

Original Article

Prevalence of refractive errors among carpet weavers of Kashmir valley, India

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To determine the prevalence of refractive errors in carpet weaving population of Kashmir valley. In this cross sectional study, the sample was taken from various carpet weaving centres of Srinagar, carpet weaver was taken as a person who wove carpets for more than 7 hours a day for at least 1 year or more. The variables of age, gender, duration of carpet weaving and ocular components with respect to their frequency, were observed. Persons suffering from anterior and posterior segment diseases, malnutrition, fever or any debilitating diseases which could directly or indirectly alter the refractive state of eye were excluded from the study. In this study, 500 carpet weavers were evaluated, 386(77.20%) were males and 114(22.80%) were females. Out of 500 cases 326(65.20%) were found to have some error of refraction. The prevalence of myopia without astigmatism was highest at 284(56.80%) followed by myopic astigmatism at 30(6.00%) and hypermetropia was seen in 12(2.40%) carpet weavers. Moreover it was observed that longer the duration of involvement in carpet weaving more the incidence of refractive errors and refraction in carpet weavers had a significant relation to the ocular components. The results of this study showed that carpet weaving had a strong correlation with myopia. In addition to duration of near work, variation in refraction may be due to the changes of ocular components particularly axial length (AL) and vitreous chamber depth (VCD).

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Key words : Myopia, hypermetropia, astigmatism, ocular biometry, refractive error, carpet weaving.

Anomalies of the refractive state of the eye, the refractive errors, are by far the commonest cause of defective vision. Epidemiological studies indicated that uncorrected refractive errors are accounted to be among the important risk factors for visual impairments in the world¹. According to available studies, uncorrected refractive errors are the second cause of blindness based on the presenting vision². Although these errors can be easily corrected with glasses, many reports indicate that 50% of the children and adults are affected by this defect in different parts of the world³.

In addition to demography, age, gender, and education, factors such as ocular biometry, profession, near work, and environmental and genetic factors have been assessed⁴. The relationship between near work and myopia has been investigated in laboratory, epidemiologic, and experimental studies and has been confirmed by most of them⁵. Some studies have shown that prolonged near work may cause transient myopia⁶. Important studies conducted by McBrien, Saw and Morgan have assessed the relationship between myopia and near work^{7,8}. Since near work is considered a risk factor for myopia, controlling the exposure

to near work can be regarded as an effective way of preventing the development or progression of myopia. McBrien demonstrated this relationship in microscopists⁹; Ip *et al*⁵ also showed that a close distance during studying can cause myopia.

Carpet weaving is a traditional occupation in Kashmir. Many people belonging to poor socio economic class have taken up carpet weaving as their occupation and learn this skill in childhood. In carpet weaving, the person is involved in near work for as long as 8-12 hours a day and therefore this might cause myopia. Evaluation of refractive errors in this occupation has received little attention. The purpose of this study was to assess refractive errors in carpet weavers.

MATERIALS AND METHODS

In this cross-sectional study, persons involved with profession of carpet weaving were evaluated for refractive errors. Among carpet weaving workshops of the Srinagar city and adjoining villages 500 carpet weavers were chosen as per the below inclusion criteria. After explaining the aim and protocol of the study, the owners of all workshops consented to the participation of their workers in the study.

The inclusion criteria for carpet weavers were as the following:

- (1) More than seven hours of daily work.
- (2) Being involved in the occupation for at least one year.
- (3) No history of ocular diseases, amblyopia, aphakia,

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strabismus, refractive error surgery, diabetes, or systemic disease affecting refractive errors. During the interview, they were asked about a history of using spectacles, refractive surgery and systemic disease.

All participants signed an informed written consent prior to the study. After acquiring their written consent, carpet weavers completed a questionnaire on personal information, family history, the age at which they started weaving, hours of weaving per day, and other near work. Then, ocular examinations including visual acuity (VA) testing with a Snellen's test types/landolt's rings at 6 m, manifest refraction, retinoscopy and subjective refraction were performed. Moreover participants with subnormal vision or asthenopic symptoms were additionally subjected to refraction under cycloplegia using (cyclopentolate / atropine). Refractive errors of each eye were measured by autorefractometer (mean of three measurements, the auto refraction results were cross checked using retinoscopy). For measurement of ocular components keratometry (mean of three measurements) and biometry (mean of three measurements) were done for both eyes. Fundus examination was performed in all the participants and those with organic defects were excluded from the study. Results with the autorefractometer were recorded and used in the analysis.

