

Refractive error profile – a clinical study

Karki KJD¹ and Karki M²

¹Associate Professor, ²Medical Officer, Dept. of Ophthalmology, Kathmandu Medical College

Abstract

Aim: To study the distribution of refractive error in different ethnic groups of Nepal.

Methods: A total of 1276 new eye patients between 5-35 years of age were included in this study after a thorough eye examination consisting of vision test, anterior and posterior segment eye examination including the investigative procedures whenever needed to rule out any systemic and ocular diseases. Thereafter, the patients were subjected to rigorous streak retinoscopic refraction.

Results: Out of 1276 eye patients examined 51.33 % patients are males and 48.66 % are females. The ethnic distribution of refractive error shows that there are 32.44% Newars; 27.50% Brahmins; 21.63% Chhetriyas; 12.14% Gurungs, Magars, Rais, Limbus, Tamangs, Sunuwars; and 6.26% Madhesias. Out of 414 Newar patients, 14.00% patients are myopic; 29.71% hyperopic; and 56.28% astigmatic. In 351 Brahmin patients, 14.81% patients are myopic; 49.85% hyperopic; and 35.32% astigmatic. In 276 Chhetry patients, 13.40% patients are myopic; 48.18% hyperopic; and 38.40% astigmatic. Out of 155 Gurungs, Magars, Rais patients, 11.61% are myopic; 52.90% hyperopic; and 35.48% astigmatism. Out of 80 Madhesias patients, 11.25% are myopic; 37.50% hyperopic; and 51.25 % astigmatic.

Conclusion: Thus, a refractive error profile is drawn up in Nepalese population.

Key words: refractive error, distribution, Nepalese population.

Refractive errors (ammetropias) are not eye diseases; they are disorders in which the dioptric power of the eye has changed so that the parallel rays of light from infinity, with the accommodation at rest, are focused either in front or behind the retina with the result either the vision is impaired or the asthenopic symptoms develop in the patient.

The early history of detection and measurement of refractive error dates back to 384 -321 B.C. when Aristotle correctly differentiated between myopia and presbyopia (quotations from Aristotle's *Problematica*).

According to National Blindness Survey Nepal, 1981, refractive error was identified, based on pinhole correction, as a primary ocular disorder in 1.3 % of those 39,887 examined persons of all ages¹. The refractive errors(7.00 %) are the second major cause of blindness in India².

A series of population-based surveys of refractive error and associated visual impairment in school-age children, sponsored by the WHO, were conducted in five different geographic regions using a common protocol- the refractive error survey in children (RESC)³. These RESC surveys, which began in 1988, were carried out in a rural district in Eastern Nepal⁴; a rural county outside of Beijing, China⁵; an urban area

of Santiago, Chile⁶; a rural district near Hyderabad in Southern India⁷ and an urban area of New Delhi, in northern India⁸. A sixth survey is currently being carried out in Durban, South Africa. Others are also planned.

These comparative studies elucidated some important differences in the prevalence of refractive errors of Asian and White children across different geographic regions. The prevalence of myopia did not differ markedly between 5 years olds in these countries (China < 1%; Nepal < 2 %; Chile 3.5 %); however, the prevalence of myopia was much higher in Chinese 15 years olds (males 36.7 %; females 55.00 %) compared to 15 years olds in Nepal (males 2 %; females 1 %) and Chile (males 25 %; females 15 %). Conversely, the incidence of moderate or high hyperopia (< 2 D) in children 5-15 years of age was much higher in Chile (Nepal 1.1%; China 8.5%; Chile 21.6 %). The higher percentage of moderate and high hyperopes in Chile would suggest that White populations are more likely to be hyperopic than Asian populations.

Correspondence:

Dr. K. J. D. Karki
Associate Professor, Dept. of Ophthalmology
Kathmandu Medical College, Sinamangal, Kathmandu, Nepal
E-mail: kjd.karki@yahoo.com

These studies also demonstrate that visual impairment, which in this age group is almost entirely because of correctable refractive error, will vary in a corresponding fashion. These data represent children across different geographic and ethnic origins as well as different cultural settings and reduced vision because of uncorrected refractive error is an important public health problem.

