■ ***Original article***

Pattern of refractive errors among the Nepalese population: a retrospective study

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Abstract

Introduction: Refractive errors are a major cause of visual impairment in the population.

Purpose : To find the pattern of refractive errors among patients evaluated in a tertiary care hospital in the western region of Nepal.

Materials and methods: The present hospital-based retrospective study was conducted in the Department of Ophthalmology of the Manipal Teaching Hospital, situated in Pokhara, Nepal. Patients who had refractive error of at least 0.5 D (dioptre) were included for the study.

Results: During the study period, 15,410 patients attended the outpatient department and 10.8 % of the patients were identified as having refractive error. The age of the patients in the present study ranged between 5 - 90 years. Myopia was the commonest refractive error followed by hypermetropia. There was no difference in the frequency of the type of refractive errors when they were defined using right the eye, the left eye or both the eyes. Males predominated among myopics and females predominated among hypermetropics. The majority of spherical errors was less than or equal to 2 D. Astigmatic power above 1D was rarely seen with hypermetropic astigmatism and was seen in around 13 % with myopic astigmatism. "Astigmatism against the rule" was more common than "astigmatism with the rule", irrespective of age.

Conclusion: Refractive errors progressively shift along myopia up to the third decade and change to hypermetropia till the seventh decade. Hyperopic shift in the refractive error in young adults should be well noted while planning any refractive surgery in younger patients with myopia.

Keywords: myopia, hypermetropia, astigmatism, ethnicities, age

Introduction

Refractive error is the most common ocular disorder worldwide and it is estimated that 2.3 billion people are living with this disorder (Brien A H et al 2000). In both developing and developed nations, uncorrected refractive errors are responsible for a significant amount of blindness, though the treatment required is simple and successful (Dandona & Dandona, 2001). Realizing the enormous need for correction of refractive errors worldwide, the World Health Organization has adopted the correction of refractive errors in developed and developing countries as one of the main priorities in its "Vision 2020: the right to sight" initiative (Dandona & Dandona, 2001; Thylefors B, 1998). Refractive error is also one of the leading causes of visual impairment in all population groups and has an important impact on economic development and quality of life (Pararajasegaram R 1999; WHO, 2000).

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As refractive errors are a major cause of mild to moderate visual impairment in the population, knowledge of the prevalence of refractive errors would be helpful in planning public health strategies. The pattern of refractive errors varies according to population characteristics such as age, gender and ethnic group. Though population-based studies on refractive errors have been conducted in some countries of Asia like Indonesia, India, Nepal, Taiwan, China and Singapore, all these studies were conducted among either school-aged children or young and middle-aged adults only (WHO, 2000)

Nepal is one of the least developed nations in the South East Asia Region (SEAR). According to the National Blindness Survey of Nepal of 1981, refractive error was identified as a primary ocular disorder in 1.3 % of the 39,887 examined persons of all ages (Brilliant, 1988). In 1998, a population-based study conducted in school-age children in Eastern Nepal showed that 2.9 % of children had visual morbidity of which 56 % was due to refractive error (Pokharel GP et al 2000). A similar study conducted in three schools of Kathmandu valley in 2002 found refractive error as the commonest (8.1%) type of ocular morbidity (Nepal BP et al 2003). There is a paucity of information about the pattern of refractive errors among people belonging to all age groups.

According to the 2001 census, the total population of Nepal was 23.15 million. The sex ratio was 997 males for 1000 females, and because of the high growth rate, the population of the country is fairly young. About 39.3 % of the total population is in the 0-14 age group. Only 6.5 % are above 60 years of age; 81 % of economically active population is employed in the agricultural sector and 42 % of the population is below the poverty line (Population Monograph of Nepal, 2007). The population is predominantly Hindu at 80 % followed by Buddhist at 10.7 % and Islam at 4.2 %. More than 83 % of the total population lives in rural areas. Only 48.1 % of males (above 14 years of age) have minimum high school level education while among females, it is 27.2 %. The health infrastructure of Nepal is poor and according to the Nepal Living Standard Survey of 1996, only 41.4 % of the rural households have access to the nearby health institution within a walking distance of thirty minutes
(Sharma HB et al 2001). In the present hospital-based retrospective study, an attempt was made to find the pattern of refractive errors among patients evaluated in a tertiary care hospital in the western region of Nepal.

