CLINICAL STUDY OF CORRELATION BETWEEN DEGREE OF MYOPIA AND AXIAL LENGTH OF EYEBALL IN MYOPIC PATIENTS

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ABSTRACT

BACKGROUND

The refractive error around the globe has been estimated to be around 800 million to 2.4 billion. Refractive errors are the most common cause of visual disorders. Amongst them myopia is the most common disorder. As per the 2001-02 national survey on blindness in India, refractive errors accounts for 19.7% of total blindness.

METHODS

Anterior segments of 150 eyes of patients were examined using slit lamp biomicroscope. The visual acuity, cycloplegic refraction, retinoscopy, fundoscopy were done for all the selected patients after obtaining an informed consent. The axial lengths that were obtained using A-scan were correlated with the degree of myopia. They were further sub classified on the basis of age, sex, familial factors and complications.

RESULTS

In this study, out of 150 eyes Females constituted 65.06% of the total cases while males constituted 34.93% of the total cases. Subjects having less than -6D constituted 69.9% of the cases. The degree of myopia progressively increased with increase in axial lengths particularly in those with greater than -6D. Myopia of greater than -15D was commonly associated with degenerative changes. Severity increases with increase in axial lengths. Lower degrees of myopia have good corrected visual acuities while the longer axial lengths having higher grades of myopia had worst corrected visual acuities.

CONCLUSIONS

All patients showed an increase in the axial length, which was greater for highly myopic eyes. High degrees of myopia associated with complications may require careful follow up.

KEYWORDS

Myopia, Visual Acuity, Refraction, Axial Length, A-Scan

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BACKGROUND

Refractive errors are the most common cause of visual disorders. Amongst them myopia is the most common disorder. Myopia or short-sightedness is a type of refractive error in which parallel rays of light coming from infinity are focused in front of the retina when accommodation is at rest.[1] It affects all the age groups, ethnic groups, genders and causes blindness. Myopia is a global health problem associated with not only vision impairment but also blinding complications. Myopia can be classified into-

1. Axial myopia**:** It occurs due to the increase in antero-posterior length of the eyeball. It is the commonest form.
2. Curvatural myopia: It occurs due to increased curvature of the cornea, lens or both.
3. Positional myopia: It is produced by anterior placement of crystalline lens in the eye.
4. Index myopia: It results from increase in the refractive index of crystalline lens associated with nuclear sclerosis.
5. Myopia due to excessive accommodation occurs in patients with spasm of accommodation.[1]

Ultrasonography A - scan measures the axial length i.e., antero posterior diameter of the eyeball with high degree of accuracy. It utilizes ultrasonic frequencies of 10 MHZ. Based on the degree of myopia, it can be again classified into two types namely simple myopia (-0 to -6 dioptres)**,** pathological myopia (>-6 dioptres).

As per the 2001-02 national survey on blindness in India, refractive errors accounts for 19.7% of total blindness.[2] Studies from the early 2000s from India have quoted prevalence of myopia in children is 7.4% by Murthy et al. and 4.1% by Dandona et al.[3,4] Studies in adults have found myopia prevalence ranging from 19.4% in Taiwan to 41.8% in Japan.[5,6] It is a condition occurring as a result of increased global axial length or increased refractive power

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of anterior segment but the former being the more important. Von Jeager first described congenital myopia in 1855. Studies have revealed that myopia is found more often in females than males and also prevalence of myopia increased with age, with a maximum of 67.2% in the age group between 30 to 40 years.[7] Higher degrees of myopia are known to have higher axial lengths and complications like lattice degeneration, posterior staphyloma, retinal detachment, vitreous opacities, and retinal tears. High myopia can have a profound effect on the visual acuity of the patient and can cause blindness.[8] Myopia also poses medical burden with increased incidence of glaucoma and cataracts in those myopic individuals.[9]

We wanted to study the correlation between axial length, age, sex and complications associated with the degree of myopia.

METHODS

This is a cross sectional study conducted on 150 eyes of the patients attending the outpatient department of Ophthalmology at Karnataka institute of medical sciences, Hubli. Ethical clearance is obtained from the institution.

