Can I have a “P” please?

What P is a branch of medicine that deals with the care of infants, children and adolescents who come in different sizes, shapes, and colours, from different economic backgrounds, have different tastes, a limited attention span, frequently squirm and can be quite vocal when displeased? Paediatrics!

Andrew Keirl discusses infant refractive errors, examination, prescribing and anthropometry.

Refractive Errors in Children

Both the refraction and dispensing of children requires knowledge of the expected levels of visual acuity and also the expected refractive errors for various age groups. Such information is often termed age-related normal values or norms. Studies of early refractive development have shown the average newborn refractive error to be +2.00 D (±2.00). Hypermetropia increases from birth and peaks at 3 to 6 months of age. It then gradually decreases towards emmetropia (via the process of emmetropisation) at about 6 years of age. The most rapid decline in hypermetropia occurs between 6 months and 2 years of age and the emmetropisation process is complete in over 80 per cent of children by 12 months of age. Children who develop strabismus do not generally show emmetropisation and often demonstrate either increasing hypermetropia or no change in refractive error.

Useful facts relating to refractive errors in children

- Approximately 8% of 5 to 7 year olds have more than 0.75 D of astigmatism
- 15-30% of 6 to 15 year olds are myopic
- 5 to 7 year olds with a refraction close to emmetropia are at the greatest risk of developing juvenile myopia
- High myopia is associated with ocular and systemic diseases in young children such as retinal dystrophies, lenticular abnormalities and Marfan's syndrome

Interestingly, premature babies have been shown to be less hypermetropic.

Table 1 gives age related norms for mean spherical refractive error from the age of 3 months to 4 years.

In many areas of the UK, vision screening of pre-school children does not take place and unfortunately some parents do not appreciate that regular NHS sight tests are available for all children under the age of 16 years. When a child presents for an eye examination their age will determine the ocular conditions that may be present (target conditions), the examination techniques that can be used and the visual acuity that is considered to be acceptable. Target conditions for pre-school and school entry children include strabismus and amblyopia. At age 7, myopia, significant hypermetropia, astigmatism, binocular vision problems and colour vision problems can be identified.
defects are target conditions. From the age of 11, myopia is the most significant target condition. Risk factors for the development of refractive error include:

- Prematurity
- Low birth weight
- Maternal disease
- Gender differences
- Ethnic differences
- Genetic predisposition
- Genetic conditions

**Astigmatism in children**

There is a high prevalence of against-the-rule astigmatism in newborn infants. Astigmatism is more common in infants than in adults and significant amounts of astigmatism are common in children under 3½ years of age. At birth a mean value of 1.00 dioptre of astigmatism is present which reduces to adult levels by 2 to 5 years of age. The age of 3½ years is important in the development of astigmatism for two reasons. Firstly, the prevalence of astigmatism drops significantly by this age and secondly, there is an increased prevalence of with-the-rule astigmatism. After 5 years of age, with-the-rule gains prevalence. Useful facts relating to astigmatism are:

- Astigmatism is greatest in the first 3 months
- 70% of 1 year-olds have >1.00D cylinder reducing to <5% by age 4

**Table 2** gives an overview of refractive error in 6 to 9 month old infants.

**Assessment of visual acuity**

In young infants who cannot respond verbally, visual function can be measured using either behavioural or electrophysiological techniques. Electrophysiological techniques such as visual evoked potentials (VEPs) measure the electrical responses of the nervous system as a result of visual stimulation. While this technique may be useful in hospital and research environments, it is rarely applicable in general optometric practice. However, VEP studies have demonstrated adult-like acuity responses at 12 months.

An example of a behavioural technique is preferential looking (PL) where the infant’s direction of gaze is observed in response to a real stimulus and a null or control stimulus presented simultaneously. There are now numerous age-related tests available for the assessment of visual acuity in children. There is of course some variability in the accuracy of the tests available and some only provide an estimate of a child’s acuity. In most cases the result obtained will depend on:

- The acuity of the child
- The design of the test used
- The motivation and attention of the child
- The presence of any pathology
- The skill of the examiner

**Visual acuity testing from birth to 12 months**

Options include:

