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Examining Children

Examining children often requires an adapted approach to both communication style and the tests used. This booklet aims to guide optometrists through what can be a very rewarding process.

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Contents

0.1 Introduction

Many optometrists are reluctant to examine children, particularly pre-school children. For many, this is the result of imagined difficulty and, possibly, lack of confidence.

For the optometrists contributing to this programme, examining a child patient is no more difficult than an adult; in fact in many cases they feel it is easier. It certainly can be very rewarding!

Examining children

0.2

Key points

Examining children is NOT more difficult than examining adults

- Create a child-friendly environment:
  - A low table and chairs for the waiting room
  - Have a supply of toys, colouring materials etc.

Take a pragmatic approach

- You may not be able to do every test at one visit:
  - You may not be able to do retinoscopy
  - You may not be able to do a subjective routine
  - You may not be able to do a cover test
- Abandon tests quickly if they are not successful and move on
- A series of short visits may be more productive than one long one
- Do not be afraid to re-book.

You must learn to trust your observations

- Rely on objective not subjective findings
- Results will vary – especially retinoscopy and cover test findings.

Absolute accuracy is not the key goal

- 0.50 D sphere errors or a small cyl not corrected is not important.

The structure of your routine needs to be fluid and adaptable

- Base it on the presenting history
- Begin with something achievable, ie cover test or stereopsis.

Managing the parental expectations may be the hardest part

- Address parents' concerns:
  - Why have you come?
  - Are you worried?
  - What are you worried about?
- Don't be dismissive.

Communicate with the child at their level

- Talk to child NOT parents
- Address child by name frequently
- Praise the child, don't criticise.
- Above all: MAKE IT FUN!

0.3 General issues

Always bear in mind that to the child an optometric practice is an unfamiliar and threatening environment. Much can be done to minimise the threatening nature by adapting the practice to take into account the concerns a child patient might have. If possible, adapt an area to be child friendly: bright cheerful colours, furniture such as tables and chairs at a child's height, toys, books and drawing materials will all help to put the child at ease.

It is also important to communicate with the child on their level using language that they will understand, but without being patronising. Talk to the child, rather than the parents, addressing them by their name frequently.

If in the consulting room the child is wary and intimidated, sitting the child, particularly a pre-school child, on the parent's lap may help to minimise the threatening nature of the practice environment, the consulting room equipment and indeed the optometrist themselves. A whole examination can be conducted in this way.

Making the examination fun is in many respects the key to success. If you are able to, try and turn the examination and its individual elements into a game. The use of toys in the examination itself, as fixation objects for example, will help foster this fun element.

Normal development of vision can only be established by comparing the performance of a particular patient with the expected level of development for a child of that age. The refractive findings, level of visual acuity and binocular vision must be compared to the expected level of achievement for the child's peer group to establish normality or otherwise.

0.4

Safeguarding

Best practice with regards to Safeguarding is to ensure that a parent or guardian is available to accompany a child patient (of any age) into the consulting room.

Further information on Safeguarding can be found in the Docet Safeguarding course.

Safeguarding Children for Optometrists Level 2

Safeguarding children

0.5 Examination routine

Don't expect your examination of a child patient to mimic the routine you would use on an adult. Your routine needs to be flexible and adaptable and you should be prepared to abandon a particular test if it is not successful and move on to something else, or use an alternative technique. Indeed the order in which tests are conducted might seem quite illogical. The only important rule is that you do the tests that you believe are necessary; the order in which they are done does not matter.

Base the structure of your routine on the presentation and the history of each individual patient.

It is important not to be frustrated or concerned about minor variations or perceived lack of accuracy in the results of clinical investigations. It is important, though, to have confidence and to be able to trust your own observations. Absolute accuracy in the examination of a child patient is not critical. A sphere which is 0.50 D out, or failure to correct a small cylinder, is not going to affect the visual development of the child. It should be expected that findings will fluctuate, particularly retinoscopy and cover test results.

Don't expect to necessarily get all tests completed on one single visit. Depending on the level of cooperation and alertness of the child this may not be possible. Split the routine into smaller, more manageable elements that the child can cope with and re-book for another day to complete your examination.

It will help the routine to run smoothly if the child has a success rather than a failure early on. For that reason it may be better to pick something like the cover test to begin rather than checking vision or visual acuity first. Any child over 36 months should have stereopsis, so that may be a good place to start.