In this study, refractive errors were defined based on the spherical equivalent (SE=half of negative cylinder + sphere). Myopia was defined as a minimum SE of -0.5 diopter (D) or less in at least one eye⁴. Hypermetropia was defined as a minimum SE of +0.5 D or more in at least one eye, provided the other eye is not myopic.⁴ Astigmatism was defined as a cylinder power of 1.0 D or more.

The following categorization was considered for refractive errors: mild myopia (-0.5 to -3.0 D), moderate myopia (-3.1 to -6.0 D), and severe myopia (more than -6.0 D); mild hypermetropia (0.5 to 2.0 D), moderate hypermetropia (2.0 to 4.0 D) and severe hypermetropia (more than 4.0 D).

Based on astigmatism axis, an axis of 180 ± 20 was classified as with-the-rule (WTR), an axis of 90 ± 20 was considered against-the-rule (ATR), and others were considered oblique astigmatism.

STATISTICALLY ANALYSIS

Simple logistic regression was applied to assess the association between refractive errors and carpet weaving. Chi square (X^2) testing was employed and values were taken against degrees of freedom (DF) and p value was calculated to assess the statistical significance.

RESULTS

In this study, 500 carpet weavers were evaluated. Of these participants, 77.20% were male and 22.80% were female. The mean age of 29 (range, 06 to 55) years were evaluated. The mean duration of carpet weaving was 20

(range, 1 to 40) years. Of 500 carpet weavers 326(65.20%) were observed to have refractive errors of which 284 (56.80%) had myopia, 30(6.00%) had myopic astigmatism bringing incidence of total myopia at 314(62.80%). A total of 12(2.40%) among 500 carpet weavers were found to have hypermetropia.

Table 1 presents the prevalence of refractive errors with gender break up revealing that no statistical association was observed between prevalence of refractive errors and gender.

Table 2 shows a statistically significant association with the duration of carpet weaving and incidence of myopia.

Table 3 shows family history has significant bearing in the occurrence of refractive error in the study group. Out of a total of 66 carpet weavers with family history of refractive error (myopia), 63(95.45%) were having some degree of refractive error (myopia). Statistically analysed the values have a x^2 value of 68.79 with DF =1 giving a p value <0.001 which is highly significant.

Table 4 shows the relationship between ocular components and refractive errors in the carpet weaving population, showing that axial length(AL), anterior chamber depth(ACD) and vitreous chamber depth(VCD) had the most relationship to myopia while as lens thickness(LT) and corneal curvature radius(RC) were not significantly different in the myopes compared to the non myopes.

The prevalence of severity of myopia and hypermetropia among carpet weavers has been demonstrated in the below graph, demonstrating clearly the bulk of workers with myopia (Fig 1).

Table 1 — Prevalence of refractive errors with gender break up

Sex	Total cases	Cases with refractive errors	Statistical inference
Male	386(77.20%)	253(65.54%)	$X^2 = 0.09$ Df=1 P>50(not Significant)
Female	114(22.80%)	73(64.04%)	
Total	500	326(65.20%)	

Table 2 — Association of refractive error with duration of carpet weaving

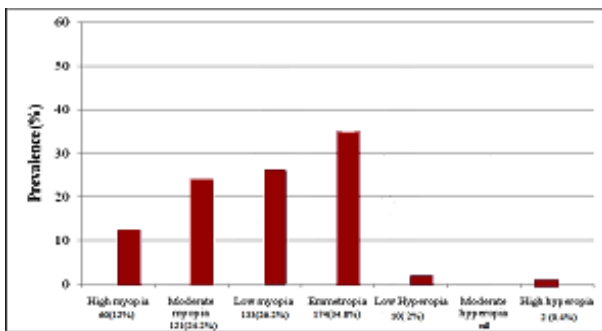
Total duration of carpet weaving	Total cases	Cases with Myopia	Statistical Inference
<2 years	52	16(30.77%)	$X^2 = 30.60$ Df = 2
<3 years	51	18(35.29%)	
<4 years	60	36(60.00%)	P<0.001 (Significant)
5 Years And Above	337	244(72.40%)	