- Preferential looking
- Occlusion behaviour
- Hundreds and thousands

 Preferential looking (PL) tests such as the Keeler Acuity Cards (Figure 1) and the Cardiff Acuity Cards (Figure 2) measure resolution acuity and can be used to estimate the acuity of very young children. Such tests consist of a patterned and a plain background. The principle of the test assumes that the child will always look at a patterned background in preference to a plain one. The patterns used in PL tests are generally square-wave gratings (alternating black and white lines of equal thickness and length). A pair of lines (one white and one black) is known as a cycle. The
The gratings used in PL tests are described in terms of their spatial frequency (the number of black and white pairs or cycles in each degree of visual angle) and the higher the spatial frequency, the finer the grating. Within 60 minutes of arc (1 degree) there will be 30 cycles. The finest set of stripes which attract attention is therefore taken as an estimate of visual acuity.

When designing PL tests the stimulus must be isoluminant (equal average luminance) to the grey background (Cardiff Cards) or to the blank stimulus (Keller PL Test). This means that when the stimulus is beyond the resolution limit of the subject, the Cardiff Cards will look uniformly grey. In other words, the optotype has vanished. The Keeler PL Test will appear to have two grey circles of equal luminance within white circles and the infant will show no looking preference. When using a PL test the examiner must be unaware of the position of the stimulus when presenting it to the infant. This allows for an unbiased judgement of eye movements. Judgements regarding the position of the stimulus must be made using the eye movements of the child. The infant must correctly identify the position of the grating/optotype on at least three out of four presentations for that stimulus to be regarded as “seen”. Increasingly fine targets are presented until the point where the examiner is no longer able to correctly judge the position of the stimulus from the infant’s eye movements. It is important to note that PL testing provides an estimate of acuity. The Keeler Acuity Cards can be used from birth to one year and the Cardiff Cards from one year to two-three years. The Cardiff Cards have the patterns presented at the top and bottom of the charts, which is helpful when examining children with nystagmus. The Keeler Acuity cards are printed in a horizontal orientation although the card can of course be held vertically. The Cardiff Cards are not good at detecting amblyopia so crowded optotype tests should be used as soon as the child is able to manage a letter based test. The Keeler Test is used at 38 cm. The Cardiff Cards can be used at either 50 cm or 1 m. Figure 3 illustrates the development of visual acuity from birth to 4 years as measured using preferential looking.

Alternate occlusion (Figure 4) is a very basic method of vision assessment that can be performed in infants of only a few weeks old. During this totally objective test, the infant’s behavioral response to the alternate occlusion of each eye is assessed. The response should be identical on both sides. If the child appears to object to one eye being covered amblyopia in the contralateral eye should be suspected.

**Visual acuity testing from 12 months to 2½ years**

Options include:

- Cardiff cards
- Letter matching

**Visual acuity testing from 2½ years onwards**

Options include:

- Kay pictures
- Lea symbols
- Sheridan-Gardiner
- Sonksen-Silver acuity test
- Keeler logMAR crowded test (Glasgow acuity cards)
- Crowded Kay pictures
- logMAR acuity charts
- Snellen letters

**Letter and picture tests**

Amblyopia is one of the important target conditions when examining pre-school children. It is initially detected as a reduction in visual acuity and is either strabismic or refractive (anisometropic) in origin. In strabismic amblyopia, visual acuity is much worse for crowded than for isolated targets. Since one of the main goals of measuring...
Figure 3: The development of acuity from birth to 4 years as measured using preferential looking.

Figure 4: Alternate occlusion

Figure 5: A single Kay Picture with contour interaction lines to induce crowding (Test Chart 2000 pro).

Figure 6: logMAR LEA Symbols (Test Chart 2000 pro).

Figure 7: The Sheridan-Gardiner Test.

Figure 8: Single Sheridan-Gardiner letter with contour interaction lines to induce crowding (Test Chart 2000 pro).
visual acuity in young children is to detect strabismic amblyopia, crowded targets should be used whenever possible when measuring the vision of young children. The crowding phenomenon is described as difficulty in discriminating visual acuity tests when they are presented next to each other in a row whereas single tests of the same size are resolved and is relevant to the design and use of picture and letter tests that employ single optotypes. It is important to stress that the use of single letters or pictures can overestimate acuity in amblyopic subjects. For children aged between 2 and 4 years various crowded acuity charts are available which are usually supplied with marching cards. By the age of 4-5 years, most children can read or match letters on a Snellen or logMAR chart which should be presented in a crowded format.