It is particularly important to be positive and encouraging to the child even if they do not perform a test well, praising rather than criticising them. However it is not necessary to pretend that every test has a successful result and showing failure is acceptable. Do end the examination on a positive note, however, and finish with a success, even if it is necessary to return to a test completed earlier. Finishing on a line of letters on the chart that you know the child can see and praising the result works well and is a good standby.

0.6 History and symptoms

History and symptoms will inevitably come from the parents who will be expressing their own concerns about their child's vision. The "symptoms" will be largely based on parental observation of the child's behaviour to give clues to the state of the vision. So it is important to establish a few basic questions:

- Why have you brought your child in to be examined?
- Are you worried about your child's vision?
- What are you worried specifically about?

Never underestimate or dismiss a parent's concerns or observations; they are rarely wrong.

It is helpful to ask questions relevant to a child patient and the symptoms they are likely to experience. For example, children rarely complain of symptoms such as headaches and won't experience diplopia.

Always bear in mind any risk factors that might apply and in particular relevant family history, such as high refractive error and squint. Always obtain as much information about an absent parent as diplomatically as possible, bearing in mind there might be a relationship with the child but not the other parent.

Specific elements of the child's history and the mother's pregnancy may be of great importance. Maternal illness during pregnancy, prematurity at birth, a difficult or assisted delivery may have relevance for the development of the child's visual system.

1.0 Visual acuity testing

Norms

Table 1 below gives average expected visual acuity measures for children from birth to six years of age. In young children visual acuity values tend to vary depending which type of test is used.

The following reference provides an additional guide to testing the visual acuity of young children: Saunders, K. (2010) Testing Visual Acuity of Young Children: An Evidence-based Guide for Optometrists. Optometry in Practice, 11(4), 161-168.

Test types by age

Birth to 12 months

Preferential Looking Cards (eg Keeler Acuity Cards)
Occlusion behaviour
Hundreds and thousands
Visually directed reaching
Peekaboo Vision App by Glasgow Centre for Ophthalmic Research

12 months to 2.5 years

Cardiff Acuity Test
Hundreds and thousands
Peekaboo Vision App by Glasgow Centre for Ophthalmic Research

2.5 years onwards

Lea symbols
Kay Picture Test
Sheridan-Gardiner
Sonksen-Silver
Cambridge Crowding Cards
Crowded Kay Picture Test
LogMAR Crowded test
Snellen letters

Table 1

Age	Visual acuity test	VA < 6 weeks premature	VA 6 - 9 weeks premature	VA > 9 weeks premature	Near VA @ 25cm
Birth	Keeler PL cards	6/300			
One month	Keeler PL cards	6/200 – 6/90			
Three months	Keeler PL cards	6/90 – 6/60	6/90 – 6/75	6/130 – 6/90	
Six months	Keeler PL or Cardiff	6/36 – 6/30	6/60 – 6/50	6/75	
Nine months	Keeler PL or Cardiff	6/24	6/36	6/60	
One year	Cardiff cards	6/18	6/24	6/36 – 6/30	
18 months	Cardiff cards	6/12	6/18	6/24 – 6/18	
Two years	Cardiff or SG singles or Kays @ 3m	6/12 – 6/9	6/12	6/15 – 6/12	6/12 – 6/9
Three years	SG, Kay or logMAR singles @ 3m	6/9 – 6/6 singles	6/9 – 6/6 singles	6/9 singles	6/9 – 6/6
Four years	SG, Snellen or logMAR singles or Morph	6/9 – 6/6 Morph	6/6 Morph	6/9 – 6/6 singles	6/6 or N5
Five years	SG, Snellen or logMAR singles or Morph	6/6 – 6/5	6/6 – 6/5	6/6 Morph	6/6 or N5
Six years	Snellen or logMAR Morph	6/6 – 6/5	6/6 – 6/5	6/6 – 6/5	6/6 or N5

Table 1: Age norms for visual acuity and the tests used (measurements are all approximate) (adapted from C. Rushen and L. Speedwell)

Preferential looking visual acuity (PL) cards

Although cooperation is known to decline noticeably around the age of 12 months, forced-choice preferential looking (PL) is regarded as a quick and sensitive indicator of monocular visual deficit in children under 1 year.

This test uses a series of rectangular cards with a patch of square-wave gratings of various spatial frequencies on one side and an equal sized patch of equal luminance in plain grey on the other. The cards are presented unseen by the optometrist and there is a peephole halfway between the two patches through which the optometrist watches the infant. A judgement must be made if it is fixating to the right or left (the forced-choice).

