the Cochran Q test. With the "eyeball" test one looks for overlap of the confidence intervals of the trials with the summary estimate. In the example above note that the dotted line running vertically through the combined odds ratio crosses the horizontal lines of all the individual studies indicating that the studies are homogenous. Heterogeneity can also be assessed using the Cochran chi-square (Cochran Q). If Cochran Q is statistically significant there is definite heterogeneity. If Cochran Q is not statistically significant but the ratio of Cochran Q and the degrees of freedom (Q/df) is > 1 there is possible heterogeneity. If Cochran Q is not statistically significant and Q/df is < 1 then heterogeneity is very unlikely. In the example above Q/df is <1 (0.92/4= 0.23) and the p-value is not significant (0.92) indicating no heterogeneity.

Note: The level of significance for Cochran Q is often set at 0.1 due to the low power of the test to detect heterogeneity.

Appendix 3: PEDro Scale[6]

PEDro scale

1.	eligibility criteria were specified	no ❑ yes ❑ where:
2.	subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	no ❑ yes ❑ where:
3.	allocation was concealed	no ❑ yes ❑ where:
4.	the groups were similar at baseline regarding the most important prognostic indicators	no ❑ yes ❑ where:
5.	there was blinding of all subjects	no ❑ yes ❑ where:
6.	there was blinding of all therapists who administered the therapy	no ❑ yes ❑ where:
7.	there was blinding of all assessors who measured at least one key outcome	no ❑ yes ❑ where:
8.	measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	no ❑ yes ❑ where:
9.	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"	no ❑ yes ❑ where:
10.	the results of between-group statistical comparisons are reported for at least one key outcome	no ❑ yes ❑ where:
11.	the study provides both point measures and measures of variability for at least one key outcome	no ❑ yes ❑ where:

The PEDro scale is based on the Delphi list developed by Verhagen and colleagues at the Department of Epidemiology, University of Maastricht (*Verhagen AP et al (1998). The Delphi list: a criteria list for quality assessment of randomised clinical trials for conducting systematic reviews developed by Delphi consensus. Journal of Clinical Epidemiology, 51(12):1235-41*). The list is based on "expert consensus" not, for the most part, on empirical data. Two additional items not on the Delphi list (PEDro scale items 8 and 10) have been included in the PEDro scale. As more empirical data comes to hand it may become possible to "weight" scale items so that the PEDro score reflects the importance of individual scale items.

The purpose of the PEDro scale is to help the users of the PEDro database rapidly identify which of the known or suspected randomised clinical trials (ie RCTs or CCTs) archived on the PEDro database are likely to be internally valid (criteria 2-9), and could have sufficient statistical information to make their results interpretable (criteria 10-11). An additional criterion (criterion 1) that relates to the external validity (or "generalisability" or "applicability" of the trial) has been retained so that the Delphi list is complete, but this criterion will not be used to calculate the PEDro score reported on the PEDro web site.

The PEDro scale should not be used as a measure of the "validity" of a study's conclusions. In particular, we caution users of the PEDro scale that studies which show significant treatment effects and which score highly on the PEDro scale do not necessarily provide evidence that the treatment is clinically useful. Additional considerations include whether the treatment effect was big enough to be clinically worthwhile, whether the positive effects of the treatment outweigh its negative effects, and the cost-effectiveness of the treatment. The scale should not be used to compare the "quality" of trials performed in different areas of therapy, primarily because it is not possible to satisfy all scale items in some areas of physiotherapy practice.