Kay Pictures (Figure 5) will be familiar to most practitioners. The original letters, presented in booklet form, were based “loosely” on the design of Snellen letters and consist of easily recognisable shapes such as a house or cat with one shape on each page. Pictures are difficult to standardise in terms of detail and spatial frequency and a lack of uniformity in targets at the same acuity level will reduce the sensitivity of the test. However, logMAR and also crowded tests are now available. A recognition booklet is provided to help determine how the child interprets each shape. For example the house shape may be interpreted as a box or a home. Kay Pictures are available in 3 and 6 meter versions. In addition, many electronic and computer based testing systems incorporate Kay Pictures as standard.

LEA Symbols (designed by Lea Hyvärinen) are suitable for children aged 18 months and above and consists of 4 symbols (Figure 6) along with a key card for naming or pointing. The shapes used are a house, heart (or apple) circle and square. All four symbols are equally sensitive to blur and equally difficult to distinguish. This means that when blurred, all the symbols appear as “circle” or “ball”. The symbols are easy to name, sign or point to on a key card. The symbols used conform to the logMAR design in terms of detail, line width and overall size and are therefore more sensitive than the original Kay Pictures.

As far as tests incorporating single letters are concerned, the most commonly test used is probably the Sheridan-Gardiner test (Figure 7). This test can be used at either 3 or 6 metres and is available in 5 or 7 letter formats. It consists of five booklets containing single letter optotypes on each page. Three booklets assess visual acuity from 6/60 to 6/18, 6/18 to 6/6 and 6/6 to 6/3. A forth booklet has one letter at each acuity level and can be used to assess visual acuity from 6/60 to 6/6. There is also a booklet for measuring reduced Snellen visual acuity and near vision in N notation. The original letters were designed using un-crowded Snellen letters which would of course overestimate acuity in amblyopic eyes. Electronic test charts can easily present single letters in a crowded format by adding contour-interaction lines (Figure 8). The Sheridan-Gardiner can be used with young children and also when measuring the acuity of intellectually impaired adults. The lack of crowding inherent in the original Sheridan-Gardiner test was addressed with the Sonksen-Silver acuity test. In this test the letters are presented in a row, spaced at intervals of one letter width. This spacing allowed the introduction of contour interaction (crowding), although only in the horizontal meridian.

**Keeler logMAR crowded test**

This test was originally known as the Glasgow Acuity Cards® and was designed to reflect the principles of the logMAR chart. The letters in the Glasgow test were designed for presentation at 3 m in a flip card format. Each page presents four letters contained within a box, providing both horizontal and vertical contour interaction for each letter (Figure 9). The design features of the Glasgow cards are:

- Linear progression of letter sizes using a logarithmic scale
- Letters of approximately equal legibility
- Equal number of letters per line
- Control of contour interaction
- Screening cards to determine initial level of acuity

The test is quick and easy to perform and provides an accurate method of detecting a change in letter acuity.

**Visual acuity testing for older children**

Conventional letter tests such as the Snellen and logMAR charts are suitable for most five year olds. Alternative but seldom used tests include Landolt C’s, (broken wheel test) and Tumbling E’s (Figures 10 and 11).

**What is normal?**

The question that has not yet been addressed is what level of visual acuity is normal? The answer to this question depends on what method has been used to measure the acuity. As an example, if the visual acuity of a 6 month old child was measured using visual evoked potentials the expected or normal result would be an acuity equivalent to 6/12. However, if preferential looking was used the expected result would be 6/60. So which is correct? The answer is “both” depending on which method is used. Whatever
Figure 10. Landolt Cs.

Figure 11. Tumbling Es.

Figure 12. Pseudo-deviations

Figure 13. Patient demonstrating a large right esotropia.

Figure 14. Patient has a fully accommodative esotropia.
method is employed, the norms for the test used must be known as the level of acuity will vary with the test used (Table 3).

**Strabismus**

Strabismus occurs when the visual axes are misaligned and the two eyes do not therefore point directly at the object of regard. Approximately 2-4 per cent of the population have a strabismus. Risk factors for the development of strabismus include:

- genetic predisposition (positive family history)
- refractive error (significant hypermetropia)
- prematurity and birth trauma (esotropia)
- maternal drug use (all types of strabismus)
- genetic conditions (Down’s syndrome)
- secondary to systemic conditions (cerebral palsy)
- secondary to ocular conditions (albinism)

Occasionally a young child’s facial anatomy can give the impression of a squint and cause concern to a parent. These pseudo-deviations are illustrated in Figure 12. The most common strabismus associated with spectacle wear is an esotropia which is an inward turning of the eye and is illustrated in Figure 13. Esotropias can be non-accommodative, fully accommodative or partially accommodative. As the term suggests, a fully accommodative strabismus is corrected with spectacles (Figure 14).