Materials and methods

The present hospital-based retrospective study was conducted at the Department of Ophthalmology, Manipal Teaching Hospital (MTH), affiliated to Manipal College of Medical Sciences, a teaching medical institution listed in the 7th edition of WHO recognized medical schools and situated in Pokhara (Kaski district), Western Development Region (WDR) of Nepal. The WDR constitutes about 20 % of the total population of Nepal (Sharma HB et al 2001). The study period was 1st January 2002 to 31st December 2003.

The medical records number of patients diagnosed as having any of the diseases H52, H52.1, H52.2, H44.2, H52.3, H52.4 or H53, according to the International Classification of Diseases (ICD-10), during the above period were noted from the outpatient register of the Department of Ophthalmology. Case files of the above patients were collected from the Medical Records Department and data on socio-demographic factors, unaided vision, vision with best possible visual correction and the refractive correction given were retrieved in a structured pro-forma. All the patients had undergone objective refraction. The cycloplegic refraction had been done where necessary.

Classification of the patients was done on the basis of the final prescription after subjective refraction.

- If patients had the same vision with their old glasses they were entered as wearing correct glasses and otherwise not wearing correct glasses.
- Patients who had refractive error of at least 0.5 D and who would be benefited by wearing glasses for distant vision and/or near vision or for relieving asthenopic symptoms were included for the study.
- The other eye of emmetropic patients having a refractive error (of at least 0.5 D) was also included in the study.
- Under H53.0 [amblyopia], only those patients having refractive-error related [ametropic, anisometropic and meridional] amblyopia were included in the study.

- Astigmatism "with the rule" was defined as myopic astigmatism at 180±20º or hypermetropic astigmatism at 90±20º, and "against the rule" as myopic astigmatism at 90±20º or hypermetropic astigmatism at 180±20º. Astigmatism at >20º to <70º or >110º to <160º was considered as oblique astigmatism.

Patients having other diseases in the eye responsible for diminished vision like any retinopathy, squint, significant cataract, aphakia, pseudophakia and uncontrolled diabetes mellitus were excluded from the study. Data was entered and analyzed using the statistical package SPSS 11.5 (SPSS Inc., Chicago, IL, USA).

Results

During the study period, 15,410 patients attended the outpatient clinic at the department of ophthalmology. Out of these, 1668 (10.8 %) patients were prescribed spectacles and among them 426 (26 %) had pure presbyopia in both eyes. Latter, patients were excluded from the analysis and hence 1242 patients were included for further statistical analysis.

Among 1242 patients, 644 (51.9 %) were males and 598 (48.1 %) were females. The age of the patients varied between 5 and 90 years. The mean age of male patients was 36.2 years (SD 18.8 years) and that of female patients was 40 years (SD 17.8 years); the difference in age was found to be statistically significant (P<0.001).

The Total number of people having refractive errors in both eyes were 1120, as 122 (10 %) had error in only one eye. The number of people with refractive error in the right eye was 1184 and that in the left eye was 1178. Thirty percent of the patients were from outside Kaski district, pointing towards the ability of the hospital in drawing patients from distant areas; and 60 % of these belonged to the near-by districts of Syangja, Tanahu and Baglung. The unaided vision when individual eyes were considered was

	Right Eye	**Left Eye**
6/18 or better-	58.5%	60.8%
<6/18 to 6/60 amounting to visual impairment	31.4%	29.8%
<6/60 to 3/60 amounting to severe visual impairment	9.3%	8.4%
Less than 3/60 amounting to blindness	0.7%	0.9%

Table 1
Distribution of type of refractive errors and gender according to age

	Age in years							
Types of refractive error	**<15 (%)**	**15-24 (%)**	**25-34 (%)**	**35-44 (%)**	**45-54 (%)**	**55-64 (%)**	**>64 (%)**	**Total (%)**
Myopia	59 (62.8)	177 (69.4)	58 (46)	25 (25)	36 (17.2)	5 (3)	18 (18.2)	378 (36.1)
Hypermetropia	9 (9.6)	11 (4.3)	8 (6.3)	32 (32)	117 (56)	109 (66.1)	45 (45.5)	331 (31.6)
Myopic astigmatism	20 (21.3)	62 (24.3)	57 (45.2)	34 (34)	26 (12.4)	13 (7.9)	13 (13.1)	225 (21.4)
Hypermetropic astigmatism	4 (4.3)	4 (1.6)	3 (2.4)	9 (9)	30 (14.4)	38 (23)	22 (22.2)	110 (10.5)
Mixed astigmatism	2 (2.1)	1 (0.4)	0	0	0	0	1(1)	4 (0.4)
Gender	52	162	67	46	66	84	49	526
Male	(55.3)	(63.5)	(53.2)	(46)	(31.6)	(50.9)	(49.5)	(50.2)
Female	42 (44.7)	93 (36.5)	59 (46.8)	54 (54)	143 (68.4)	81 (49.1)	50 (50.5)	522 (49.8)
Total	94 (100)	255 (100)	126 (100)	100 (100)	209 (100)	165 (100)	99 (100)	1048 (100)