Taking into consideration all these facts and figures that are coming up recently, a clinical study was designed, planned and conducted in Kathmandu city to find out the distribution of refractive error in different main ethnic groups of Nepal.

Materials and methods

Kathmandu is a capital city located in mid-hilly central part of Nepal. The people of different racial ancestry with their varied religious, cultural and social beliefs reside in this city. Moreover, people from different walks of life from all over the country come to this city. All these factors made possible the heterogeneous group of people of Mongoloid, Aryan and Aboriginal ancestry representing the main ethnic groups with their different genetic make -up and varied social, cultural, religious, and environmental backgrounds.

The study was conducted in a private eye clinic starting from June 2003 to May 2004 using a direct ophthalmoscope, a streak retinoscope, a canon's auto refractometer, a trial set of lenses and a slit - lamp biomicroscope.

The refractive error at birth changes and its progression usually appears at the age of 5 years and continues up to 35 years. The ethnicity of the inter-caste married females are taken from their parenthood. All the new cases from 5-35 years of age who came either for impairment of vision or refractive error related asthenopic symptoms or both were examined by the author himself to make it more reliable and ensure uniform quality assurance in the eye examinations. The retinoscopic refraction which is the most important part of the examination in refractive error needs a lot of interest, stamina and experience..

A thorough eye examination consisting of vision test, anterior and posterior segment eye examination including the investigative procedures whenever needed to rule out any systemic and ocular diseases were done and the patients having any pathological diseases for their aforesaid problems were excluded from the study. The remaining patients were subjected to rigorous streak retinoscopic refraction in

all cases and auto refraction for the confirmation of cylindrical axis after cycloplegia in some cases. The refractive error does not only cause impairment of vision, but also other refractive error related asthenopic symptoms which can be more troublesome to the patients rather than impairment of vision. Moreover, low refractive errors don't affect the vision in the majority of the patients, but they are notorious for their asthenopic problems. As this study was carried out not only to find out the refractive error and impairment of vision but it was also designed and planned to study the refractive error distribution as a whole of the Nepalese population, all the types of refractive error whether low or high were included.

Results

A total of 1276 new eye patients were identified and entered for the study taking into consideration all the inclusive and exclusive criteria as laid down in the methodology before the start of the study. Out of the 1276 patients examined 655 (51.33%) were males and 621 (48.66%) were females.

The percentage of different types of refractive error in these patients showed that myopia was found in 174 (13.63 %) patients; hyperopia in 543 (42.55 %) patients; and astigmatism in 559 (43.80%) patients. Out of total 559 astigmatic patients, simple myopic astigmatism was present in 57 (10.19 %) patients; compound myopic astigmatism in 336 (60.10 %) patients; simple hyperopic astigmatism in 6 (1.07 %) patients; compound hyperopic astigmatism in 78 (13.95 %) patients and mixed astigmatism in 82 (14.66 %) patients.

The prevalence of different types of refractive errors among various ethnic groups in Nepal is found to be different from this study. The ethnic distribution of refractive error shows that there are 414 (32.44 %) Newars; 351 (27.50 %) Brahmins; 276 (21.63 %) Chhetriyas; 155 (12.14%) Gurungs, Magars, Rais, Limbus, Tamangs, Sunuwars; and 80 (6.26%) Madhesias. Out of 414 Newar patients, 58 (14.00%) patients are myopic; 123 (29.71 %) hyperopic; and 233 (56.28%) astigmatic. In 351 Brahmin patients, 52 (14.81%) patients are myopic; 175 (49.85 %) hyperopic; and 124 (35.32%) astigmatic. In 276 Chhetry patients, 37 (13.40%) patients are myopic; 133 (48.18 %) hyperopic; and 106 (38.40 %) astigmatic. Out of 155 Gurungs, Magars, Rais patients, 18 (11.61%) are myopic; 82 (52.90%) hyperopic; and 55 (35.48%) astigmatism. Out of 80 Madhesias patients, 9 (11.25%) are myopic; 30 (37.50%) hyperopic; and 41 (51.25 %) astigmatic.

This study shows that astigmatism is highest in Newar and Madhesias communities; whereas hyperopia in Brahmins, Kshatriyas, Gurungs, Magars, Rais Limbus, Tamangs, Sunuwars. Out of

all types of astigmatism, compound myopic astigmatism is the most common type in all ethnic groups..