The cover test (Figure 15) is arguably the most useful test in the assessment of binocular anomalies and is the only test that differentiates a strabismus (heterotropia) from a Heterophoria. The cover test is usually performed at distance (6 m) and near (33 cm) with the near test using both unaccommodative and accommodative targets. There are two versions of the cover test. These are the cover/uncover test which is used to detect strabismus and Heterophoria and the alternate cover test which is used in the assessment of Heterophoria.

**Stereopsis**

Stereopsis is the highest grade of binocular vision and its presence indicates that the optical, neural and motor functions of both eyes are adequate. Assessment of stereopsis is frequently easier than monocular acuity in 1-2 year olds. By the age of 3, a stereoacuity of 60 seconds of arc is achievable. Several tests for stereopsis are available (Figure 16) some of which require the use of a polarising or a red-green filter.

- No spectacles: Lang I & II, Frisby
- Red-green spectacles: TNO
- Polaroid spectacles: Titmus, Randot

**Amblyopia**

Amblyopia has been defined as a visual loss resulting from an impediment or disturbance to the normal development of vision. It usually exists when an early interruption to the development of vision such as strabismus or anisometropia causes a visual deficit which, in later life, cannot be corrected.
using spectacles. Amblyopia can develop up to about the age of 7 to 8 years. This is known as the **sensitive period**. During this period, any disruption to binocularity or to a clear image in one eye is likely to cause amblyopia. There are several causes of amblyopia, the most common being strabismus and anisometropia or a combination of both. The prevalence of amblyopia is about 3%. Two approaches are commonly used to diagnose amblyopia. The first is simply a difference in acuities of two lines or more. The second is acuity in the amblyopic eye of less than 6/9. This assumes that the child is old enough for the visual acuity norms to be 6/6. Because of the crowding phenomenon, amblyopia must be investigated using crowded acuity charts.

**Treatment of amblyopia**

Treatment of amblyopia is by occlusion (Figure 17). However, treatment can only be effective if there is a clear retinal image so appropriate refractive correction and accurate dispensing is therefore essential. The duration of occlusion will vary with age of the patient and the type and depth of amblyopia present. Strabismic amblyopia must be treated before the age of 7-12 years. After this age, treatment is less likely to be effective and may also cause binocular sensory adaptations to strabismus to breakdown causing diplopia. For these two reasons (low probability of success and a risk of diplopia) it is usually recommended that strabismic amblyopia should not be treated over the age of 7-12 years. Anisometropic amblyopia is a refractive problem and treatment can be attempted at any age. It is important to remember that accurate refraction and dispensing is at core the of any treatment regimen.

**Spectacle frames and frame selection**

Frames selected for children should not be based solely on aesthetics. A frame selected for infant or young child must:

- Ensure an anatomically correct fit
- Place the lenses correctly in front of the eyes for the purpose of occlusion, accommodative control or the correction of a refractive error
- Be comfortable, stable and not damage the forming features
- Not inhibit the natural development of the nasal structure

The main features of spectacle frames for children compared with those for adults’ are:

- The crest height is lower
- The frontal angle is larger
- The splay angle is larger
- The frontal width is smaller
- The angle of side is smaller

In addition, and as a consequence of the child’s smaller cranial features:

- The boxed lens size will be smaller
- The lens aperture must have a shape that differs from adult designs
- The length to bend and the length of drop will be shorter
- The vertex distance is often very short

We often forget that the world we live and work in was built by (and for) adults. Because of this, children often have to look upwards resulting in the direction of gaze being through the gap between the upper rim of the frame and their eyebrows. This may be of little consequence for myopic children but could have repercussions for esophoric hypermetropes as an uncorrected accommodative esophoria may become decompensated and breakdown into an esotropia. And don’t forget that the underdeveloped nasal features of a child means that the spectacles often slip. It should be noted at this point that mechanical problems caused by the lenses might compound the problem of slipping. Stock uncut plus lenses that are much larger than the minimum uncut diameter, or plus lenses that have not been surfaced to produce minimum thickness may unnecessarily increase the weight of the appliance, which may cause further dispensing problems such as slipping frames and sore nasal areas.