Table 2
Amount of different types of refractive errors

Type of refractive error		Amount of refractive error (Dioptres) <=1	>1 to <=2	>2 to <= 6	>6	Total
Myopia		162 (47.5)	95 (27.9)	78 (22.9)	6 (1.7)	341 (100)
Compound Myopic astigmatism*		37 (56.1)	9 (13.6)	16 (24.2)	4 (6.1)	66 (100)
Hypermetropia		257 (83.4)	44 (14.3)	7 (2.3)	0	308 (100)
Compound Hypermetropic astigmatism*		22 (81.5)	4 (14.8)	1 (3.7)	0	27 (100)
Myopic astigmatism	Simple	120 (89.5)	11 (8.2)	3 (2.2)	0	134 (100)
	Compound**	57 (82.6)	9 (13)	3 (4.3)	0	69 (100)
Hypermetropic astigmatism	Simple	71 (94.6)	4 (5.3)	0	0	75 (100)
	Compound**	30 (93.8)	2 (6.2)	0	0	32 (100)
Mixed astigmatism		0	3 (75)	1(25)	0	4 (100)

*Spherical component, **Cylindrical component

Table 3
Distribution of astigmatism in different age groups

Refractive Error	Axes	Age in years <15	15-24	25-34	35-44	45-54	55-64	>64	Total(%)
		13	41	46	28	23	12	12	175
	90±20º	(54.2)	(63.1)	(79.3)	(70.0)	(41.1)	(24.5)	(32.4)	(53.2)
Myopic		5	19	9	3	3	0	1	40
astigmatism	180±20º	(20.8)	(29.2)	(15.5)	(7.5)	(5.35)	(2.7)	(12.2)	
		2	2	2	3	1	2	1	13
	90±20º	(8.3)	(3.1)	(3.45)	(7.5)	(1.8)	(4.1)	(2.7)	(3.95)
Hypermetropic		2	2	1	6	29	35	22	97
astigmatism	180±20º	(8.3)	(3.1)	(1.72)	(15)	(51.8)	(71.4)	(59.5)	(29.5)
								1	1
	90±20º	0	0	0	0	0	0	(2.7)	(0.3)
Mixed		2	1						3
astigmatism	180±20º	(8.3)	(1.5)	0	0	0	0	0	(0.91)
Total		24	65	58	40	56	49	37	329
		(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

Table 4
Distribution of different refractive errors in different ethnicities

	Ethnicity						
Type of refractive error	**Newars**	**Brahmins**	**Chhetriyas**	**Gurungs**	**Magars**	**Others**	**Total**
Myopia	70	99	46	69	36	58	378
	(43.8)	(32)	(42.2)	(33)	(33)	(38.2)	(36.1)
Hypermetropia	39	99	29	86	38	40	331
	(24.4)	(32)	(26.6)	(41.1)	(34.9)	(26.3)	(31.6)
Myopic astigmatism	35	74	22	33	22	39	225
	(21.9)	(23.9)	(20.2)	(15.8)	(20.2)	(25.7)	(21.4)
Hypermetropic astigmatism	16	34	12	21	13	14	110
	(10)	(11)	(11)	(10)	(11.9)	(9.2)	(10.5)
Mixed astigmatism	0	3 (1)	0	0	0	1 (0.7)	4 (0.4)
Total	160	309	109	209	109	152	1048
	(100)	(100)	(100)	(100)	(100)	(100)	(100)

For patients with refractive errors in both eyes, 161 (14.4 %) people did not have same the vision in two eyes. Therefore the same visual parameters were applied to the better eye and the comparative figures were 64.9%, 26.8 %, 7.8 % and 0.4 % respectively. In one child with Down syndrome, the vision was undetermined as he was not cooperative for vision testing.