Table-1 Sex Distribution

Sex	No.	Percentage
Male	655	51.33
Female	621	48.66
Total	1276	100.00

Table-2 Distribution of Types of Refractive Errors

Types	No.	Percentage
Myopia	174	13.63
Hyperopia	543	42.55
Astigmatism	559	43.80
Total	1276	100.00

Breakdown of Types of Astigmatism-559(n)

1.Simple myopic astigmatism	57	10.19
2.Compound myopic astigmatism	336	60.10
3.Simple hyperopic astigmatism	6	1.07
4.compound hyperopic astigmatism	78	13.95
5.Mixed astigmatism	82	14.66
Total	559	100.00

Table-3 Ethnicity Distribution

Newars	414	32.44
Brahmins	351	27.50
Chhetriyas	276	21.63
Gurungs, Magars, Rais, Limbus, Tamangs, Sunuwars	155	12.14
Madhesiyas	80	6.26
Total	1276	100.00

Table-4 Distribution of Types of Refractive errors in Ethnic groups

Refractive error	Newars		Brahmins		Chhetriyas		Gurungs, Rais		Madhesiyas	
	No.	%	No.	%	No.	%	No.	%	No.	%
Myopia	58	14.00	52	14.81	37	13.40	18	11.61	9	11.25
Hyperopia	123	29.71	175	49.85	133	48.18	82	52.90	30	37.50
Astigmatism	233	56.28	124	35.32	106	38.40	55	35.48	41	51.25
Total	414	100.00	351	100.00	276	100.00	155	100.00	80	100.00

Breakdown of Types of Astigmatism

	No.	%								
1.Simple myopic astigmatism	24	10.30	13	10.48	8	7.54	8	14.54	4	9.75
2.compd myopic astigmatism	151	64.80	81	65.32	58	54.71	24	43.63	22	53.65
3.Simple hyperoic astigmatism	3	1.28	0	0.00	1	0.94	2	3.63	0	0.00
4.Compound hyperoic astigmatism	22	9.44	14	11.29	23	21.69	9	16.36	10	24.39
5.Mixed astigmatism	33	14.16	16	12.90	16	15.09	12	21.81	5	12.19
Total	233	100.00	124	100.00	106	100.00	55	100.00	41	100.00

Discussion

Refractive error is the most common ocular disorder. However, there are marked differences in the prevalence of certain ocular disorders amongst various racial and ethnic groups. These differences probably reflect the unique genetic make-up of these various groups coupled with a variety of environmental influences. Ethnic variations are particularly marked for the prevalence of refractive errors. White population based studies from the United States ^{9,10} and Australia ^{11,12} have reported a prevalence of myopia ranging from 15-76% in adults. The prevalence has reported to be significantly higher in Singapore 35%¹³. Asian countries in particular have also been experiencing a dramatic increase in the prevalence of myopia. here were 82% myopics in all ethnic Chinese Singapore military recruits screened between July 1996 to June 1997.¹⁴

The RESC surveys also showed marked differences in the prevalence of refractive errors of Asian and White children across different geographic regions. The survey conducted in Jhapa district in children of 5-15 years and both sexes showed the prevalence of hyperopia (2D or greater) 1-4%; myopia (-0.5D or less) 1-2%; and astigmatism (0.75D or greater) 2.2%.

This recent clinical study of refractive error carried out in 1276 eye patients shows almost equal affections in both males and females.

The refractive error distribution in different ethnic groups in Nepal highlights very important and informative data. The refractive errors are more common in Newar community and astigmatism (56.28%) is the most common type; whereas Brahmins, Chhetriyas, Gurungs, Rais, Magars, Tamangs, and others share almost the same percentage of hyperopia – Brahmins (49.85%), Chhetriyas (48.18%), Gurungs, Magars, Rais etc

(52.90%), and Madhesias (37.50%). Out of all types of astigmatism, compound myopic astigmatism is the most common in all ethnic groups. Myopia is almost equally distributed among all ethnic groups.

There are a number of investigations to demonstrate the relationship between near work and myopia and myopic astigmatism. Newars in Nepal have the highest literacy rate; most of them are employed in academic and clerical jobs; and majority of them are involved in business, industry and fine traditional craftsmanship from ages. All these professional jobs demand near work which may be the reason for high percentage of astigmatism especially myopic astigmatism.