The prerequisites of a child’s frame do not significantly differ from those of an adult’s frame. These are:

1. To hold the lenses in the required position
2. The frame must display stability, rigidity and strength
3. The frame must be comfortable to wear and give acceptable cosmesis
4. Best use must be made of the natural field of view

**Anthropometry for children’s spectacle frames**

Anthropometry is the study of human body measurements. Before the early 1960s, little interest was shown in the design of children’s spectacle frames. The literature does however contain several primary research papers concerning the relationship between the facial measurements of children and the manufacture of spectacle frames for use in paediatric dispensing. Important facial measurements in paediatric dispensing are bridge measurements, specifically...
the crest height, bridge projection, frontal angle and splay angle. These measurements are defined in Table 4 and illustrated in Figures 18 to 22. The corresponding frame measurements are defined in Table 5. It should be noted that bridge projection can be positive, negative or “zero”. Negative and zero bridge projections are often encountered when dispensing to younger age groups and negative bridge projections are sometimes referred to as “inset” bridges.

Table 6 is a compilation of the results of various studies found in the available literature and shows the mean values for children’s bridge measurements. The data shows that at around 13 years of age, the bridge dimensions are more or less equivalent to adult dimensions.

Most children’s facial measurements will equal those of adults by 13 years of age. The exceptions to this are the head width and the front to bend which both increased by approximately 10 mm after 13 years. Adult bridges have heights of 5-7 mm and splay and frontal angles of 20-25°.

The facial measurements of Afro-Caribbean children have also been studied and a summary of available data is given in Table 7. These differences are significant and indicate that the demographics of a practice may influence the design of children’s frames selected. Interestingly, there is little reference in the literature to the facial measurements of Oriental children.

In 1993, a study into the facial characteristics in children with Down’s syndrome was carried out by Woodhouse et al. This important and interesting study measured the facial characteristics in children with Down’s syndrome and compared them with two previous studies. The results of the study showed that between 7 and 14 years of age, the facial characteristics of children with Down’s syndrome do not change with age and rarely coincide with those of other children, either of a similar age or younger.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crest height</td>
<td>The vertical distance from the horizontal centre line of the front to the mid-point of the lower edge of the bridge</td>
</tr>
<tr>
<td>Bridge projection</td>
<td>The minimum horizontal distance from the back plane of the front to the centre of the back of the bridge</td>
</tr>
<tr>
<td>Frontal angle of pad</td>
<td>The angle between the vertical and the line of intersection of the pad plane with the back plane of the front</td>
</tr>
<tr>
<td>Splay angle of pad</td>
<td>The angle between the pad plane and a normal to the back plane of the front</td>
</tr>
</tbody>
</table>

Table 4. Definitions of the important facial measurements.

Table 5. Definitions of the corresponding frame measurements.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crest height</td>
<td>The distance, measured in the assumed spectacle plane, between the lower limbus and the nasal crest</td>
</tr>
<tr>
<td>Bridge projection</td>
<td>The horizontal distance between the assumed spectacle plane and the eyelashes in their most projecting position</td>
</tr>
<tr>
<td>Frontal angle</td>
<td>The angle between the vertical in the assumed spectacle plane and a parallel to the assumed bearing surface on the side of the nose</td>
</tr>
<tr>
<td>Splay angle</td>
<td>The angle between the assumed pad bearing area on the nose, and a normal to the assumed spectacle plane</td>
</tr>
</tbody>
</table>

Table 4. Definitions of the important facial measurements.

Table 5. Definitions of the corresponding frame measurements.