Last amended June 21st, 1999

Appendix 4: Details of vision disorders/ problems seen by orthoptists

Disorder/ disease	Australian	International
Acute acquired tropia		UK[72]
Age-related macular degeneration	Grey[1,8,9,73]	
Amblyopia (including strabismic)	Peer-reviewed[74] Grey[1,9,73]	Austria[75] Canada[65,76,77] Germany[29,75,78-82] Netherlands[36-38,40,52,55,79,83,84] Pakistan[85] Sweden[86] Switzerland[75] UK[75,87] USA[35,88,89]
Ametropia		Italy[90]
Anisometropia		Italy[90]
Anterior and posterior segment injuries (combined)		Germany[91]
Aphakia	Peer-reviewed[20]	
Astigmatism		Italy[90]
Asthenopia	Peer-reviewed[43]	
Cataracts (including congenital)	Peer-reviewed[20,21] Grey[45,73]	Sweden [92] UK[28]
Chronic progressive external ophthalmoplegia		UK[93]
Compressive optic neuropathy	Peer-reviewed [56]	
Convergence deficiency	Peer-reviewed [43]	
Corneal scarring		UK[28]
Decompensating phoria (eso, exo, hyper)		UK[53]
Decreased/ poor visual acuity	Peer-reviewed[19,21,74]	Canada[94] Netherlands[52] UK[28]
Diabetic retinopathy/ eye disease	Peer-reviewed[31,95] Grey[45,73]	France[30,96]
Dilated pupils	Peer-reviewed[43]	
Diplopia	Peer-reviewed[13,41,43]	UK[53,72] USA[88,97]
Dry eyes	Peer-reviewed[21]	
Duane's retraction syndrome		UK[28]
Dyslexia		France[98]
Ectopic lentis	Peer-reviewed[20]	
Eye & ocular problems	Peer-reviewed[48]	
Eye movement disorders (e.g. following a head injury or stroke)	Grey[1,8,73]	
Flashes or floaters	Peer-reviewed[21]	
Fusion disruption		Saudi Arabia[99]
Glaucoma	Peer-reviewed[21,100] Grey[1,8,9,45,73]	Japan[33] New Zealand[100]
Heterophoria	Peer-reviewed[101]	
Heterotropia	Peer-reviewed[101]	

Hyperopia		Italy[90]
Inferior oblique muscle overaction		UK[15]
Inferior rectus underaction		UK[53]
Intermittent exotropia (including distance)	Peer-reviewed[67]	Iran[102] Singapore[34] UK[103,104]
Internuclear ophthalmoplegia		UK[53]
Macular pathology (including holes)		Canada[105] USA[97] UK[14,32]
Myopia	Peer-reviewed[106]	Italy[90]
Nystagmus		Canada[65] UK[28]
Near reflex spasm		UK[53]
Orbital cellulitis		UK[53]
Orbital dacryoadenitis		UK[53]
Orbital fracture	Peer-reviewed[107]	UK[53]
Orbital metastases		UK[53]
Orthophoria		Italy[108]
Phoria		Singapore[34]
Presbyopia		Canada[109]
Ptosis		UK[28]
Red eyes	Peer-reviewed[21]	
Refractive error/ symptoms	Peer-reviewed[20,21,101] Grey[110 45]	Netherlands[55] Pakistan[69]
Strabismus	Peer-reviewed[13,111] Grey[73]	Canada[65,109] France[112] Italy[108] Netherlands[16,54,55,83,113] Russia[112] Sweden[86] UK[28,114] USA[88,89,115]
Superior oblique myokymia		UK[53]
Vertigo		China[116] France[116]
Visual fields testing and management	Peer-reviewed[43] Grey[7,110]	
Vision impairment/ pathology	Peer-reviewed[117]	UK[49]
Visual neglect	Peer-reviewed[41,43] Grey[118]	

UK: United Kingdom, USA: United States of America

Appendix 5: Co-morbidities of patients seen by orthoptists

Condition	Australian	International
Angelman Syndrome		Italy[90,119]
Blocked ventriculoperitoneal shunt		UK[53]
Brain tumours	Peer-reviewed[56]	
Brainstem lesions		UK[53]
Cochlear implant		Ireland[59]
Cranial nerve paralysis		UK[53]
Deaf		Greece[120] UK[120]
Demyelination		UK[53]
Depression	Peer-reviewed[44,121]	
Developmental disorders		Netherlands[54]
Diabetes	Grey[45]	France[30,96] UK[53]
Down Syndrome		UK[64]
Hydrocephalus		Sweden[86]
Hypertension		UK[53]
Infants of opiate dependent mothers	Peer-reviewed[111]	
Intellectual disabilities	Peer-reviewed[68]	
Malignancy		UK[53]
Migraine		UK[53]
Miller Fisher syndrome		UK[53]
Multiple disabilities	Peer-reviewed[117]	
Multiple sclerosis	Peer-reviewed[42]	
Myasthenia gravis		UK[53]
Myositis		UK[53]
Neurological conditions	Peer-reviewed[41]	
Neurosarcoid		UK[53]
Psychomotor retardation		Netherlands[54]
Sinusitis		UK[53]
Spina bifida cystica		Sweden[122]
Stroke	Peer-reviewed[43]	UK[23,49,51,123,124]
Temperomandibular dysfunction		Italy[125]
Thyroid conditions		UK[53]
Trauma		UK[53]