The test works on the basis that a child will prefer to look at an object with visual interest, ie the grating, rather than a plain field of the same luminance. When the grating is too narrow to be differentiated the child will gaze randomly at one side or the other. The card with the highest spatial frequency expected to be seen in accordance with the infant's age is presented to each eye, preferably twice, for a definite response. The visual acuity is estimated as the highest spatial frequency the child is believed to be able to see. The test seems to be equally effective if the patches are presented vertically so a variation of horizontal and vertical presentations helps to maintain the infant's interest.

Occlusion behaviour

From about three months of age, a child will object if an eye with better vision is covered while they are looking at something of interest. Gross loss of vision in one eye is unlikely if the baby appears equally happy and able with either eye covered.

Hundreds and thousands / visually directed reaching

Small cake decorations (100s & 1000s) held in the palm of the hand (or mother's hand) can be used to gain attention in the over six month olds. At nine months the baby may prod the decorations and at one year old attempt to pick them up. The cake decorations themselves should not however be regarded as a reliable measure of visual acuity: the average decoration held at 33 cm is roughly equivalent to 6/60 and when held at 25 cm, equivalent to 6/150.

Peekaboo Vision app

This app was released in 2016 and uses a preferential looking technique on a tablet device. When compared to Keeler Acuity Cards, results were similar (reference see below). Currently (Sep 2022) this app is available to download via this website:

https://www.peekaboo.scot.nhs.uk/

Reference: Livingstone I, Butler L, Misanjo E et al.(2019) Testing pediatric acuity with an iPad: validation of "Peekaboo Vision" in Malawi and the UK. Trans Vis Sci Tech. 8(1):8

Lea symbols

The Lea symbols are a means of testing visual acuity in children aged two to four years old.

Lea symbols

Described originally in 1980 they were devised by Lea Hyvärinen, a Finnish paediatric ophthalmologist. The symbols used were selected after a long period of research and trialling to conform to the following key principles:

- The test symbols are simple shapes familiar to small children
- They blur equally

- They are calibrated against Landolt C, the international standard reference optotype
- The spaces between optotypes are equal to the width of the optotypes
- The distance between the test lines is equal to the height of the lower line.

The test is made up of a combination of the Lea shapes, a square, a circle, a house, and an apple (heart), and may be applied as a line test or single symbols at near as well as far distances.

The test is easy to apply and well-accepted by children. The near test is contained on a reading card with large reference symbols printed at the bottom so the child can match the shape of the test symbol if they are unable or unwilling to name it. Visual acuity for distance is measured with the chart held at three metres. If that distance is too great for a young child, testing can be performed at two metres. In older children measurements can be made at distances up to six metres if required.

Kay Picture Test

The test comprises of a series of pictures. These pictures are of common objects that should be known to a child and the test is based on the child recognising and naming the object, although there are matching cards available for very shy children. It is effective and useful for children aged 2-3 years.

The test is currently (Sep 2022) available in a linear crowded format, measuring acuities from 0.7 to -0.2 logMAR and single crowded format, measuring acuities from 1.0 to -0.1. Older versions, showing single optotypes measuring acuity from 3/3 (6/6) to 3/30 (6/60), may also still be in use. However, where possible, the crowded, logMAR version should be used.

Recognition booklets can also be supplied and add to the usefulness of the test, as they can be loaned to a parent for practice in naming the pictures and having one eye occluded at home.

Sheridan-Gardiner test

In the Sheridan-Gardiner test single letters are displayed at either 3 or 6 metres and the child points to the matching letter on a key card. The test's main drawback is that it measures single letter visual acuity giving a misleadingly high result for children with amblyopia.

Sonksen-Silver acuity system

The Sonksen-Silver acuity system uses the Sheridan-Gardiner letter selection but presented in a line with standardised spacing to introduce crowding and remove the single letter advantage for amblyopes. The letters are matched on a key card in the same way as the Sheridan-Gardiner test.

Cambridge Crowding Cards

This is another test for use at 3m or 6m, designed to elicit the crowding phenomenon. The Sheridan Gardiner selection of letters is used and the child has to identify the letter which is surrounded by four others. The matching letters can be arranged so that there is no confusing resemblance to the letters displayed on the test card; this method is said to be more accurate than linear testing.

Although both the Sonksen-Silver acuity system and the Cambridge Crowding Cards are better than single letter presentation, they are difficult to administer without pointing, thus to some extent isolating the required letter.

