

Chronological Age and Subjective Perception of Visual Acuity among Myopic Patients Practicing Eye Relaxation

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Abstract:

Myopia is a condition where a parallel ray entering the eye converges anterior to the retina. It is the most common refractive condition affecting 30% to 35% of the population even in Western countries (Grosvenor, T. & Goss, D., 1999). Myopia is seen to be rapidly progressive under stress. Stress is perceived to have positive correlation to age (Mroczek & Almeida, 2004). In the view of the greater prevalence of myopic condition and the influence of age on myopic condition, in the present study an attempt has been made to devise strategies for alleviating myopic vision through a set of eye relaxation practices. The sample included in the study is 177 myopic patients categorized into four groups based on their chronological age (namely, 0-12years, 13-18years, 19-39years and above 40years). Intervention involving ten sessions of eye relaxation practices are given to the sample. Analysis of the results indicated significant improvement in the level of visual acuity in all the four age groups with the younger groups taking a slightly more favourable turn.

Key words: Myopia, Visual acuity, Eye, Relaxation, Age.

Myopia or Error in distant vision is a condition where both the lens and the cornea are too strong or the eye ball too long that the parallel rays entering the eye converge into focus anterior to the light sensitive area of the retina. The condition can be

corrected by placing a concave lens in front of the eye initiating the incoming rays to diverge. The power of the concave lens is measured in diopres (D). Three types of Myopia are observed. They are:

- a) Simple Myopia: This is a condition where visual degeneration does not occur after adolescence. Here a degree of 5D or 6D may be attained.
- b) Developmental Myopia: This is a congenital condition where the child is born with an abnormally long eye. The refraction soon after birth may be 10 D, but in this type of myopia progression is rare.
- c) Pathological axial Myopia: This is degenerative and progressive. The refractive changes appear in childhood, usually between the ages 5years and 10 years and increase steadily up to the age of 25 years or beyond, finally amounting to 15D to 25D or more.

Prognosis: Low or moderate degrees of simple myopia (up to 5D or 6D), unless occurring in very young children have good prognosis. They are not likely to progress. The same condition in a child below the age of 6 years or 7 years; if it is not congenital is of grave prognosis and may progress to 10D to 15D of myopia or more accompanied by serious degenerative changes in the fundus and defects of vision.

Treatment: Conventional treatment consists of wearing correcting spectacles and surgical management. Myopia is seen to be rapidly progressive if the child is under stress, temporary cessation of schooling and a change of air to country with plenty of healthy exercise is seen to be desirable (Miller, 1978).

Research conducted on the topic reveal myopia to be the most prevalent refractive condition. Studies to assess the prevalence of refractive error in an urban population in southern India, on subjects >15 years of age, the prevalence of myopia was 19.39%, of Hyperopia 9.83%, and of astigmatism 12.94% (Dandona, R., Dandona, L., Naduvilath, T.J., Srinivas,

M., McCarty, C.A., & Rao, G.N., 1999). Another study conducted in Andrapradesh on a sample that included one fourth urban and three fourth rural populations indicated a prevalence rate of 15.2% myopic patients. (Murthy, G.V.S., Gupta, S.K., Ellwein, L.B., Munoz, S.R., Pokbarel, G.P., Sanga, L., & Bacbani, D., 2002).

Visual acuity has always been related to age. Myopia is normally detected at the age of 4 or 5 years. The progression is observed to be rapid during adolescence in comparison to childhood and adult hood. The progression of myopia is perceived to be arrested after adulthood and myopic symptoms start declining. Several studies are seen to support this. Studies conducted in South India on 4800 subjects above the age of thirty five indicate myopia increased significantly with age. (Raju, P., Ramesh, S.V., Aravind, H., George, R., Baskaran, M., Paul, P.G., Kumaramanickavel, G., McCarty, C., & Vijaya, L., 2004). Studies reported the prevalence of myopia of 36.5% in adults aged 40 years and older in rural and urban area in southern India (Dandona et al, 1999; Dandona, R., Dandona, L., Srinivas, M., Sahare, P., Narsaiah, S., Munoz, S.R., Pokharel, G.P., & Elliwein, L.B., 2002) and decreased of 24% in those 40 to 49 years of age, to 12% in those 70 to 79 years (Wu, H.M., Seet, B., Yap, E.P.H., Saw, S.M., Lim, T.H., & Chia, K.S., 2001). Research conducted in United States, indicate the decline of myopia from 42% in adults 43 to 54years of age to 14% in those 75years or older.