<table>
<thead>
<tr>
<th>Age</th>
<th>3 - 4½</th>
<th>4½ - 6</th>
<th>6½ - 8½</th>
<th>10 - 11½</th>
<th>13½</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crest height (mm)</td>
<td>-0.8</td>
<td>-0.5</td>
<td>+0.5</td>
<td>+2.4</td>
<td>+4.5</td>
</tr>
<tr>
<td>Projection (mm)</td>
<td>+0.2</td>
<td>+1.0</td>
<td>+1.4</td>
<td>+1.6</td>
<td>+3.0</td>
</tr>
<tr>
<td>Frontal angle (°)</td>
<td>34</td>
<td>34</td>
<td>32</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>Splay angle (°)</td>
<td>35</td>
<td>34</td>
<td>32</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

Table 6. Mean children’s bridge measurements

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Approximate difference for Afro-Caribbean children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crest height</td>
<td>-2 mm</td>
</tr>
<tr>
<td>Projection</td>
<td>-1 mm</td>
</tr>
<tr>
<td>Frontal angle</td>
<td>+7°</td>
</tr>
<tr>
<td>Splay angle</td>
<td>+9°</td>
</tr>
</tbody>
</table>

Table 7. Facial measurements of Afro-Caribbean children.

<table>
<thead>
<tr>
<th>Age</th>
<th>Crest height (mm)</th>
<th>Bridge projection (mm)</th>
<th>Frontal angle (°)</th>
<th>Splay angle (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0 to 8.9</td>
<td>-3.0</td>
<td>-1.0</td>
<td>26.3</td>
<td>33.8</td>
</tr>
<tr>
<td>9.0 to 11.9</td>
<td>-1.3</td>
<td>-2.4</td>
<td>26.4</td>
<td>35.0</td>
</tr>
<tr>
<td>12.0 to 14.0</td>
<td>-1.4</td>
<td>-2.8</td>
<td>26.3</td>
<td>33.8</td>
</tr>
</tbody>
</table>

Table 8. Means of crest height, bridge projection, frontal angle and splay angle for the three age groups investigated in the

Table 9. Summary of other facial measurements included in
The authors state that children with Down’s syndrome cannot be fitted satisfactorily with conventional children’s frames and suggest that a specially designed range of frames be made available.

Significant refractive error is very common among children with Down’s syndrome so the requirement for spectacles for this group is high. It has been reported that 77% of children with Down’s syndrome suffer from a refractive error\textsuperscript{16}. In Down’s syndrome, the nature of the ametropia can be myopia or hypermetropia and there is often a significant astigmatic error. Another study has shown that accommodative problems may require correction in up to 80% of school age children with Down’s syndrome\textsuperscript{17}. Other ocular problems associated with Down’s syndrome include cataract, nystagmus, strabismus and keratoconus. Subjects measured in the Woodhouse study were divided into three groups based on age. Table 8 gives the results for crest height, bridge projection, frontal angle and splay angle.

The crest height in children generally shows an increase with age, starting with a negative crest and becoming progressively more positive with age. The Down’s syndrome group showed a slight but insignificant increase with age. The Woodhouse study showed that crest height is lower in children with Down’s syndrome. The bridge projection in children also increases with age, starting at around zero and increasing to about 4-5 mm by 14 years. Bridge projection in Down’s syndrome appears to decrease with age. Children with Down’s syndrome have frontal angles that are smaller than expected and splay angles that are larger than expected. Other points of interest from the Woodhouse study are summarised in Table 9.

The Woodhouse et al study clearly shows that the Down’s syndrome child presents a special case in paediatric dispensing as there was not a single child in whom all facial measurements fell within the normal range. The other problem highlighted by the study was that the facial measurements of Down’s syndrome children were not consistently smaller or larger than expected. If the measurements were consistently larger or smaller one could simply fit a frame designed for an older or younger child. On occasions, the only option for a Down’s syndrome child would be the supply a hand made frame.
About the author

Andrew Keirl BOptom (Hons) MCOptom FBDO

Following qualification as a Dispensing Optician Andrew worked as a practice manager from 1982 to 1984 before being appointed Training Officer for Dollond and Aitchison. In 1988, he was asked to join the then Anglia Higher Education College in Cambridge to instigate and develop courses in Ophthalmic Dispensing. During his last four years at APU he joined the Optometry programme as a part-time student while at the same time, retaining a full-time teaching and administrative role. Andrew qualified as an Optometrist in 2003. He currently works as an Optometrist, Dispensing Optician and Contact Lens Practitioner in his own independent practice in South East Cornwall. He has served on many of the Association of British Dispensing Opticians (ABDO) committees over the years including its Academic Committee and has lectured extensively in the UK on both pre-registration and continuing education and training (CET) courses. In addition to UK activities Andrew has lectured and examined in several overseas countries including Singapore, Malaysia, Kenya, Germany, Ireland, Sweden and Zimbabwe.