UK: United Kingdom

Appendix 6: Tasks performed by orthoptists

Task	Australian	International
Administer drugs	Grey[126,127]	
Assess accommodation	Peer-reviewed[128]	
Assess binocular vision		UK[15] USA[89]
Assess binocularity using 20 dioptre prism		UK[62]
Assess closing	Peer-reviewed[21]	
Assess colour vision	Peer-reviewed[11]	
Assess contrast sensitivity	Peer-reviewed[11]	
Assess corneal light reflex		UK[28]
Assess diplopia	Peer-reviewed[56]	
Assess eye dominance	Peer-reviewed[128]	
Assess extraocular movements		Spain[129] UK[129]
Assess fixation		UK[130]
Assess head posture		Germany[26,78]
Assess lid function	Peer-reviewed[21]	UK[23]
Assess intraocular pressure (including the use of air tonometer)	Peer-reviewed[12]	France[131]
Assess isotropia photorefraction		UK[132]
Assess monocular fixation pattern		Germany[81]
Assess monocular logMAR acuity		UK[62]
Assess motor fusion		UK[14,133]
Assess ocular alignment	Peer-reviewed[101]	Italy[90] Netherlands[55] UK[23,28,124,134]
Assess ocular motility/ movement (including smooth pursuit and saccadic movement, including with a Goldmann telescope)	Peer-reviewed[11,12,41,56,67,68,128,135]	Belgrade[136] Germany[26,78] Greece[120] Iran[102] Ireland[59] Italy[90,108,125] Netherlands[55] Serbia[136] UK[14,15,23,25,28,49,61,93,120,124,130,133,134] USA[115]
Assess pupils (e.g. direct and consensual pupil reaction to light)	Peer-reviewed[12,21,68]	UK[23,25]
Assess reference eye	Peer-reviewed [128]	
Assess refraction (including cycloplegic, and autorefraction)	Peer-reviewed[12,21]	Belgrade[136] Iran[102] Italy[90] Netherlands[16] Serbia[136] UK[61,62,137] USA[115]

Assess retinal correspondence		UK[23]
Assess sensorial status		Italy[108,125]
Assess stereoacuity	Peer-reviewed[68,135]	Belgrade[136] Canada[27,105] Germany[29] Greece[120] Ireland[59] Serbia[136] UK[14,28,76,120,133] USA[115]
Assess stereo function		Germany[81]
Assess stereopsis	Peer-reviewed[11,12,128]	Netherlands[55] UK[23,49,62]
Assess strabismus		Germany[26] UK[25,61,137]
Assess suppression		UK[15]
Assess the AC/A ratio		Iran[102]
Assess the angle of strabismus (near and far fixation)		Germany[81] Netherlands[16,113]
Assess the optic nerve head		Japan[33]
Assess the quality of fixation		UK[130]
Assess vergence (convergence/ divergence, and fusional vergence)	Peer-reviewed[42,68,128]	Belgrade[136] China[116] France[116] Iran[102] Italy[125] Netherlands[55] Serbia[136] UK[23,61,130,132,134] USA[138]
Assess visual acuity (corrected and uncorrected, including Snellen)	Peer-reviewed[11,12,19,21,41,42,56,67,68,95,128,135]	Belgrade[136] Canada[27,105] France[30] Germany[26,29,78,81] Greece[120] Iran[102] Ireland[59] Italy[108] Netherlands[16,37,38,40,55] Serbia [136] Spain[129] UK[15,28,61,76,120,124,129,133,137,139,140] USA[35,115]
Assess visual fields	Peer-reviewed[11,19,41141] Grey[73]	UK[15,23,124]
Assess visual neglect/ inattention	Peer-reviewed[41]	UK[124]
Assist in surgery	Grey[73]	USA[89]
Conduct a prism tests		Spain[129] UK[14,25,28,129,130,132]