Conventional management of myopia involves the use of spectacles or surgical correction. However progression of myopia is observed after the implication of both the methods. Researches point to the fact that stress and strain of the eyes leads to rapid progression of myopia. Rosenfield's (1994) study on the reasons of myopia indicates that all myopia is not induced due to accommodation deficit alone but excessive near work is also a major predisposing factor. Studies also reveals that temporary myoptization was observed among 64% Italian

video display terminal workers during assessment of vision at the culmination of a shift (Leberto, F., Gobba, F. & Broglia, A., 1988). A study in Sweden further indicates that occurrence of eye discomfort is seen to increase in relation to the number of hours spend in video display terminal (Bergqvist, U.O., Knave, B.G., 1995). Interestingly, a study on Australian school children revealed that more than the numbers of hours spend on reading it is the type of material that had more effect on the progression of myopia. Amusing and light reading for long duration did not affect the progression of myopia as much as strenuous and uninteresting work (Ip, J.M., Saw, S., Rose, K.A., Morgan, I.G., Kifley, A., Wang, J.J., & Mitchell, P., 2008).

Many studies emphasize that eye exercises, muscle relaxation techniques, bio feedback, eye patches, eye massages alone or in combinations can aid in the management of progression of myopia. Bambridge A (2002) conducted studies on a patient with myopia using holistic methods of treatment (CranioSacral therapy, Aroma therapy massage, Self healing methods of Meir Schneider, The Alexander technique, Bates method, psychotherapy and counseling) and reducing the spectacle strength. The patients account shows that this method is much effective as far as myopia is concerned. Baltimore visual training administered on 1334 cases with myopia indicated improvement in the level of visual acuity in both eyes, with the left eye having better improvement than the right eye. The system included biofeedback control of accommodation, visual training, and relaxation (Trachtman, 1991). Orfield's (1994) treatment regimen included nutrition rich diet, yoga, outdoor walks, postural training using Alexander's technique, advanced chiropractic and under corrected lenses. The treatment proved effective in bringing down myopia from -3.87D and -3.37D to -0.50D and -0.25D respectively in right eye and left eye. Effect of eye relaxation practices on 30 myopic (blurred distant vision) patients, 15 in the experimental group (constituted individuals working on

computers for 5 or more hours per day) and the remaining 15 in the control group (myopic subjects who do not work on the computer), indicated improvement in visual acuity in both the groups (Lekshmi, K. & Asha, B., 2011).

In addition to the above mentioned relaxation methods physical exercises involving outdoor activities are seen to have a positive effect upon preventing the progression of myopia. A study conducted among the medical students in Denmark suggested that physical activities have a protective effect on development and progression of myopia (Jacobsen, N., Jensen, H. & Goldschmidt E., 2008). A study conducted to compare the prevalence of myopia among 6 and 7 year old Chinese school children in Sydney and Singapore indicated lower prevalence in Sydney, associated with the increased hours of outdoor activities (Rose, K.A., Morgan, I.G., Wayne, S., Burlutsky, G., Mitchell, P., & Saw, S., 2008).

The above mentioned researches reveal that in addition to physiological factors the refractive condition myopia is influenced to a large extent by psychological factors like stress and demographic factors like age. The present study attempts to trace the impact of age, if any on the change in level of visual acuity attained through eye relaxation practices.

Method

Sample

177 myopic patients attending an institution for eye relaxation constitute the sample of the present study. They were between the chronological ages of 4years to 56years. The sample included were urban residents of Kerala of the upper middle class socioeconomic status. Myopia most often develops and progresses between the ages of 7 and 16 years, then stabilizes in the late teens. Cross-sectional refractive data for individuals beyond age 16 suggest that onset and increase of myopia after that age occurs, although it is smaller in degree and appears

limited until the age of 40years, when reading difficulty or hyperopic vision sets in. Hence based on their chronological age the sample is allotted into four groups as follows:

- 0-12years: This constitutes the childhood group during which myopia is initially detected (N- 51).
- 13years-18years: The adolescent group when rapid physical growth accompanied by quick progression of myopia is observed (N- 49).
- 19years-39years: The early adulthood when the bodily changes are not very rapid, but psychological pressures are present (N- 64).
- Above 40years: The age when myopia ceases to progress and other refractive conditions like hyperopic vision or reading difficulty starts and they are also observed to be the most stressed age group (N- 13).

Tools

Tools include vision testing charts and reading material used for exercises.

1. Snell en's test chart for distant vision: The chart consists of a series of letters arranged in lines each diminishing in size. A person with average visual acuity will be able to read the top letter at 60 meters, the second line at 36 meters, the third line at 24 meters, fourth line at 18 meters, fifth line at 12 meters, sixth line at 9 meters and the last line at 6meters. Vision is checked by seating the subject 6 meters away from the chart and is asked to read the chart. Depending on the number of lines the subject is able to read, the vision is graded at 6/60, 6/36, 6/24, 6/18, 6/12, 6/9, 6/6, here 6/6 vision represents normal eyesight. In our study two versions of Snell en's chart are provided, one to do the exercises and other to record vision (this is to avoid familiarity to the chart).