2.0 Binocular status

Cover test

The cover test is one of the simplest objective tests to perform and yet potentially the most informative. It has the potential to give information about the type, size and control of a deviation, the likely binocular function present and the probable involvement of extraocular muscle anomalies. In order to maximise this potential though, it is vital that the child can be encouraged to fixate a suitable object appropriate for their age.

Suitable fixation targets can be many and varied. For a younger child a pen torch, retinoscope or ophthalmoscope light may be suitable, or a small, brightly-coloured, interesting toy may be used. As accommodation must be suitably stimulated, any fixation target should preferably have some visual interest. For an older child, a small graphical object recognisable to the patient, such as a cartoon character or a "budgie stick" might be more suitable.

Cover Test

Hirschberg test

This is a gross test of ocular alignment based on a subjective assessment of the position of the corneal reflex: the first Purkinje image. A pen torch is normally held in front of the child, close to, and in the same plane as, the examiner's eye. In an orthophoric infant the corneal reflex is just slightly nasal to the centre of each cornea due to angle lambda. If, however, the child has a marked squint then the apparent position of the reflex relative to the centre of the pupil will be displaced: towards the temporal side in the case of esotropia and towards the nasal side in the case of exotropia.

The following rule of thumb may be applied for any age of patient:

1 millimetre = 22 prism dioptres

20Δ Base-out test

The 20Δ base-out test is a basic test of motor fusion for children up to five years of age.

The presence of fusion is a sign that some degree of binocular vision has developed. A base-out prism is held before one eye while the child looks at a suitable fixation target. The eye behind the prism should adduct rapidly to restore normal fusion and quickly abduct again on removal of the prism. The speed of the fusion movements is a simple guide to the quality of the binocularity.

The following prisms are suitable:

Table 2

Six months of age	10Δ base-out
12 – 18 months of age	15Δ base-out
Over 18 months of age	20Δ base out

Other possible responses are:

- No movement – implies no fusion or lack of attention
- Slow to overcome the prism or slow to recover after the prism has been removed – implies poor fusion.

By the age of five years, a child should cooperate with the measurement of the prism fusion range using a prism bar. The normal range for near is 35 Δ – 45 Δ base-out to 12 Δ – 8 Δ base-in.

20Δ Base-out test

Motility test

Together with the cover test, the motility test is a key assessment when examining a child patient. It will give information about the range of ocular movements and whether they are concomitant or incomitant.

As with the cover test, success in motility testing for a younger child patient is heavily dependent on them being offered an interesting and stimulating fixation target. A wide variety of toys can be adapted for use as a motility target if they are reasonably small, have an interesting and stimulating appearance and/or are brightly coloured. It may help to attract or maintain the child's attention to have a toy that flashes, lights up, squeaks or has some other form of auditory stimulus. (Care should be taken to ensure that, if an auditory stimulus has been used to initially alert the child to the target, subsequent eye movements are assessed in relation to the visual stimulus only.)

In very young children it may not be possible to explain the nature of the test and what you expect of them to the child. In these situations, move the child rather than the stimulus; the so-called “swinging infant" procedure. In this technique the target is kept stationary and the child is rotated. It will be necessary for the parent, by gentle holding, to prevent the child from turning their head as they rotate them. If they have been successfully encouraged to direct their attention to the stimulus, they will maintain their fixation as they are rotated and their ocular motility is assessed.

Stereopsis

A high degree of stereopsis is proof of bifoveal fixation and good binocular vision, but a poor degree or absence of stereopsis is not necessarily associated with poor vision or poor binocular function. In practice, good stereopsis provides the examiner with confidence that a binocular vision anomaly is not present, whereas poor stereopsis requires careful assessment to establish the probable cause.

Stereopsis is known to be present in infants as young as four months of age, but in practice it may be difficult to demonstrate any stereopsis in children under one year of age. Table 3 below gives average expected stereo acuity measures for children. Stereo acuity values tend to vary depending which type of test is used.

Table 3

Age	Stereo (secs of arc)
Birth	
One month	
Three months	
Six months	600 Frisby
Nine months	300 Frisby
One year	210 – 170 Frisby
18 months	170 – 150 Frisby
Two years	100 – 85 Frisby
Three years	85 – 55 Frisby
Four years	40 – 30 Frisby
Five years	30 – 20 Frisby
Six years	10 – 5 Frisby

Table 3: Age norms for stereo acuity and the tests used (measurements are all approximate) (adapted from A. Grounds by C. Rushen and L. Speedwell)

The Lang test and the Frisby screening test are designed to produce a behavioural response: the child attempts to reach out and grasp the object, and may provide a result in some children as young as six to 12 months. In older children a variety of tests are available.