Conduct a mallet unit test		UK[142]
Conduct a prism reflex test		UK[28]
Conduct automated refraction test		Netherlands[113]
Conduct biometry		UK[143]
Conduct perimetry (including computerised)	Grey[110]	UK[124]
Conduct corneal pachymetry	Peer-reviewed[141] Grey[73]	
Conduct corneal topography	Peer-reviewed[12]	
Conduct cover tests (including prism cover tests, near and distant, unilateral and alternating)	Peer-reviewed[12,41,42,56,67,68,128]	Belgrade[136] China[116] France[116] Germany[26,29,78] Iran[102] Ireland[59] Italy[125] Netherlands[16,113] Serbia[136] Spain[129] UK[14,15,23,28,61,62,129,132,133,137,139] USA[35,115]
Conduct cycloplegic retinoscopy		Netherlands[113]
Conduct a dilated fundoscopy		Iran[102]
Conduct functional investigations		France[71]
Conduct fundus photography	Peer-reviewed[31]	
Conduct Hirschberg test		Germany[29] UK[132]
Conduct hole in card test	Peer-reviewed[12]	
Conduct ocular dominance testing	Peer-reviewed[12]	
Conduct on-road driving assessments (including eye movement patterns, and identification of vision-based information in the driving environment)	Peer-reviewed[11]	
Conduct optical coherence tomography	Peer-reviewed[141]	UK[32]
Conduct photorefraction test		Netherlands[113]
Conduct stereotests		Spain[129] UK[76,129,133]
Conduct the Maddox test (rod and cross)		Canada[125] China[116] France[116] Netherlands [113]
Conduct tonometry (including applanation)	Peer-reviewed[21,68,100,141]	New Zealand[100]
Conduct prism tests (near and distant)		UK[133]
Conduct prism vergence testing		UK[28] USA[35]
Conduct stereo retinal imaging		Japan[33]
Conduct ultrasonography (A scans)	Peer-reviewed[141]	

	Grey[110]	
Conduct uncover tests (near and distance)		Germany[26] UK[137]
Conduct convergence training	Peer-reviewed[43]	
Correct refractive error	Peer-reviewed[74]	
Conduct visual training		USA[89]
Dispense binocular vision corrections		France[71]
Detect amblyopia		UK[137]
Detect heterophoria decompensation		UK[142]
Detect hypermetropia		UK[137]
Educate parents about hygiene and care of contact lenses	Peer-reviewed[20]	
Educate the family about the use and care of Bangerter foil		USA[35]
Examine the cornea	Peer-reviewed[12]	
Examine the retina	Peer-reviewed[12]	
Explain diagnostic findings and/or management options with the patient, parents, teachers and other health and/or medical professionals	Peer-reviewed[43,117]	Netherlands[36,38,40] UK[123]
Imaging the back of the eye	Grey[73]	
Inspect the anterior eye		Canada[27] Germany[26] Netherlands[55]
Instillation of eye drops, including anaesthetic, dilating and fluorescent drops	Peer-reviewed[21,68,141]	
Measure eye pressure	Grey[73]	
Measure fusion amplitude in synoptophore		Belgrade[136] Serbia[136]
Measure fusional vergence reserves		UK[142]
Measure phoria (using Maddox wing)		Belgrade[136] Serbia[136]
Measure strabismus		USA[89]
Observation of misalignment		UK[134]
Perform visual rehabilitative procedures		France[71]
Prescribe atropine	Peer-reviewed[74]	
Prescribe and modify glasses/ lenses	Peer-reviewed[43] Grey[1,3,73,110,144,145]	Austria[75] Germany[75] Sweden[86] Switzerland[75] UK[75] USA[88]
Prescribe occlusion	Peer-reviewed[41,43,74] Grey[118]	Austria[75] Canada[76] Germany[75,79] Netherlands[36-38,40,52,79,83,84,146] Switzerland[75]