Anisometropia of more than 3 dioptres was seen in 19 patients (1.5 %) out of which 10 (0.8 %) had myopia or myopic astigmatism and 9 (0.7 %) hypermetropia or hypermetropic astigmatism.

When patients with refractive error in the right eye were considered, 97 % of the patients improved to more than 6/12 with best possible correction and the rest (3 %) improved to 6/12 or less amounting to amblyopia. Similar figures were noted when patients with refractive error in the left eye were considered. When patients with refractive error in both eyes were considered vision improved to more than 6/12 in both eyes in 96 % of patients and to 6/12 or less in 1.3 % of patients. In the rest (2.7 %) the vision in one of the eye improved to more than 6/12 and in the other eye, equal to or less than 6/12.

The type and frequency of refractive errors seen, when the patients' right eye or left eye was considered separately, was almost the same with myopia in 34 %, hypermetropia in 30 %, simple myopic astigmatism in 15 %, simple hypermetropic astigmatism in 7 %, compound myopic astigmatism in 9 %, compound hypermetropic astigmatism in 4 % and mixed astigmatism in 0.5 %. When patients with refractive errors in both eyes were considered, 72 of them did not have same type of error in two eyes. Statistical analysis was done after excluding them; even then the overall proportion of different refractive errors did not vary significantly. The comparative figures were 33.8 %, 29.6 %, 13 %, 7%, 7.1 %, 2.9 % and 0.4 % respectively.

Among 72 patients who had different types of refractive errors in the two eyes, 41 had myopia in one eye and the error in the other eye was myopic astigmatism in 39 (95 %) of which compound myopic astigmatism in 31 (76 %), was more common, with the rest, having simple myopic astigmatism 8 (19 %). Another 12 patients had hypermetropia in one eye with the error in other eye being hypermetropic astigmatism in 10 (83 %), of which compound hypermetropic astigmatism, in 8 (67 %), was more common with the rest being simple hypermetropic astigmatism in 2 (16 %). The rest of the 19 patients had simple myopic (12) or simple hypermetropic

astigmatism (7) in one eye associated usually with corresponding compound astigmatism in the other eye. The rest of the statistical analysis was restricted to those 1048 patients who had the same type of refractive errors in both eyes.

Myopia (Table 1) was the commonest (36.1 %) type of refractive error followed by hypermetropia (31.6 %). Up to 24 years of age, myopia showed an increasing trend which decreased progressively after that to rise again after 64 years. The opposite trend was seen with hypermetropia. The increasing trend with myopic astigmatism continued up to the age of 34 and then decreased progressively to rise again after 64 years. The frequency of hypermetropic astigmatism progressively increased after 24 to get stabilized at the age of 64. Even though the overall percentage of male and female patients was the same, significant gender differences were observed in different age groups. The percentage of male patients was more compared to females up to the age of 34 years and the reverse was observed in the 35 - 44 and 45 - 54 age groups. No gender difference was seen between male and female patients above 55 years of age. Males (60.3%) predominated among myopes and females (65%) predominated among hypermetropes.

Table 2 gives the amount of different types of refractive errors. Patients having the same refractive error range in both eyes were considered for statistical purposes. The majority of patients had a spherical error less than or equal to 2 D except with myopia and spherical component of compound myopic astigmatism. Spherical error above 6 D in both eyes was seen only among myopia and spherical component of compound myopic astigmatism patients. Astigmatic power above 1 D was rarely seen with hypermetropic astigmatism and was seen around 13 % of those with myopic astigmatism.

Out of 339 patients with astigmatism 329 (97 %) had either "with the rule" or "against the rule" astigmatism in both eyes. Two patients (0.6 %) had different oblique astigmatism in the two eyes, and 8 (2.4 %) patients had oblique astigmatism in one eye along with "with the rule" or "against the rule" astigmatism in the other. Table 3 gives the percentage distribution of "with the rule" or "against the rule" astigmatism in different age groups. "Astigmatism against the rule" was more frequent (83 %) than "with the rule" (17 %). Myopic astigmatism against the rule was the commonest (53.2 %), followed by hypermetropic astigmatism (29.5 %) against the rule. Up to 44 years of age, myopic astigmatism against the rule was common, and after 44 years hypermetropic astigmatism against the rule was common.

The distribution of the types of refractive errors in different ethnic groups is shown in Table 4. Brahmins (29.5 %) predominated over other communities in the present study to have refractive errors followed by Gurungs (19.9 %). Myopia was the major type of refractive error in Newars and Chhetriyas while hypermetropia was more common among Gurungs. In Brahmins myopia and hypermetropia had a similar occurrence.