Stereopsis tests are available in a variety of designs and produce a three dimensional object in a variety of different ways. Most tests use simple geometrical shapes as test objects presented against a random patterned background. It seems to be unavoidable that stereo tests produce monocular clues of depth to some degree; precautions may need to be taken in the application of the tests to ensure that these clues are minimised. The following tests are in common use:

The Lang Stereotest

The Lang Stereotest is a screening test for young children and uses two images, reproduced in fine strips, which are separately seen by each eye when focused through a series of fine cylindrical lens elements. If binocularity exists in some part, then the images are fused and seen in depth. Its big advantage, particularly for younger children, is that no filters are required so no spectacles need to be worn.

Lang II sterotest

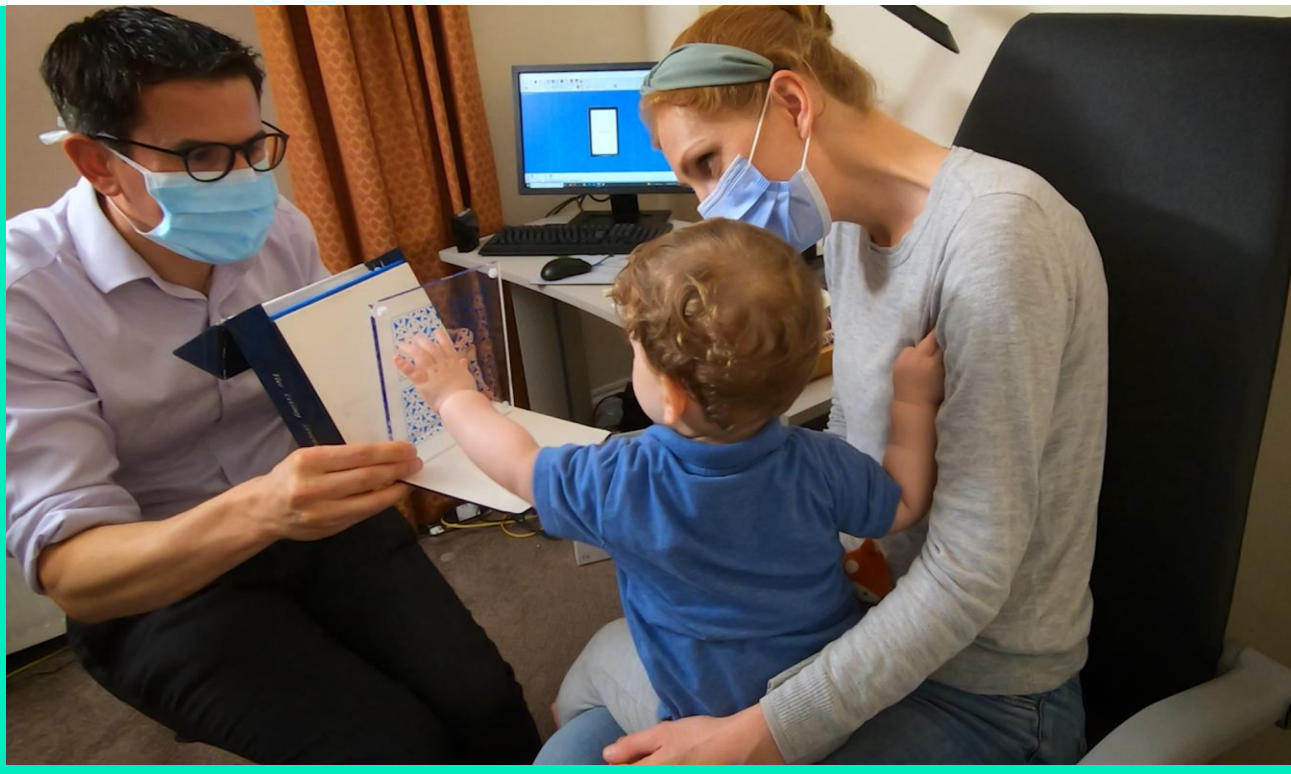
The test is available in two forms. The Lang I test measures stereopsis at 1,200, 600 and 550 seconds of arc and the Lang II test, which is finer, measures 600, 400 and 200 seconds of arc. The Lang II test also has an object (star) which is always visible, even with only one eye.