Inclusion Criteria

All patients attending the outpatient department of Ophthalmology, Karnataka Institute of Medical Sciences, Hubli, for diminished vision within the age group of 10 to 60 years, with pseudophakia, and with diabetes and hypertension were included in the study.

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Exclusion Criteria

Patients with corneal pathologies, lenticular opacities, glaucoma, retinitis pigmentosa and uveitis were excluded.

Methodology

A clinical study on patients with complaints of blurring of vision attending the outpatient department of Ophthalmology, Karnataka institute of medical sciences and who are willing to participate in the study. After taking written informed consent a detailed history regarding their complaints, the onset, duration of complaints, past history of wearing spectacles and family history is to be enquired. The patients are to be screened in the outpatient department. Preliminary examination of visual acuity for distance is to be determined with Snellen's chart and pinhole improvement is noted. Cycloplegic refraction is done for patients in the age group of 10 to 15 years &retinoscopy is performed in all the patients included in the study. Refraction readings are to be determined with a retinoscope in a dark room and subjective correction is to be given. Retinoscopy readings are to be done after using a cycloplegic like cyclopentolate (0.5 to 1%) and they are called for post mydriatic refractive correction after 3 days. For auto refractometer, three consecutive autorefractor measurements were performed and the average value was used for analysis. The patients were reviewed again for assessment of subjective dioptric refractive acceptance. They were then be prescribed appropriate refractive correction for refractive error. The results of objective refractometry technique will be compared to the results of subjective dioptric acceptance of refractive correction. The following measurements with dioptres (D) will be recorded for analysis**:** 1. Spherical Power 2. Cylindrical Power 3. Spherical Equivalent (Spherical Power + (0.5× Cylindrical Power) 4. Axis. Those patients with myopia are segregated and subjected for slit lamp examination and fundus examination with direct or indirect ophthalmoscope. The patients are then explained the procedure of axial lengths using A scan are determined. The axial length so obtained are co-related with degree of myopia. They are then further sub-classified on basis of age, sex, familial factors and complications.

RESULTS

In the present study, axial lengths of 150 eyes were measured using the A scan ultrasonography.

Gender	No. of Cases	Percentage
Males	29	34.93%
Females	54	65.06%
Total	83	100

Table 1. Proportion of Myopia in the Two Genders

Degree of Myopia	No. of Eyes	No. of Patients	Percentage
0 to -3D	82	41	54.66%
-4 to -6D	23	14	15.33%
-7 to -9D	23	15	15.33%
-10 to -12D	06	04	04%
-13 to -15D	04	03	02.66%
-16 to -18D	08	04	05.33%
-19 to -21D	04	02	02.66%
Total	150	83	

Table 2. Correlation Between the Degree of Myopia and Number of Patients

Degree of Myopia	Range of Axial Length	No. of Eyes	Percentage
0 to -3D	21 to 25 mm	74	49.33%
-4 to -6D	22 to 26 mm	30	20%
-7 to -9D	23 to 27 mm	22	14.66%
-10 to -12D	22 to 24 mm	10	06.66%
>12D	26 to 30 mm	14	09.33%
Total		150	

Table 3. Correlation Between Range of Axial Length and Degree of Myopia

The above table shows that the shorter axial lengths associated with lower degrees of myopia when compared to the longer axial lengths associated higher degrees of myopia. It is seen that, as the axial length increases, dioptric power also increases.

Myopic Fundus Features	No. of Eyes	Percentage
Myopic crescent	50	33.3%
Tessellated fundus	54	36%
Vitreous changes	26	17.3%
Choroid degenerative changes	10	06.6%
Fuchs's spots	06	04%
Peripheral retinal degeneration	04	02.66%
Total	150	

Table 4. Number and Percentage of Myopic Eyes Showing Fundus Changes

The above table shows that tessellated fundus was present in maximum number of eyes (54) 36% whereas, peripheral retinal degeneration was present in only 2.66% eyes.