Discussion

Uncorrected refractive errors are an important cause of blindness and visual impairment in many countries (Dandona L et al 1998). In developing countries however, it is often difficult to provide efficient refraction services for a variety of reasons, and this results in a high prevalence of uncorrected refractive errors in these regions. Avoidable blindness and low vision can restrict progress in education, limit motor development in children, affect mobility, limit career opportunities and restrict access to information. It is a burden on the community and its social and income generating services. So there is a priority need to control and prevent these disorders. For this, information about the pattern of refractive errors in the population is essential. It helps in planning effective community programs to deal with the problem.

In our study, myopia was found to be the commonest refractive error. Myopia and myopic astigmatism was more common among youngsters below 35 years of age while hypermetropia and hypermetropic astigmatism was more common in those above 35 years of age. Similar findings were reported from Nigeria, Zaire and Israel (Adegbehingbe et al 2003, Kaimbo-Wa-Kaimbo & Missotten, 1996; Rosner & Belkin, 1991). Nepal BP et al (2003) from Kathmandu found the incidence of myopia to increase progressively after the age of 8 years up to

16 years. Myopia has been shown to progress after puberty but at a slower rate and axial elongation of the eyeball is the supposed mechanism (Lin LL, 1996). A population-based study conducted in Hong Kong among adults above 40 years of age showed hypermetropia as the predominant refractive error, which is similar to our findings (Lam CS, 1994). The pattern of shift toward hypermetropia among younger adults and the shift toward myopia among older adults seen in our studies is consistent with longitudinal observations in many other population studies (Wu SY et al 2005, Lee KE et al 2002, Prema Raju et al 2004, Shufelt C et al 2005, Dandona R et al 1999, Wong TY et all 2001). Older persons had shorter axial and vitreous chamber lengths, shallower anterior chambers and thicker lenses than younger individuals in the Los Angeles Latino Eye Study (Shufelt C et al 2005). These differences in biometry were associated with a trend toward greater hyperopic refractive errors until the age of 70 years. Vitreous chamber depth was the most important determinant of refraction in adults of more than 40 years old in the Tanjong Pagar Survey (Wong TY et al 2001). Ooi CS & Grosvenor T (1995) suggested that decrease in the gradient-index of the lens occurs with increasing age. Other possible explanation cited is the decrease in the power of the aging lens, either due to a decrease in the curvature of its surface as it grows throughout life or an increase in the density of the cortex that makes the lens more uniformly refractive (Dandona R et al 1999). One more explanation for this may be that latent hypermetropia becoming manifest when the amplitude of accommodation decreases. Incidence of myopia was found to decrease with advancing cortical opacities in Barbados Eye Study (Wu SY et al 2005). The natural tendency towards hypermetropia in young adults argues against doing any refractive surgeries in patients with low myopia who form the main bulk of myopic patients.

In patients of age over 64 years, we saw a change towards myopia in our patients. The patients seen in this age group may be less than the actual number, as patients with significant cataract and pseudophakia were excluded from the study. Studies have shown that in the "after 60 years" age group, when a myopic shift was observed, it was strongly associated with the presence of nuclear opalescence (Wu SY et al 2005, Lee KE et al 2002, Shufelt C et al 2005, Wong TY et al 2001). Recent work by Glasser & Campbell (1999) has shown that the focal length of the lens increases up to age 65 years and then begins to decrease.

A hospital-based study done in Kathmandu valley reported an entirely different scenario with astigmatism (43.8 %) being the commonest error followed by hypermetropia (42.55 %) and then myopia (13.63 %) (Karki & Karki, 2003).

In our study, myopia was common among males while hypermetropia was more common among females. Some of the population-based studies conducted in different parts of world showed similar trends (Wu SY et al 2005, Prema Raju et al 2004, Attebo K et al 1999, Katz J et al 1997, Cheng C et al 2003). Wong TY et al (2001) from Singapore found in their study that after controlling for age, women had shorter axial lengths, shallower anterior chamber depths and shorter vitreous chamber depths than men, which may be the reason for the above finding.

