PROFESSIONAL BOARD FOR OPTOMETRY AND DISPENSING OPTICIANS

CLINICAL GUIDELINES FOR PAEDIATRIC EYE EXAMINATIONS

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ABBREVIATIONS & ACRONYMS

EUA	Examination under anaesthesia
VA	Visual acuity
IOP	Intra-ocular pressure
NPC	Near point of convergence
AC/A	Accommodative convergence/accommodation
PRA	Positive elative accommodation
NRA	Negative relative accommodation
MEM	Monocular estimate method

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INTRODUCTION

Early detection and treatment of eye and vision problems in children is important as vision plays a critical role in a child's physical, cognitive, and social development. Uncorrected vision disorders and eye conditions can interfere with learning, and in some cases lead to permanent vision loss. In addition, vision disorders in childhood may continue to affect one's health and well-being into adulthood.

This guideline, for Paediatric Eye Examinations recommends examination procedures for evaluation of the eye health and vision status of infants and children to reduce the risk of vision loss and facilitate normal visual development. Furthermore, the guideline seeks to advise practitioners on developing an appropriate timetable for eye and vision examinations and selecting appropriate examination procedures to effectively examine the eye health and visual status of paediatric patients in order to minimise or avoid the adverse effects of eye and vision problems.

The practitioner should establish a diagnosis, formulate a management plan. In some cases, a tentative diagnosis may be reached, and the patient may be referred for further care to another health care professional. In addition, practitioners should also be aware of ocular manifestations of child abuse and neglect such as external and/or retinal eye trauma and signs of Shaken Baby Syndrome.

For the purpose of this guideline, we will consider the following age group categories (1):

Infants and Toddlers	New-born - 2 years & 11 months
Preschool Children	3 - 5 years & 11 months
School-age Children	6 -18 years of age

1. EXAMINATION OF INFANTS AND TODDLERS

Eye and vision examination of infants and toddlers may include but is not limited to the following aspects of care:

1.1 Patient history

1.1.1 A comprehensive patient history for infants and toddlers should include:

a. Nature of the presenting problem including the chief complaint
b. Visual and ocular history.
c. General health history including prenatal, and postnatal care.
d. Family eye and medical histories, and
e. Developmental history of the child.

1.1.2 Having the parent/s fill out a questionnaire facilitates obtaining the patient history.

1.2 Visual acuity measurements

1.2.1 Assessment of visual acuity for infants and toddlers with age-appropriate methods and techniques. Estimation of visual acuity also helps to assess the level of binocularity.

1.2.2 Subjective visual acuity (VA) testing requires verbal identification of targets may not be suitable for infants and toddlers.

1.2.3 Binocular status may result in making certain hypotheses/ assumptions about VA e.g., when a unilateral, constant strabismus is present, visual acuity is presumed to be reduced in the strabismic eye, while in an alternating strabismus, visual acuity is likely to be normal in both eyes.

1.3 Refraction

1.3.1 Objective measures of refraction are preferred e.g.,

a. Cycloplegic retinoscopy; and
b. Age-appropriate retinoscopy.

1.4 Binocular vision assessment

1.4.1 The following procedures are useful for assessing binocular function:

a. Cover test
b. Angle Kappa and Hirschberg test
c. Krimsky test
d. Bruckner test

e. Versions
f. Near point of convergence

1.4.2 Cover test may be most useful for evaluation of binocular vision in preverbal children.

1.4.3 The Hirschberg test, Krimsky test and Bruckner test are useful in infants.

1.5 Eye health assessment

1.5.1 An evaluation of ocular health may include:

a. Evaluation of the ocular anterior segment and adnexa.
b. Evaluation of the ocular posterior segment.
c. Assessment of pupillary responses; and
d. Visual field screening (confrontation).
e. Pupil function (direct, consensual, and afferent pupil integrity)

1.5.2 The cover test and versions, both important binocular vision assessment procedures, are important for ocular health assessment. For example, the presence of strabismus may indicate diseases such as neoplasm, neuromuscular disorder, infection, vascular anomaly, or traumatic damage.