Answers can be checked by holding the test vertically, where stereo clues disappear, or by holding the test upside down when the object pattern is inverted.

The Frisby test

The Frisby stereotest presents objects viewed with "real" depth, that is, they do not use stereograms to create three-dimensional effects. As with the Lang test children avoid having to wear red/green or Polaroid spectacles. Care must be taken to avoid monocular clues through parallax movements when using the test. The test can measure stereo acuity in the range 600 – 15 seconds of arc.

The Frisby test is available in a screening version designed for younger children and infants. It presents a three-dimensional object field, together with a flat image side by side in a preferential looking format. In this case a spontaneous pointing or looking responses can be observed to establish that stereopsis is present.



Frisby test

TNO

The TNO test is a random-dot type of stereotest requiring the wearing of red and green glasses. It comprises seven test plates and comes in an adult and children's version. It can assess stereo acuity down to 15 seconds of arc.

The Titmus test

This is perhaps the most familiar stereo test because of its use of a large three dimensional fly to elicit a response in the vast majority of patients. It uses a crossed Polaroid visor to achieve stereopsis and in part cartoon characters to make the test more appealing to younger children. It suffers because of noticeable monocular clues which may be difficult to disguise. The Titmus test will assess stereo acuity from a gross 3552 – 700 for the fly and 800 – 40 seconds of arc for the graded tests.

The Randot test

The Randot test is in effect a modified Titmus test and is based on the same polarised design. It uses a random pattern background to remove many of the monocular clues present in that test.

3.0 Refraction

Norms

Refractive error in infants is predominantly hypermetropic; there are very few myopes. Table 4 lists average refractive errors throughout early childhood. As you will see from the table over the first two years of life the majority of this hypermetropic refractive error has disappeared and by four years of age it has more or less gone completely. This process is known as emmetropisation. A number of factors can disrupt the emmetropisation process and care may be needed in the management of refractive error in young children in order to avoid this.

Table 4

Age	Average Rx
Birth	
One month	
Three months	+3.00
Six months	+2.50
Nine months	+2.25
One year	+2.00
18 months	+1.50
Two years	+1.25
Three years	+1.00
Four years	+0.50
Five years	+0.50
Six years	+0.50

Table 4: Age norms for refractive error (measurements are all approximate).
(Adapted from A. Grounds by C. Rushen and L. Speedwell)

In addition to spherical refractive error, astigmatism of around 1 – 2 dioptres is common.

As with other areas of examining children described in this text, the assessment of refractive error will by necessity have to rely heavily on various objective retinoscopy techniques and the use of measures to control accommodation.

Static retinoscopy

This is the term used to describe distance fixation retinoscopy where the patient's accommodation is relaxed. This may be difficult to achieve in very young children, and the use of an assistant to encourage the child to maintain fixation can be very valuable. As with the motility test, flashing or squeaking toys can be very useful.

It is likely that for many children it is the retinoscope light itself which is the most interesting object and it may be very difficult to stop them looking at it rather than your intended target. If you are refracting an infant then this may be used to your advantage by adopting the Mohindra technique.

The Mohindra technique uses the retinoscope (held at 50cm) as the fixation target. Providing all other light sources in the examination room are extinguished, the child will fixate the retinoscope light but their accommodation will be relaxed. It is advised that the correction factor applied (to take account of the relaxed accommodation), should be adapted depending on the age of the patient. A correction factor of -1.25D for adults, -1.00D for children older than 2 years and 0.75D for those under this age, should be added to the final ret result.

With infants and very young children a trial frame is impractical and retinoscopy should be done by holding trial lenses in front of the patient's eyes. It may be easier to refract using spherical lenses only rather than attempt to hold a sphere and a cyl together.

Cycloplegic refraction

Cycloplegic refraction is an essential tool in the examination of children, although the application of the drops can be challenging for the child, the parents and the optometrist. Whilst it might be argued that for a cooperative child with good acuity, normal oculomotor balance, good stereopsis, no relevant family history and normal accommodation a cycloplegic examination may not be needed, with certain groups of children, a cycloplegic refraction should always be considered.

These are:

- Children with unexplained poor VA
- Children with poor stereopsis
- Children with an esophoria or manifest esotropia
- Children with over or underactive accommodation
- Children of parents with high hypermetropia or squint.