Family History	No. of Cases	Percentage
Present	22	26.5%
Absent	61	73.4%
Total	83	
Table 5. Incidence of Family History		

Ocular Condition	No. of Eyes	Percentage
Nystagmus	02	01.33%
Divergent squint	04	02.66%
Keratoconus	02	01.33%
Diabetic retinopathy	04	02.66%
Pigment degeneration	10	06%
Night blindness	00	00%
Macular scar	04	02.66%
Total	26	
Table 6. Number of Myopic Cases with Associated Ocular Condition		

The above table shows that 6% of myopic cases are associated with pigment degeneration.

Visual Improvement	No. of Eyes	Percentage
6/6 - 6/9	72	48%
6/12 – 6/18	32	21.33%
6/24 – 6/36	25	16.66%
6/60 – CF 3 mtr	12	08%
CF 2 mt - CF 1 mt	06	04%
No improvement	03	02%
Total	150	
Table 7. Degree of Visual Improvement with Glasses		

The above table shows that 48% of the total eyes had improvement of vision up to 6/6-6/9 whereas, no improvement in vision was observed in 2%.

Complications	No. of Eyes	Percentage
Choroidal haemorrhage	00	00%
Retinal detachment	04	02.66%
Complicated cataract	00	00%
Posterior staphyloma	02	01.38%
Macular scar	04	02.66%
CNVM	02	01.38%
Total	12	
Table 8. Number of Myopic Eyes Showing Complications		

The above table shows that 2.66% of eyes had retinal detachment and macular scar whereas, none of the patients had choroidal haemorrhage and complicated cataract.

DISCUSSION

In the present study, patients having 0 to -3D of myopia and -3 to -6 D accounts for 69.9% in this study.

	Low Myopia< -6D	High Myopia>-6D
Tron[10] (computation)	22.19 – 28.08	24.88 – 38.18
Deller[11] (radiology)	20.5 – 26.0	25.5 – 28.5
Stenstorm[12] (radiology)	22.0 – 28.0	23.5 – 29.50
Sorsby et al[13] (computation)	22.01 – 28.0	25.01 – 37.0
Table 9. Range of Axial Length in Low and High Myopia		

Yang J, Song X, Wang Y[14] in their paper published in 1997 observed that ultrasound biometry to be the best method of axial length measurement. Reports by Hauff W**,**[15] using 10 MHz sound probe for A scan biometry enabled measurements of the axial lengths of the eye to within an accuracy of 0.1 mm. In present study, it was noted that the degree of myopia progressively increased with increase in axial length especially, >-6D. Beyond, -6D a definite relationship between the axial length and degree of myopia was seen. Every degree of myopia corresponded to approximately an increase by 0.39 mm in the axial length. Nicolcescu AM[16] concluded that axial myopia is the most frequent form of myopia. In this study of axial myopia, 34.93% of the subjects were males and 65.09% were females. Studies conducted by Wang[17] et al reveal a higher prevalence of myopia in females compared to males in all age groups.

Age Group	Females	Males
43-54	47.50	37.80
55-64	26.50	23.40
65-74	15.90	13.30
Table 10. Gender Difference in Refraction Wang[17] et al		

In the present study, the majority of cases having shorter axial lengths had myopia of less than -6D and showed mainly a physiological fundus. All eye >-15D had pathological myopic fundus changes. The incidence and severity of complications showed an increase in the axial lengths and the degree of myopia. Similar findings have been reported by Curtin BJ.[18] He reports an increase frequency of crescents with increase in axial lengths. In the present study, tessellated fundus and optic disc crescent were found out to be the most common posterior pole findings. Karlin DB[19] reported that the frequency of crescents increased with axial length until all eyes larger than 29 mm had crescents. Pigmentary degeneration was seen commonly in 51-60 and >60 age groups.

CONCLUSIONS

The majority cases of myopia were observed in females. There exists a statistical correlation between axial length and degree of myopia. Longer axial lengths were associated with high degree of myopia and shorter axial lengths were associated with low degree of myopia. Also, high degrees of myopia were associated with complications and compromised quality of life due to poor vision when compared to low degrees of myopia associated with less complications and good quality of life due to good vision.

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