1.5.3 Gross external ocular evaluation or the eye and adnexa should also be conducted.

1.5.4 In children between the ages of 6-9 months evaluation using a penlight or transilluminator may also prove useful.

1.5.5 With the older infants a variety of interesting targets that can be attached to the transilluminator.

1.5.6 A hand-held biomicroscope may be used for evaluation of the anterior segment

1.5.7 If a corneal problem is suspected attempt an examination using sodium fluorescein and a Burton lamp if it is not possible to use a slit lamp biomicroscope. Another simple alternative is to use a self-illuminated, hand-held magnifying lens, or a 20D condensing lens with a light source.

1.5.8 When adequate fundus examination is indicated by the patient history but not possible, examination under anesthesia/sedation (EUA) may be warranted and will require referral to an ophthalmologist.

1.5.9 Measuring intraocular pressure (IOP): Glaucoma may be suspected in the presence of corneal edema, increased corneal diameter, tearing, and myopia. the Hand-held

applanation and non-contact tonometers may be useful for this. EUA may also be indicated to r/o glaucoma.

1.5.10 Imaging tests are sometimes indicated in consultation with a paediatric ophthalmologist or neurologist. Signs such as nystagmus, developmental delay, poor growth, regression of skills, and seizures along with relevant symptoms and risk factors are important indicators.

2. EXAMINATION OF PRESCHOOL CHILDREN (3 - 5 YRS & 11 MONTHS OF AGE)

a. Although the vast majority of children in this age group can communicate verbally, it is preferable in most cases for the parent/caregiver to accompany the child into the examination room.
b. It is important to ensure that the child feels relaxed and at ease, therefore begin the examination with procedures that appear less threatening.
c. Age-appropriate examination and management strategies should be used with preschool children.
d. The examination of the preschool child may include, but is not limited to:

2.1 Case history

2.1.1 A comprehensive patient history for the preschool may include:

a. Nature of the presenting problem, including chief complaint.
b. Visual and ocular history.
c. General health history, including prenatal, perinatal and postnatal history and review of systems.
d. Family eye and medical histories; and
e. Developmental history of the child.

2.2 Visual acuity measurements

2.2.1 An assessment of visual acuity with age-appropriate methods and techniques.

2.3 Refraction

2.3.1 Measurement of refractive error may involve:

a. Dry retinoscopy
b. Cycloplegic/wet retinoscopy

2.3.2 A video projection system or television is a valuable means of controlling accommodation atfixation when performing static retinoscopy in preschool children.

2.3.3 Using a lens rack or trial lenses and fogging glasses rather than phoropter is advised in order to see the child's face and observe when the child loses fixation.

2.3.4 Cycloplegic retinoscopy is an important procedure for the first examination of preschoolers especially in the presence of strabismus and significant refractive error.

2.4 Binocular vision assessment

2.4.1 The following procedures are useful for assessing binocular and accommodative function:

a. Cover test.
b. Positive and negative fusional vergences (prism bar/step vergence testing)
c. Near Point of Convergence – objective (NPC)
d. Stereopsis
e. Monocular estimation method (MEM) retinoscopy or similar dynamic retinoscopic method
f. Versions
g. Measurement of amplitude of accommodation / accommodative facility

2.4.2 If necessary, the cover test can be performed in other cardinal positions of gaze to examine for non-comitant deviations.

2.4.3 Prism bars enable measurement of the deviation. The results of the cover test can also be combined with version testing to rule out the presence of a non-comitant deviation.

2.5 Eye health assessment

2.5.1 An evaluation of ocular health may include:

a. Evaluation of the ocular anterior segment and adnexa.
b. Evaluation of the ocular posterior segment.
c. Colour vision testing.
d. Assessment of pupillary responses; and
e. Visual field screening (confrontation).

2.5.2 Traditional testing methods used to assess ocular health in adults, including dilated funduscopy can often be used in preschool children.

2.5.3 Hand-held applanation or non-contact tonometers can be used for the measurement of IOP.

2.6 Supplemental testing

2.6.1 When the preschool child's history indicates a possible development lag or a learning problem, a developmental visual perceptual screening test may help to diagnose visual information processing problems.