2. Fine print booklet: The letters of the fine print booklet is of the same size as the smallest letters in the Fundamental test

type (F14). Fundamental test type is used to assess the near visual acuity. It consists of 14 sentences in progressively diminishing size, the largest being F1 and the smallest F14. Fine print is used as one of the eye relaxation exercises. It helps in promoting attention, imagination and mobility of the eyes. The fine print is read both in candle light and bright light.

3. Ohm chart: Ohm chart has an ohm written on the centre; around it is a circle with angular projections around it. The subject is made to follow the lines in these projections very slowly and blink at each intersection. This also promotes attention and mobility of the eyes.

Intervention

Intervention was carried out using Eye Relaxation Practices (ERP) which constitutes a group of exercises involving, stimulation and relaxation of eye muscles. It is a blend of Yoga and meditation. The method alternately requires concentration and relaxation on the part of the subjects. The package of exercises includes: a) Attention to - Strokes in pictures, Words or letters, Candle flame; b) Imagination of – Pictures, Letters; c) Mobility of the eye – Side wise movement, Upward and downward movement, Diagonal movement; d) Relaxation of the eye achieved using – Splashing of water, Palming, Vapor, Cold pack.

The subjects are asked to focus on counting during the relaxation phase. This is to ensure that the mind is in a neutral state and not influenced by positive or negative thoughts. Each practice is individually explained to the subject and monitored to ensure the correctness of performance. The subject is instructed to stop the exercises immediately if any discomfort is felt.

Procedure

The initial visual acuity of the subjects is recorded using Snellen's chart, without the aid of spectacles. The visual acuity less than the first line of the chart is taken as 1 and 6/6 vision is taken as 8. The subjects are then made to do the exercises under supervision. The exercises include sunning, swaying, swinging, shifting and palming. Sunning involves letting mild sun's rays fall on upturned face with the eyes closed. It is followed by washing of the face and palming. Palming is done by seating oneself comfortably at a table and closing both eyes and covering them with the cupped palms of both the hands resting the elbows on the table and taking care not to put pressure on the eyes. Swinging is the technique of rotating the body, this is done by bouncing and passing a rubber ball and following it with one's eyes. Swaying is standing and shifting the weight of the body from one foot to another while observing the apparent motion between objects. Shifting involves observing details by shifting the focus of attention smoothly and rapidly from one point to another. The subjects are asked to do the exercises one hour each in the morning and evening and are asked specifically to avoid any change in their daily routine. At the culmination of ten sessions the visual acuity is measured again. The collected data were tabulated, processed and subjected to analysis using SPSS.

Discussion

To ascertain the effect of the eye relaxation practice sessions given to the sample on visual acuity (dependent variable in the study), t-test of significances (paired sample t-test) has been performed with pre intervention and post intervention visual acuity values of the experimental group on both distant and near vision, in both right eye and left eye under the two conditions of spectacle usage.

The analyses before and after eye relaxation practices carried out are depicted as follows:

- Visual acuity in the right eye without spectacles.
- Visual acuity in the left eye without spectacles.
- Visual acuity in the right eye with spectacles.
- Visual acuity in the left eye with spectacles.

The results of the comparison of visual acuity scores before and after eye relaxation practices are represented in table: 1.

Analysis of the visual acuity before and after eye relaxation practices of the right and left eye without and with spectacles suggests significant level of improvement at 1% level of significance in all the four age groups in consideration except in the case of the left eye of the age group 40 to 59years, in this case improvement is perceived at 5% level of significance only. Hence the level of improvement in visual acuity is perceived to be higher in the adults under 40years, adolescents and children under 12years in comparison to adults over the age of 40, which indicates that age is a decisive factor that influences improvement in visual acuity.

Studies (Bowen MD, 1996) on stress affecting the eyes indicate that distress creates chronic activation of body's stress response and will result in disease over time. Brown (1984) reports that 75% to 90% of all diseases count stress as a direct or indirect cause. Selye (1974) said that every disease has some amount of stress adaptation to it; according to him stress triggers General Adaptation Syndrome (GAS) starting off a set of physiological responses like, the enlargement of the adrenal gland, the shrinking of thymus and lymph gland and the production of ulcers. The GAS response can sensitize or desensitize the tissues further in response to the hormones of stress. In tissues directly affected by stress a Local Adaptation Syndrome (LAS) can occur, triggering selective exhaustion of muscles, eyes or inflamed tissues all represented in the final stages only in LAS. LAS in turn stimulate the hypothalamic

pituitary adrenalin inducing the production of cortisol. Cortisol in excess in combination with reduced level of testosterone levels indicates myopia (Balacco, 1982). Hence relaxation would induce reduction of the levels of cortisol, which in turn reduces myopia.