The Brahmins also have highest literacy rate in Nepal. They are professionally engaged in literary and religious works and devoted to academic pursuits; and a good percentage of them are in clerical jobs as well. However, the majority of them are in agriculture. Whereas, the Chhetriyas, Gurungs, Rais, Limbus and others have neither very high literacy rate nor professionally involved in near and fine work jobs. Majority of these ethnic groups are either in police or military services or they are involved in hard manual work and agriculture. That might be the reason why there is low prevalence of myopia and myopic astigmatism in these ethnic groups of Nepal.

Clinically significant hyperopia or astigmatism are present at birth or at early age. That's why, it is presumed that these conditions are hereditary in nature. On the other hand, because myopia is seldom present at birth but becomes evident in late childhood, many researchers believe that it occurs as a result of environmental rather than hereditary factors. However, those who are in favour of hereditary factors often argue that a genetically

determined trait does not always have to be present at birth.

The role of environmental factors in myopia and myopic astigmatism was forwarded by Donders who proposed that prolonged tension in the eyes during close work with elongation of the visual axes causes these types of refractive error. Progressive myopia on the other hand has definite genetic factor to play in its aetiology as it is familial and more common in certain races like Chinese, Japanese, Arabs and Jews; and uncommon amongst Negroes.

Conclusions

The refractive errors are the most common eye disorders. The prevalence of refractive errors varies considerably across different geographic locations as well as different ethnic groups. The visual impairment and asthenopic problems in children are almost entirely because of correctable refractive errors. The role of hereditary and environmental factors for the cause of refractive errors has been a lively topic of discussion for many authors and researchers. However, the role of these two factors is not yet decided. Thus, the controversy of "the nature versus nurture"¹⁵ debate in ocular refraction still goes on.

References

1. Brilliant GE et al. The epidemiology of blindness in Nepal. Chelsea, Michigan : the Seva Foundation,1988.
2. Govt. of India, Present status of National programme for control of blindness, Ophthalmology section, DGHS, New Delhi,1992.
3. Negrel AD, Maul E, et al. Refractive error study in children : Sampling and measurement methods for a multi- country survey. Am J ophthalmology 2000;129: 421-426
4. Pokhrel GP, Negrel AD et al. Refractive error study in children :results from Mechi zone, Nepal. Am J ophthalmol 2000; 129 :436-44.
5. Jhao J, Pan X et al. Refractive error study in children: results from Shunyi District,, China. Am J ophthalmol 2000;129 : 427-435.
6. Maul E, Barroso S et al. Refractive error study in children : Results from La Florida County, Chile. Am J ophthalmol 2000; 129 : 445-454.
7. Dandano R, Dandano L, Srinivas M et al. Refractive error study in children in rural population in India. Invest Ophthalmol vis sci 2002;43: 615-622.
8. Murthy GVS, Gupta SK et al. Refractive error in children in an urban population in New Delhi. Invest Ophthalmol vis sci 2002;43:623-631.
9. Katz J, Tielsch JM et al. Prevalence and risk factors for refractive errors in an adult inner city population. Invest Ophthalmol vis sci 1997; 38: 334-40.
10. Wang Q, Klein BE et al. Refractive status in the Beaver Dam study. Invest Ophthalmol vis sci 1994; 35: 434-7.
11. Wensor M, Mc Carty CA, et al. Prevalence and risk factors of myopia in Victoria, Australia. Arch Ophthalmol 1999; 116 : 658-63.
12. Allebo K, Ivers RQ et al. Refractive errors in an older population : The Blue Mountains Eye study. Ophthalmology; 106: 1066-72.
13. Wong Ty, Foster PJ, et al. Prevalence and risk factors for refractive errors in adult Chinese in Singapore. Invest Ophthalmol vis sci 2000; 41 : 2486-294.
14. Wu H-M, Seel B et al. Does education explain ethnic differences in myopia prevalence. A problem based study of young adult males in Singapore. Optom vis sci 2001; 78 : 234-9.
15. Multi Do, Zudnik K et al. Myopia : the nature versus nurture debate goes on. Invest Ophthalmol vis sci 1996; 37 : 952-7.