2.6.2 Testing can help assess developmental level, detect visual perceptual dysfunction, and enable early identification of children at risk for the development of learning related vision problems. The assessment of visual perceptual development may include:

a. Denver Developmental Screening Test (DDST)
b. Developmental Test of Visual Motor Integration (DTVMI)

2.6.3 Referral to an occupational therapist and/or paediatrician may also be indicated.

3. Examination of School-age Children (6 through 18 years of age)

3.1 Patient History

3.1.1 A comprehensive **patient history** for the school-age child may include:

a. Nature of the presenting problem, including chief complaint
b. Visual and ocular history
c. General health history, including prenatal, perinatal, and postnatal history and review systems
d. Family eye and medical histories
e. Developmental history of the child; and
f. School performance history

3.1.2 Special attention should be paid to school performance due to the critical relationship between vision and learning. Probe for signs and symptoms suggestive of a learning related vision problem.

3.2 Visual acuity measurement

Visual acuity may be assessed with the Snellen acuity chart which may need to be modified for children 6-8 years of age by isolating specific lines or characters.

3.3. Binocular vision assessment

3.3.1 Evaluation of binocular and accommodative function and ocular motility may include the following procedures:

a. Cover test
b. Near point of convergence (NPC)
c. Positive and negative fusional vergences.
d. Accommodative amplitude and facility, including accommodative convergence/accommodation (AC/A) ratio, fusional vergence amplitude, vergence facility, negative relative accommodation (NRA) and positive relative accommodation (PRA) tests
e. Monocular estimation method (MEM) retinoscopy or any other related retinoscopy method
f. Stereopsis
g. Versions - assessment of stability of fixation, saccadic function, and pursuit function

3.3.2 Symptoms such as eyestrain, blurred vision, double vision, loss of place, skipped lines, word movement on the page, inability to sustain attention when reading, and decreased reading comprehension over time may indicate accommodative, binocular vision and/or oculomotor dysfunction.

3.3.3 Careful evaluation of these conditions in the school-age population is critical due to the impact on learning.

3.4 Refraction

3.4.1 Measurement of refractive error is critical in this age group and cognizance should be taken of myopia management concepts. The following procedures are recommended:

a. Static (distance) retinoscopy
b. Cycloplegic retinoscopy; and
c. Subjective refraction.

3.4.2 For children over the age of 8 years, conventional assessment procedures to measure refractive error can be used.

3.4.3 For patients below the age of 8 years, static retinoscopy may be performed using trial lenses and fogging glasses.

3.4.4 Cycloplegic refraction may be necessary in such conditions as strabismus, amblyopia, significant hyperopia and/or binocular and accommodative anomalies.

3.5 Eye health assessment

3.5.1 An assessment of ocular health may include:

a. Evaluation of the ocular anterior segment and adnexa
b. Evaluation of the ocular posterior segment
c. Measurement of intraocular pressure
d. Colour vision testing
e. Assessment of pupillary responses
f. Visual field screening (confrontation)

3.5.2 Traditional testing procedures used in adults can be used with school-age children including the use of a slit lamp biomicroscope to evaluate the anterior segment and conduct binocular indirect ophthalmoscopy to evaluate the posterior segment on dilated pupils.

3.5.3 IOP can be measured with either applanation or non-contact tonometry.

3.6 Supplemental testing

3.6.1 Visual information processing function must be evaluated. If the patient history indicates a possible developmental lag or a history of learning problems, a visual perceptual screening is warranted. Two tests available for probing these areas are the Gardner Reversal Frequency Test-Recognition subset (directionality) and the Development Test of Visual Motor Integration.

3.6.2 If problems are suspected in other developmental areas such as behaviour, language, or social development are detected refer the patient to the relevant health care practitioner.

4. Patient education

4.1 Educate the patient, parents or caregivers about eye or vision disorders, the recommended treatments and the importance of further care.

4.2 Eye safety, the risks of incurring sports-related eye injuries and how to reduce such risks should also be addressed.

4.3 Emphasise early preventive eye care, including recommendations of when children should have routine eye examinations done i.e., at the age of 6 months, at age 3 years, before entering first grade, and periodically during the school years (Table 1).