Andrew has previously held the posts of External Examiner in Ophthalmic Dispensing at Bradford College, External Examiner for the Visual Sciences Department within School of Life and Health Sciences at Aston University and Subject Editor (Ophthalmic Lenses and Dispensing) for the CET Journal Optometry in Practice.

References


Acknowledgements

Figure 12 is taken from Kanski JJ *Illustrated Tutorials in Clinical Ophthalmology* published by Butterworth-Heinemann. The author gratefully acknowledges the kind permission of Mr Jack Kanski to use this image.

Figure 22. The splay angle
Further recommended reading


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Schramm K D. Dispensing Pediatric Eyewear. Butterworth Heinemann, Boston, USA.

Walsh G (2007) Introduction to binocular vision part 1 Dispensing Optics 22 (9) 10-18

Walsh G (2008) Introduction to binocular vision part 2 Dispensing Optics 23 (1) 4-12

To take the test online:

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- You will need your current Employee number to enable you to access the system.
- When requested, you will also need to enter your current GOC number (format 01-12346 or D-1234
- If you do not have a current GOC number and have been given a temporary Username from the GOC then contact us directly to be given an access code.
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- You may save the test at any point to return to later
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- The answers to each question will appear in random order, so if you have prepared the answers in advance then please check that you are entering your responses correctly.
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www.clearviewtraining.co.uk
Multiple Choice Questions

1. What type of astigmatism (if any) is present in most new born babies?
   A  No astigmatism
   B  A small amount of with the rule astigmatism
   C  A high level of oblique astigmatism
   D  A high level of against the rule astigmatism

2. What refractive errors would we not expect to find in children below the age of 3½ years?
   A  A Moderate degree of hypermetropia
   B  A high prevalence of astigmatism
   C  A very low prevalence of anisometropia
   D  Myopia

3. The most common refractive error found in 4 to 5 year old children is:
   A  Low hypermetropia
   B  High myopia
   C  Low myopia
   D  High levels of against the rule astigmatism

4. Which of the following is the most appropriate test for an eighteen month old child?
   A  Keeler acuity cards.
   B  Snellen letters
   C  logMAR acuity cards
   D  Cardiff cards.

5. Which of the following anomalies of binocular vision is often fully controlled using spectacles?
   A  Partially accommodative esotropia
   B  Fully accommodative esotropia
   C  Incyclotropia
   D  Nystagmus

6. Tests that present optotypes in a crowded format must be used when which of the following conditions is suspected?
   A  Myopia
   B  Hypermetropia
   C  Amblyopia
   D  Astigmatism

7. Which of the following statements is true when comparing a frame measured, fitted and adjusted for a child with one measured, fitted and adjusted for an adult?
   A  The frontal width of the child's frame is larger
   B  The crest height of the child's frame is lower
   C  The frontal angle of the child's frame is smaller
   D  The angle of side of the child's frame is larger

8. With reference to frame and facial measurements, which of the following statements is not correct?
   A  Bridge height is synonymous with crest height
   B  Crest height is defined as the distance, measured in the assumed spectacle plane, between the lower limbus and the nasal crest
   C  The careful selection of crest height can be used to control the vertical position of a frame
   D  The careful selection of bridge projection can be used to control the vertex distance of a frame

9. Generally speaking, which two facial measurements remain largely unchanged from childhood through to adulthood as the facial features develop?
   A  Splay angle and frontal angle
   B  Crest height and bridge projection
   C  Head width and front to bend
   D  Angle of crest and apical radius

10. With regard to the facial measurements of a child with Down's syndrome, which of the following statements is correct?
    A  The crest height increases with age from a negative value to a positive value
    B  The bridge projection decreases with age and is usually less than expected
    C  The frontal angle is larger than expected
    D  The interpupillary distance is larger than expected

11. Which of the following ocular conditions is not associated with Down's syndrome?
    A  Significant refractive error
    B  Accommodative problems
    C  Retinitis pigmentosa
    D  Strabismus

12. With regard to children's facial measurements, which of the following statements is most correct?
    A  The head width reaches adult dimensions at age 13.
    B  The front to bend reaches adult dimensions at age 13.
    C  The bridge height usually becomes more positive as children grow.
    D  The bridge projection usually becomes more negative as children grow.