More Research Needed to Assess the Magnitude of Refractive Errors World-wide

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Development of Refractive Errors

Ocular growth is essential to the understanding of the development of refractive errors (RE). '*The eye is approximately 17 mm long at birth. From birth to age 6, the eye will grow by around 5 mm, will lose 4 dioptres of corneal power and 20 dioptres of lens power. In the general population, there is a preponderance of emmetropes and the prevalence of 'acquired' myopia is only 2% by the age of 6 years. During the following 8 years, when the average eye grows only an additional 1 mm, the prevalence of myopia increases more than sevenfold, to 15% by the age of 15 years*' [1]

It can be stated that:

- Newborn children are usually hyperopic (the mean RE under cycloplegia has been reported to be about 2 dioptres).
- Low grade hyperopia is the usual refractive state that is maintained throughout infancy and childhood, despite great alteration in the constituents of the refractive system.
- In subsequent years, the antero-posterior axis of the eye elongates, with thinning of the crystalline lens and flattening of the cornea, which leads to emmetropia in children by age 8 to 10 years. (There is often a slight increase in the amount of measurable hyperopia during the first seven years, but this gradually diminishes before puberty).
- Myopia is a common and important cause of visual impairment which is usually acquired and nearly always progressive. It rarely occurs before the age of 5 years and new cases appear throughout childhood and adolescence, particularly between the ages of 6 to 15. Thereafter, the prevalence of myopia appears to level-off.
- Ingeneral,intheadult,emmetropiaisthe most common condition found, although this depends on the population studied. Almost 100% of medical students in Taiwan are myopic and the figure is very nearly as high in Japan.

Existing Epidemiological Limitations

In the outline of the main activities to be carried out within the launched **Global Initiative for the Elimination of Avoidable Blindness (Vision 2020: The Right to Sight)**, refractive errors have been listed, along with cataract, trachoma, onchocerciasis and childhood blindness, among eye problems whose prevention and cure should provide enormous savings and facilitate societal developments.

There is clinical evidence that RE (myopia particularly), and to a lesser extent amblyopia and strabismus are very common ophthalmic disorders in children. However, despite the recognised importance of correcting refractive anomalies in children, there are few reliable studies on the type and prevalence of the various RE encountered. Although it appears that there is considerable geographic variation in prevalence, based on reported studies, the available scientific knowledge is incomplete concerning the distribution of RE in different populations and the variation of prevalence with age, gender and race. Moreover, it remains particularly difficult to make comparisons between reported 'prevalences' because of the following reasons:

- The operational definitions of emmetropia, myopia and hyperopia are not uniform across studies.
- Populations with limited representativeness have been studied (surveys have generally dealt with convenience samples, such as school children or military recruits, rather than population-based samples).
- Dissimilar demographic make-up of the studied populations (age and sex composition in particular).
- Procedures used to assess the refraction status are different (examinations may have been performed with or without cycloplegia).

Spectacles can be effectively used in the very young

Photo: Murray McGavin

In order to determine the magnitude and the public health significance of RE in children of different ethnic origins, and to strengthen the delivery of refractive services, additional data are needed. This is the rationale underlying the development of a protocol for an international population-based study on RE. This study protocol (supported by the World Health Organization under National Institute Contract NO1-EY-2103) has been entitled: **'The Refractive Error Study in Children'.**

The Refractive Error Study in Children (RESC)

RESC was designed to assess the prevalence of RE and vision impairment in children (5 to 15 years of age) of different ethnic origins and cultural settings.

The RESC design, sample size and measurement methods ensure that the age-and sex-specific prevalences of refractive error can be estimated with reasonable accuracy in the target populations.

The testing and examination protocol includes standardised visual acuity measurements (presenting, uncorrected and best-corrected using a retro-illuminated LogMAR chart with five tumbling 'E' optotypes on each line), lensometry when appropriate, ocular motility and eye alignment evaluation, cycloplegic (two drops of cyclopentolate 1% administered five minutes apart to each eye) retinoscopy and autorefraction, and examination of the anterior segment, media and fundus.

Three RESC surveys have already been conducted in 1999 in Chile, China and

Nepal. (Results have been accepted for publication and will appear as four articles in an upcoming issue of the *American Journal of Ophthalmology*). Similar RESC studies will be carried out in India during the year 2000.

Further Research Topics of Interest

Studies of children above 15 years of age are also needed to determine whether the age-related upward trend in myopia prevalence found in the above mentioned RESC surveys in Chile and China continues far beyond age 15, and whether the natural history of myopia is changing for more recent birth cohorts.
Furthermore, the relative importance of genetic and environmental factors in explainingfamilialrelationshipsformyopia require further investigation.

Reference

1 Mutti D O, Zadnik K, Adams A J. Myopia. *Invest Ophthalmol & Vis Sci* 1996; **37**: 952–7

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VISION 2020'S STRATEGIES FOR REFRACTIVE ERRORS AND LOW VISION

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1. Create awareness and demand for refractive services through community-based services/primary eye care and school screening.
2. Develop accessible refractive services for individuals identified with significant refractive errors. This will require training in refraction and dispensing for paramedical eye workers, if ophthalmologists and/or refractionists are not available in sufficient numbers.
3. Ensure that optical services provide affordable spectacles for individuals with significant refractive errors.
4. Develop and make available low vision services and optical devices for all those in need, including children in blind school or integrated education. Certain low vision devices can be manufactured locally, or purchased externally in bulk supplies to reduce costs.
5. Includethe provisionof comprehensivelow visioncareas anintegral partof national programmesforthe preventionofblindness,orrehabilitative servicesforthevisually disabled.

Abstract

Detection of gonioscopically occludable angles and primary angle closure glaucoma by estimation of limbal chamber depth in Asians: modified grading scheme

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Aim—To evaluate the performance of limbal chamber depth estimation as a means of detecting occludable drainage angles and primary angle closure, with or without glaucoma, in an east Asian population, and determine whether an augmented grading scheme would enhance test performance.

Method—A two phase, cross sectional, community based study was conducted on rural and urban areas of Hövsgöl and Ömnögobi provinces, Mongolia. 1800 subjects aged 40 to 93 years were selected and 1717 (95%) of these were examined. Depth of the anterior chamber at the temporal limbus was graded as a percentage fraction of peripheral corneal thickness. An 'occludable' angle was one in which the trabecular meshwork was seen in less than 90° of the angle circumference by gonioscopy. Primary angle closure (PAC) was diagnosed in subjects with an occludable angle and either raised pressure or peripheral anterior synechiae. PAC with glaucoma (PACG) was diagnosed in cases with an occludable angle combined with glaucomatous optic neuropathy and consistent visual morbidity.

Results—Occludable angles were identified in 140 subjects, 28 of these had PACG. The 15% grade (equivalent to the traditional 'grade 1') yielded sensitivity and specificity of 84% and 86% respectively for the detection of occludable angles. The 5% grade gave sensitivity of 91% and specificity of 93% for the detection of PACG. The interobserver agreement for this augmented grading scheme was good (weighted kappa 0.76).

Conclusions — The traditional limbal chamber depth grading scheme offers good performance for detecting occludable drainage angles in this population. The augmented scheme gives enhanced performance in detection of established PACG. The augmented scheme has potential for good interobserver agreement.

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