4.4 The presence of certain risk factors and/or eye conditions may necessitate more frequent examinations. Develop a schedule for the required re-examinations.

References

1. Evidence-Based Clinical Practice Guideline: Comprehensive Paediatric Eye and Vision Examination. American Optometric Association.
2. Horwood, M. (2019). Clinical Examination of Ocular Alignment and Binocular Vision in Infants Under Six Months of Age. Knights Templar Eye Foundation: Paediatric Ophthalmology Education Centre.
3. Paediatric Eye Care Reference Guide. Optometry Australia Clinical Practice Guide for Paediatric Optometry.

Table 1: Recommended examination interval for paediatric patients

Patient age	Examination interval	
	Asymptomatic (risk-free/true negative)	**At risk (true positive)**
Birth to 24 months	At 6 months of age	At 6 months of age or as recommended
2 to 5 years	At 3 years of age	At 3 years of age or as recommended
6 to 18 years	Before first grade and every 2 years thereafter	Annually or as recommended

Table 2. Summary: Clinical Practice Guide

EXAMINATION PROCEDURE	Infants and Toddlers new-born - 2 years & 11 months	Preschool Children 3 - 5 years & 11 months	School-age Children 6 -18 years of age
Patient history	f. Nature of the presenting problem including the chief complaint; g. Visual and ocular history; h. General health history including prenatal, and postnatal care; i. Family eye and medical histories, j. Developmental history of the child.	k. Nature of the presenting problem including the chief complaint; l. Visual and ocular history; m. General health history including prenatal, and postnatal care; n. Family eye and medical histories, o. Developmental history of the child.	p. Nature of the presenting problem, including chief complaint; q. Visual and ocular history; r. General health history, including prenatal, perinatal, and postnatal history and review systems; s. Family eye and medical histories; t. Developmental history of the child; and u. School performance history.
VA	a. Fixation preference tests, and b. Preferential looking visual acuity test e.g. Teller Acuity cards	a. Lea Symbols chart; b. Broken Wheel acuity cards; and c. HOTV test.	Snellen acuity chart (modified for children 6-8 years of age).
Refraction	c. Cycloplegic retinoscopy; and d. Near retinoscopy.	c. Static retinoscopy d. Cycloplegic retinoscopy	d. Static (distance) retinoscopy; e. Cycloplegic retinoscopy; and f. Subjective refraction.
BV assessment	g. Cover test h. Hirschberg test i. Krimsky test j. Bruckner test k. Versions l. Near point of convergence	h. Cover test; i. Positive and negative fusional vergences (prism bar/step vergence testing); j. Near Point of Convergence (NPC); k. Stereopsis; l. Monocular estimation method (MEM) retinoscopy; and m. Versions.	h. Cover test; i. Near point of convergence (NPC); j. Positive and negative fusional vergences; k. Accommodative amplitude and facility; l. Monocular estimation method (MEM) retinoscopy; m. Stereopsis; and n. Versions.
Eye Health	f. Evaluation of the ocular anterior segment and adnexa; g. Evaluation of the ocular posterior segment; h. Assessment of pupillary responses; and i. Visual field screening (confrontation).	f. Evaluation of the ocular anterior segment and adnexa; g. Evaluation of the ocular posterior segment; h. Colour vision testing; i. Assessment of pupillary responses;	g. Evaluation of the ocular anterior segment and adnexa; h. Evaluation of the ocular posterior segment; i. Measurement of intraocular pressure; j. Colour vision testing;

	j. Pupil function (direct, consensual, and afferent pupil integrity)	j. Visual field screening (confrontation); and k. Pupil function (direct, consensual, and afferent pupil integrity)	k. Assessment of pupillary responses; and l. Visual field screening (confrontation). m. Pupil function (direct, consensual, and afferent pupil integrity)
Supplemental Tests		The assessment of visual perceptual development may include: a. Denver Developmental Screening Test (DDST) b. Developmental Test of Visual Motor Integration (DTVMI)	Relevant visual integration and perceptual assessment procedures.