Various steps can be taken to minimise the discomfort and ensure that the cycloplegic can be instilled effectively:

- Proxymetacaine: Some practitioners advocate the use of Proxymetacaine 0.5%, immediately before the cycloplegic agent. Anaesthetising the cornea has been shown to reduce discomfort as the subsequent drops are instilled and the local anaesthetic can facilitate absorption of the cycloplegic agent. However, if the child objects to the first set of drops, the second set may be even harder to administer!

- Instilling on the eyelids: In cases where the child is reluctant to open their eyes to allow instillation of the cycloplegic agent, it is possible to drop it onto the closed eyelids. Enough of the drug will find its way through the closed lids for it to be effective.

For most children confidence and decisiveness are all that is necessary in order to effectively instil a cycloplegic.

For the vast majority of child patients Cyclopentolate 1.0% is the cycloplegic of choice. It is generally well tolerated, produces effective cycloplegia in most cases, requires no tonus allowance and is available in single dose preservative free modality.

Dynamic retinoscopy

Unlike static retinoscopy this is a technique where the patient is actively encouraged to accommodate. Rather than the retinoscope being used to assess the refractive error objectively, in this situation it is used to investigate the accommodative system itself by assessing its effectiveness. In a child with normal accommodation, theoretically a neutral reflex should be observed if the fixation is in the plane of the retinoscope itself. In practice this does not happen and a small **with** movement is observed. This is known as the "lag" of accommodation and a value of +0.25 to +1.00 is normally found.

If the fixation target is kept still and the retinoscope moved away from the patient, a point will be found where the reflex is neutral; the distance between the fixation target and the retinoscope equates to the lag. A lag greater than 1 D suggests a degree of hypermetropia that the child cannot manage. An unequal lag between the two eyes suggests a degree of anisometropia that is poorly compensated for.

Dynamic retinoscopy

The Ulster-Cardiff Cube (UC-Cube) was developed by Maggie Woodhouse (Cardiff University) and Kathryn Saunders (University of Ulster) to provide a quick, objective method for measuring accommodation accuracy. The UC-Cube provides an illuminated target with a variety of pictures, letters and numbers and the optometrist then measures where the patient's eyes are focusing as they look at the target. As this is an objective method, it is useful to use for children and those with learning disabilities.

4.0 Colour vision

Congenital colour vision defects are present in around 8% of boys and around 0.5% of girls. In most cases the defect causes no appreciable handicap in normal life. It is of value for a child patient and their parent to know if a defect is present so that certain decisions – particularly career-related – can be approached in an informed way.

Ishihara test

This pseudoisochromatic plate test is the most commonly used of all colour vision tests. It is intended to be used in northern daylight at a viewing distance of 75 centimetres. The test will identify protan and deutan defects, but is very sensitive and can only very crudely quantify a defect. Although the majority of the plates rely on numeracy skills there are a number where finger tracing of a winding line can be utilised.

Color Vision Testing Made Easy

Color Vision Testing Made Easy is a 14 plate pseudoisochromatic test that uses common objects such as a dog, balloon, car and boat and symbols such as squares, circles and stars, rather than numbers or letters. This makes the test simple to use on young children as well as people with learning disabilities. It was designed by US optometrist Terrace Waggoner and is intended for children aged 3 to 5 years, although it can be successfully used on older and younger age groups.

The test is quick and easy to administer and is divided into two parts. Part I uses two of the symbols, and each of these cards is designed so that a colour deficient person can always see at least one of them and therefore does not get discouraged or self-conscious. This device also allows the tester to verify that the child understands the test and is cooperating. Part II uses the objects for matching or tracing with very young children.

The test strategy allows a child to be scored and a quantifiable result is obtained. The response patterns of the normal and colour deficient child are clear-cut so that a diagnosis can be made with a high degree of confidence.

5.0 Management

Key points

The hardest part of managing the child patient may be managing parental expectations.

Parents are often told to do something but are not given an explanation of why. Parents find this is very frustrating and it has an adverse effect on compliance.

- All members of the optometric team should be confident that they have the appropriate skills and expertise before managing any child.
- Refractive error plays a significant part in the aetiology and management of strabismus and/or amblyopia. Children with these conditions should have regular refractions (normally this will be approximately at least once a year) with fundus examinations undertaken as appropriate.
- Strabismus may be indicative of wider ocular or neurological pathology and in best practice should be referred for ophthalmic and orthoptic assessment.
- Many children with anisometropic amblyopia can be managed by optometrists in the community. The improvement of vision in the amblyopic eye with the use of spectacles alone should be monitored regularly over a six-month period. The child will require referral to an ophthalmologist if:
    - There is no improvement on two consecutive visits during this period, and
    - The vision is still below normal or
    - Vision improvement is not sustained.