		USA[88] UK[75]
Provide advice regarding head positioning	Peer-reviewed[41,43]	
Provide advice regarding positioning of reading material	Peer-reviewed[42]	
Provide convergence therapy	Peer-reviewed[43]	USA[88]
Provide ongoing guidance and counselling	Peer-reviewed[20]	
Provide pre-operative counselling	Peer-reviewed[12]	
Provide technical and clinical support to ophthalmic surgeons	Grey[3]	
Provide visual aids	Grey[110]	
Recommend exercises (including for fusion, convergence)	Grey[118]	Singapore[34] USA[88,89]
Recommend prisms	Peer-reviewed[41,43] Grey[118]	UK[147] USA[88]
Take fundus photographs		France[30,96,131]
Take measurements prior to cataract surgery	Grey[73]	
Teach parents to insert, clean and remove their infants contact lenses	Peer-reviewed[20]	
Teach scanning to compensate for visual field loss	Peer-reviewed[43]	
Test with synophtophore	Peer-reviewed[13]	
Train a nurse to conduct vision screening for children		Canada[27]
Training school teachers in eccentric viewing to assist students	Peer-reviewed[19]	
Trial contact lenses	Peer-reviewed[12]	
Use prism bars		China[116] France[116]
Use Hess charts		UK[15]
Use Plusoptix Vision Screener		UK[148]
Use synoptophore technique		China[116] France[116]
Video refraction measurements		UK[25]
Visual neglect training	Peer-reviewed[43]	

UK: United Kingdom, USA: United States of America

Appendix 7: Critical appraisal of the included randomised controlled trials using the PEDro Scale [6]

PEDro Item	Loudon[36]	Tjiam[38]
Eligibility criteria were specified	Yes	Yes
Subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	Yes	Yes
Allocation was concealed	Yes	Yes
The groups were similar at baseline regarding the most important prognostic indicators	Yes	Yes
There was blinding of all subjects	No	No
There was blinding of all therapists who administered the therapy	No	Yes
There was blinding of all assessors who measured at least one key outcome	No	Yes
Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	No	Yes
All subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"	No	No
The results of between-group statistical comparisons are reported for at least one key outcome	Yes	Yes
The study provides both point measures and measures of variability for at least one key outcome	Yes	Yes
Total	*6/11*	*9/11*

Appendix 8: Work settings

Task	Australian	International
Baby clinics		UK[25,132]
Community health centres	Grey[1,3,149]	
General practitioner surgeries		UK[61]
Hospitals (within general and special eye clinics, strabismus clinics, orthoptic departments, stroke units, ophthalmology departments and centre for vision independence)	Peer-reviewed[20,43,47,63,111,121] Grey[1,3,8,45,110]	France[98] Iran[102] Pakistan[69] Netherlands[37,38,40,55] UK[103] USA[115]
Health facilities	Peer-reviewed[48]	
Home clinic		Sweden[86]
Low vision clinics	Peer-reviewed[57] Grey[1,3,8,45,110]	
Medical centres		UK[61]
Ophthalmic/ophthalmology department		Germany[82] Sweden[122]
Ophthalmology clinic	Peer-reviewed[141]	
Ophthalmology practices	Grey[1,3,110]	
Orthoptic department		Netherlands[146] UK[53]
Outpatient ophthalmology clinic	Grey[110]	
Outpatient orthoptic clinic	Peer-reviewed[56]	Netherlands[52,83]
Primary care facilities		France[30] UK[140]
Private practice*	Peer-reviewed[21,44] Grey[1,3,8,110]	
Rehabilitation clinics	Grey3,8	
Research centres	Grey8,45	
Research clinic^		UK[139]
Schools/ kindergartens	Peer-reviewed[19,68]	Germany[26,29] Spain[129] UK[28,62,129]
Special schools		UK[61,64]
Specialist eye clinic	Grey[45]	
Stroke service		UK[124]
Tertiary referral centres		Singapore[34]
University eye clinic (including eye and ophthalmological)		Italy[108] Netherlands[16,150]

UK: United Kingdom

Appendix 9: Colleagues

Task	Australian	International
Health professionals	Peer-reviewed[43]	
Neuropsychologist		Sweden[86]
Nurse		Canada[27]
Ophthalmic nurses	Peer-reviewed[44,121] Grey[1,110]	
Ophthalmic surgeons	Grey[3]	
Ophthalmologists (including registrars)	Peer-reviewed[44,100,111,121,141] Grey[1,8,110]	Canada[77]
Optometrists	Peer-reviewed[44,121]	
Paediatric ophthalmologist		Sweden[86]
Physiotherapists	Peer-reviewed[43]	
Rehabilitation workers	Peer-reviewed[44]	
Special education teachers	Peer-reviewed[19]	
Support staff	Peer-reviewed[121]	