The majority of myopics (75.4 %) had a power less than or equal to two dioptres and 22.9 % of the rest of patients had a power >-2 D and <-6 D. Similar findings were seen in other studies (Adegbehingbe BO et al 2003, Nepal BP et al 2003). High myopia with power above -6 D in both eyes was seen in 1.7 % of patients in our study. Similar findings (definition of high myopia was either > -5 D or > -6 D) were seen in a Baltimore eye survey (1.4 %), Shihpai Eye Study (2.3 %), a 13-Year Series of Population-Based Prevalence Surveys from Israel (1.21 % for males and 1.26 for females) and a study from Sumatra (2.4 %) (Katz J et al 1997, Cheng C et al 2003, Dayan YB et al 2005, , Saw S et al 2002). High myopia was seen in only 0.5 % of patients from Nigeria (Adegbehingbe BO et al 2003). It was not seen in children surveyed in Kathmandu (Nepal BP et al 2003). The significance of high myopia is that it has a higher risk of cataract, glaucoma, myopic macular degeneration and retinal detachment, and the results of refractive surgery are less predictable in subjects with high myopia. The majority of other refractive errors were less than or equal to 2 diopters. These data may also be useful in keeping a ready stock of lenses required to meet the demands of a quick supply of spectacles in the hospital and also for local outreach community programmes.

Myopic astigmatism was more common than hypermetropic astigmatism. This is in agreement to what was seen in Nigeria and Zaire (Adegbehingbe BO et al 2003, Kaimbo-Wa-Kaimbo & Missotten, 1996). The high incidences of "against the rule astigmatism" seen in our study were also seen in many other studies (Prema et al 2004, Dandona R et al 1999, Cheng C et al 2003, Bourne RR et al 2004). Studies have shown a shift toward against-the-rule astigmatism with age (Dandona R et al 1999, Prema et al 2004, Bourne RR et al 2004). A decrease in lid tension in old age has been cited as the reason for the increase in "against the rule astigmatism" in the older age group. Gudmundsdottir E et al (2000) showed that the changes in total astigmatism and corneal astigmatism is almost parallel, which might indicate that the ''against the rule'' change is related to changes in the cornea. Baldwin WR & Mills D (1981) have shown that the steepening of the cornea in the horizontal meridian accounts for a major portion of the increase in against-the-rule total astigmatism among older patients. But in our study, "astigmatism against the rule" was more frequent than "astigmatism with the rule" irrespective of age. The same finding was specially noted in a study of an urban population in South India (Dandona R et al 1999). It was speculated that unlike in other studies, the lid tension might have been less in the South Indian population to begin with, which reduced further with age. This has to be further investigated for other unidentified reasons by a prospective study in the general population. Our study showed a change from myopic astigmatism against the rule to hypermetropic astigmatism against the rule after 44 years of age, following the general trend of myopia and hypermetropia.

In our study, the number of Brahmin patients was more compared to Gurungs, though the reverse is the case among the general population in the study area (Sharma HB et al 2001). Though the majority of the Brahmin community is engaged in agriculture, it is more literate than the Gurung community, and this could be the reason for more Brahmin patients visiting the hospital for their eye check-ups. Many studies have indicated that myopia is more common in more intelligent and more educated groups (Garner LF et al 1999; Katz J et al 1997; Matthew Wensor et al 1999; Rosner & Belkin, 1987; Wong TY et al 2001, Zylbermann R et al 1993). 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. Our study found higher occurrence of myopia among Newars and hypermetropia among Gurungs. The Newar community are more educated and employed in academic and clerical jobs (Karki & Karki, 2003). The Gurungs have neither a very high literacy rate nor are professionally involved in near-and-fine-work jobs and are more involved in the police or military services. The other explanation may be that the median age of Gurungs, Chhetriyas and Newar patients in our study was 48 years, 38 years and 31 years respectively. As myopia is more common among younger people and hypermetropia among the older ones, this may be the other reason for the interethnic differences noted in our study. A similar hospital based study conducted among patients aged 5-35 years in Kathmandu Valley showed Newars to be the commonest ethnic group reporting with refractive errors, followed by Brahmins and Chhetriyas (Karki & Karki, 2003). In that study astigmatism was the commonest error in Newars and hypermetropia in Chhetriyas and Brahmins, which was not seen in our study. More population-based studies are needed to explore these differences in the pattern of refractive errors among different ethnic groups in Nepal. The findings of the present study should be taken cautiously as this is a hospital-based study and cannot be extrapolated for the entire population of western Nepal.

Conclusions

Myopia is the commonest refractive error among males and in the younger age groups while hypermetropia is more common among females and in older age groups. There is a wide variation in the pattern of refractive errors among different ethnic groups.

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