Refractive correction

The following Guidelines for Prescribing have been drawn up by Dr Margaret Woodhouse of the Department of Optometry & Vision Sciences at Cardiff University and are widely thought to represent current good practice.

Note: Although evidence based, these represent Margaret's personal opinion and are published for guidance only. Other practitioners may adopt different criteria.

Children of any age

Consider prescribing in cases of:

- Extreme refractive errors for age
- Strabismus and/or amblyopia
- Persistent anisometropia (over 1.00D seen on at least two visits three months apart). Depending on other factors, such as the level of refractive error in the "better" eye, prescribing the inter-ocular difference only may be acceptable.

Children under two years of age

- Monitor refractive error only.

Children over two years of age

Consider prescribing in cases of:

- Significant refractive error that is not decreasing.

What is a significant refractive error (in children over two years)?

- Hypermetropia of +3.00D or greater
    - Prescribe reduced by 1.00D each eye if no BV anomalies
- Myopia of –0.75D or greater
    - Since very young children are interested mainly in near, prescription not needed
    - Prescribe full amount when child begins to need clear distance vision
- Astigmatism (in the absence of hypermetropia/myopia) of 2.50D or greater.

Children with Down's syndrome and cerebral palsy (and other disabilities)

- Are less likely to emmetropise, so consider prescribing for refractive errors earlier
- Are likely to have poor accommodative responses, so DO NOT reduce hypermetropic prescription
- Are likely to benefit from bifocals or other style of near prescription.

Squint and amblyopia

Several risk factors can be analysed to predict the possible development of squint and/or amblyopia and help plan a management strategy.

Family history of squint, amblyopia and high refractive error, prematurity and low birth weight are significant risk factors.

David Stidwell offers the following guidance:

- The onset of strabismus (and therefore strabismic amblyopia) has an age distribution very similar to the critical period, ie most children develop tropias between six months and five years, with a peak at 21 months for non-accommodative esotropia and 30 months for both partially and fully accommodative esotropias.

- Refraction over +2.00 in the better eye, anisometropia over +1.50, and a pre-existing marked heterophoria (or any combination of these) are predictable risk factors.

- Bilateral ametropia over +6.00 will produce bilateral amblyopia rather than strabismus.

- Monocular ametropia with the better eye under one dioptre will produce straight anisometropic amblyopia.

- The higher the refractive error and the higher the anisometropia the earlier the strabismus and/or amblyopia will occur, so:

    - R +2.00DS L +6.00DS will produce both anisometropic amblyopia starting from two months old and
    - An accommodative strabismus starting from three or four years old.

Occlusion

Whilst initial management for amblyopia with a refractive component is usually by way of correcting the refractive error, in some cases, occlusion may also be needed. The visual acuity at first examination and compliance with occlusion are now thought to be the main predictors of the visual outcome in children prescribed occlusion for amblyopia. Hours of occlusion and age at first visit do not seem to be associated with better outcomes.

In general, occlusion therapy should be part-time, to avoid the risk of inducing deprivational amblyopia in the "good" eye, and should be effective in all cases. Patching for two to three hours per day, preferably combined with detailed visual tasking such as drawing or computer and video games, has been shown to be as effective as longer periods and avoids many of the pitfalls of occlusion therapy and helps to improve compliance.

Detailed instruction, together with the reasoning for the therapy, should be given to the child and their parents.

Referral criteria

- If you do not feel you have the skills and expertise to manage the child appropriately then refer.
- Large angle squints may require surgery and should be referred.
- If referring a child with squint, consider the length of time to first appointment and the effect this may have on the degree of amblyopia. Consider interim occlusion therapy.
- Refer anisometropic amblyopia when, on two consecutive visits during the first six months of refractive correction:
    - No VA improvement is shown
    - The VA remains below an acceptable level
    - An early VA improvement is not sustained.

Further information

The College of Optometrists
https://www.college-optometrists.org/

The Association of Optometrists
https://www.aop.org.uk/

Lea Symbols
http://www.lea-test.fi

Kay Picture Test
http://www.kaypictures.co.uk

Color Vision Testing Made Easy
http://colorvisiontesting.com/color5.htm

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