Further analysis of the impact of age on the visual acuity is performed through one way analysis of variance of the improvement in visual acuity acquired by the sample in the ten sessions of eye relaxation practices in the right and left eye under the two conditions of spectacle usage (with and without spectacles) belonging to the four age groups (0-12years, 13years-18years, 19years-39years and above 40years). It is represented in table: 2.

Analysis of improvement of visual acuity in the right eye and left eye of the respondents belonging to the different age groups represented in the table: 3, indicate no significant differences. It can be assumed that eye relaxation practices are effective irrespective of the age of the respondent. Studies on the effect of physical activity associated with improved affective experience and enhanced cognitive processing indicates that exercise may hold important benefits for both affective experience and cognitive performance regardless of age (Hogan, C. L., Mata, J., & Carstensen, L. L., 2013). Interestingly some studies do point to age as a factor that affects stress related hormone variations, higher levels of daily negative affect were associated with elevated levels of bedtime cortisol, among older adults who, on average, reported lower levels of average negative affect supporting the theory of strength and vulnerability integration, and underscoring the importance of age when examining associations between negative affective states and diurnal cortisol (Piazza, J.R., Charles, S. T., Stawski, R. S., & Almeida, D. M., 2013). Some findings also indicate that there are clear age differences in stress and coping which deteriorates progressively with age (Folkman, S., Lazarus, R. S., Pimley, S., & Novacek, J., 1987), even though the present

study do not give conclusive evidence on the same. However the oldest age group in the study namely adults above the age of 40years seem to have lesser rate of improvement (but the difference is not large enough to be of significance) than the other groups and a study with more number of sessions and a larger sample might give a clearer picture.

Limitations of the study

The short duration and the small sample size considered in the study fails to gives a conclusive perspective regarding the effectiveness of the eye relaxation practice intervention.

Conclusion and Future study

Myopia is a commonly occurring refractive condition conventionally managed through ocular interventions like use of spectacles and surgery. It has a tendency to progress with age and visual strain. Early detection and administration of relaxation practices facilitates effective management of myopia. The administration of eye relaxation practices has initiated significant improvement in visual acuity among all the age groups of the sample. The improvement was perceived in both right eye and left in both the conditions of spectacle usage. The present study supports the fact that eye relaxation practices are equally effective among myopic patients of all age groups. Further studies may be initiated on the level of improvement retained and the nature of progression of myopia among respondents who underwent eye relaxation training.

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Appendix

Table: 1. Visual acuity before and after eye relaxation practices (ERP) in the right eye and left eye without and with spectacles

Age group		Without spectacles				‘t’	With spectacles				‘t’
		Before ERP		After ERP			Before ERP		After ERP		
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
0-12	Right eye	2.80	1.76	4.12	1.92	-11.55**	6.29	1.57	6.92	1.26	-5.44**
	Left eye	2.96	1.84	4.25	1.90	-12.22**	6.45	1.31	6.98	1.08	-5.17**
13-18	Right eye	1.94	1.44	3.02	1.72	-9.63**	6.82	1.28	7.31	1.00	-5.03**
	Left eye	2.45	2.12	3.49	2.14	-8.66**	7.02	1.03	7.53	0.61	-5.24**
19-39	Right eye	2.97	2.23	4.03	2.25	-13.29**	7.25	0.94	7.63	0.70	-4.58**
	Left eye	2.59	1.93	3.75	2.06	-14.27**	6.80	1.54	7.31	1.28	-6.18**
Above 40	Right eye	2.38	1.89	3.31	1.75	-6.74**	6.62	1.60	7.38	0.96	-2.99**
	Left eye	2.08	1.75	3.00	1.58	-6.74**	6.62	1.75	7.31	1.10	-2.63*

1% level of significance** 5% level of significance*

Table: 2. One way analysis of variance of the improvement in visual acuity of the sample without and with spectacles in the right eye and left eye regarding the four age groups in consideration

Improvement in visual acuity	Source	SS	Df	Mean SS	F
Right eye without spectacles	Total sum of squares	92.01	176		
	SS between groups	2.68	3	0.89	1.73
	SS within groups	89.32	173	0.51	
Left eye without spectacles	Total sum of squares	94.18	176		
	SS between groups	2.31	3	0.77	1.45
	SS within groups	91.86	173	0.53	
Right eye with spectacles	Total sum of squares	96.13	176		
	SS between groups	2.46	3	0.82	1.51
	SS within groups	93.66	173	0.54	
Left eye with spectacles	Total sum of squares	88.07	176		
	SS between groups	0.37	3	0.12	0.24
	SS within groups	87.70	173	0.51	