Table 3 — Association between positive family history and prevalence of refractive error

Family history of refractive error	Total children studied	Children with refractive error
In mother	51	49(96.07%)
In father	15	14(93.33%)
All cases with family history	66	63(95.45%)
No family history	434	263(55.48%)
Total	500	326(65.20%)

Table 4 —Relationship of various ocular parameters with different refractive errors

	AL (mm)	ACD (mm)	VCD (mm)	LT (mm)	RC (mm)
Myopia	24.0±1.0	3.2±0.4	16.6±1.0	3.9±0.2	7.5±0.2
Emmetropia	22.9±0.8	3.0±0.4	16.0±0.8	3.8±0.3	7.5±0.3
Hypermetropia	22.6±0.7	2.7±0.3	15.4±0.8	4.0±0.2	7.5±0.2
P value	<0.001	<0.001	<0.001	0.039	0.986



DISCUSSION

Although approximation to emmetropia is maintained throughout infancy and childhood despite great alterations in the refractive components of eye, refractive errors do creep in. Although most studies have reported that near work is a risk factor of myopia, some recent studies have contradicted this finding¹⁰. The current survey was a cross sectional study in which the exposure group was carpet weavers who had focused on near objects for long. As mentioned, 70% of the myopia in carpet weavers was attributed to weaving; this finding was expected based on other studies in this regard^{11,12}. The relationship between refractive errors and carpet weaving has received little attention in the literature, though many studies have documented the correlation between near work and myopia^{9,11,12}.

According to our findings, myopia was more severe in carpet weavers which was attributed to near work and its duration. However, Ip *et al*¹³ reported that the duration of near work did not affect myopia as the distance of the near work was more important. Some studies have also identified ocular biometric changes, specially an increase in the vitreous chamber depth¹⁴ as the main reason for myopia in near work.

Its seems that long-term chronic accommodation can result in increment of vitreous chamber depth and myopia due to scleral traction¹⁵. Some studies have demonstrated the transient effect of accommodation on myopia¹⁵. In our study, the average participant had 29 years of weaving experience, and one can assume that most of this process occurred during their adolescence when they had active accommodation. Thus, the onset age for myopia would be the 2nd or 3rd decade of their lives.

In addition to near work, environmental factors can be

regarded as a confounding factor. For example, many carpet weavers work in low light conditions. Also, the Profession runs in families for generations and therefore genetic factors may play a role in developing myopia, as was also revealed in our study. The higher prevalence of myopia in this group due to the increased axial length can justify the lower prevalence of hypermetropia. Also since hypermetropic individuals have more visual problems and symptoms during near work as compared to myopic people, they might be less interested in taking up carpet weaving as their occupation.

A higher prevalence of astigmatism in carpet weavers was one of the findings of this study which has been less addressed in other reports¹⁶. Although it is rather difficult to justify the relationship between near work and astigmatism, it might result from incyclotorsion during near work; with the contraction of the ciliary muscle during accommodation, the center of the cornea steepens and increases its power¹⁷. In a study by Buehren *et al*¹⁸, corneal topography was examined before and after 60 minutes of near work; a change in corneal topography, specially corneal astigmatism was observed in some cases which were attributed to the effect of the eyelids.

Although our study had many strong points in its methodology, it had some weaknesses as well. As myopic weavers are more comfortable with this job than hypermetropes, they probably last longer, and this could have been a source of selection bias for our samples. Since in cross-sectional studies, temporality and causation cannot be determined, we suggest that a cohort study be conducted for further assessment.

CONCLUSION

The results of this study showed that near work had a strong correlation with myopia. In addition to myopia, the prevalence of astigmatism, specially ATR astigmatism, was higher in carpet weavers who did more near work. In addition to duration of near work, variation in refraction particularly myopia may be due to the changes of ocular components mainly axial length (AL) and vitreous chamber depth (VCD).

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