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Effect of yoga eye exercises on letter recognition and reaction time in school going children with and without refractive errors-A randomized control trial

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Abstract

Background and purpose: Yoga for eyes is performed to reduce eye strain, relax extra-ocular muscles which is common in school going children, computer users and occupation involving fine work. The purpose is to assess the effect of yoga eye exercise's on refractive errors and reaction time in school going children.

Method: sixty participants was included in study of which, 30 children were with refractive errors and 30 without refractive errors. Letter recognition and reaction time was assessed using Snellen's chart, typing master game and drop ruler test. Seven yoga eye exercises was intervened and pre-post assessment was done.

Results: Participants shown good improvement in all the outcome measures. Inter-group comparison shown significant results only in letter recognition.

Conclusion: Yoga eye exercises done regularly for few minutes has improved the strength of eye muscles and proved beneficial for refractive error problems.

Keywords: Refractive errors, yoga eye exercises, letter recognition, reaction time

Introduction

Refractive errors an eye disorder, is commonest among 10 years to 17 years of age group. Children of this age has high chances of getting refractive errors because of their affection towards television, computers, and other electronic gadgets ^[1]. The global prevalence of refractive errors among children is 0.96% with highest noted in urban areas of Asia and china ^[2]. In India, the prevalence of refractive errors in children from urban and rural areas is 7.03% ^[3].

The most common consequences of refractive errors in children includes reduced educational performances, social activities and impaired quality of life. If this errors left untreated, it can lead to serious visual impairments transforming into visual blindness. Eye problems have a tendency to decrease tone in eye muscles which builds excessive strain on eyesight and causes increase tension in the eyes which increases impulses to brain via optic nerve which may percuss headaches ^[4, 5]. Lack of social awareness, failure of early recognition of refractive errors by family, community or by a public health worker, weak affordability to corrective lenses are the most common causes for increase population of refractive errors in children. Effective and feasible means of correcting this errors is by using spectacles and lenses. Eye exercises is least considerable treatment for correction of refractive error, hence intervening this kids with simple eye exercises will help in weaning of refractive errors in childhood population ^[6].

Yoga can be one of the means to exercise the eye muscles. which includes, palming, blinking, changing focus of eyes from side to side, looking upward and downward, rotational viewing, nose tip gazing and near and distant viewing. Whereas very few studies in literature speak about eye exercises. Hence lies the purpose of the present study to check the effectiveness of yoga eye exercises on letter recognition and reaction time in school going children with and without refractive errors.

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Methods

Ethical approval was obtained from Institutional review board. Two groups were formed which included 30 school going children with and without refractive errors. All participants was between 10-17 years of age of both genders. Exclusion included visual problems (like color blindness, strabismus), upper limb deformities or disabilities, amputation of hands/ fingers, and other neurological problems of upper limb.

Experimental Design

Participants were briefed about the nature of the study and intervention, only those who was willing to take intervention for 6 weeks, was recruited for the study and informed consent was obtained. Letter recognition and reaction time was assessed by a blinded assessor using Snellen’s chart, typing master game and drop ruler test before and after seven different yoga eye exercises, each exercise was for 3 minutes (first minute one eye was closed and exercised for opposite eye, 2nd minute for opposite eye, in 3rd minute both eyes was exercised together) with 1 minutes rest between two different yoga eye exercises for 5 days a week, for 6 weeks and post intervention data was obtained. Letter recognition was assessed using Snellen’s chart, which was placed in a bright illuminated room at a distance of six meters from the participants. Accuracy of reaction time was observed using typing master game and drop ruler. Permission was obtained by the developers for using the game in study. It is a game which has multiple modes and each mode having multiple levels, which helps to improve the accuracy, speed and skill of typing, among this variables speed component was used to observe reaction time in which every participant was given one minute to burst as many alphabetical balloons as they can to score

highest. In drop ruler test, a 30centimeter long ruler was used. Each participants was given three chances in which the ruler was placed just above the hand of the participant and instructed to catch the falling ruler as instantly as they can and upper end of the marking in the ruler was obtained and best of the three readings was noted and converted the centimeter grading into seconds using conversion table and this this seconds reading was recorded as reaction time of participants pre-post intervention.

Statistical Analysis

All analysis were performed manually and with SPSS (Statistical Package for Social Sciences) version 21.0. p value of <0.05 was considered statistically significant. Data is expressed as the median and means with standard deviation. Comparisons between pre and post result were made with Wilcoxon matched-pairs and paired t test. Comparisons between groups were made with the Mann-Whitney and unpaired t test.

Results

Within group comparison, results for Group A (Table-1), right and left visual acuity improved from 20/40(30-200) to 20/40(25-200) and 20/40(30-200) to 20/40(25-200) respectively, reaction time improved from 0.18±0.03 to 0.16±0.03 and letter recognition improved from 47.0±14.89 to 91.87±20.0. Results for Group B (Table-1), Right and left visual acuity improved from 20/30(25-40) to 20/30(20-40) and 20/30(25-40) to 20/40(20-40) respectively, reaction time improved from 0.18±0.02 to 0.17±0.03, and letter recognition improved from 56.07±16.39 to 78.93±19.64. All the findings where statistically significant for Group A and Group B.

Table 1: Comparison of Letter Recognition and Reaction Time in Group and Group B.

Variables	Group A			Group B		
	Pre	Post	P value	Pre-test	Post-test	p value
Left visual acuity (20/)	40(40-200)	40(25-200)	<0.001	30(25-40)	30(20-40)	<0.001
Right visual acuity (20/)	40(30-200)	40(25-200)	<0.001	30(25-40)	30(20-40)	<0.001
Reaction time (sec)	0.18±0.03	0.16±0.03	<0.001	0.18±0.02	0.17±0.03	<0.001
Letter recognition (points)	47.00±14.89	91.87±20.00	<0.001	56.07±16.39	78.93±19.64	<0.001

Median (range) and mean ± Standard deviation p value < 0.05

(Table 2) Inter-group correlation between Group A (children with refractive errors) and Group B (children without refractive errors) which showed, Right visual acuity 20/0(0-30), Left visual acuity 20/7.5(0-30) for Group A and Right visual acuity 20/0(0-10), Left visual acuity 20/0(0-10) for Group B was found to have a p value of 0.183, 0.088 for Right and Left visual acuity respectively which is

statistically not significant (<0.01). Reaction time was 0.02±0.01 for Group A and 0.02±0.02 for Group B, with p value 0.299 which is statistically not significant (<0.01). Letter recognition was 44.87±11.95 for Group A and 22.87±16.90 for Group B with statistically significant p value (<0.01).

Table 2: Inter-Group Comparison between Group A and Group B

	Group A	Group B	P value
Left visual acuity (20/)	0(0-30)	0(0-10)	0.183
Right visual acuity (20/)	7.5(0-30)	0(0-10)	0.088
Reaction time (sec)	0.02±0.01	0.02±0.02	0.299
Letter recognition (points)	44.87±11.95	22.87±16.90	<0.001

Median (range) and mean ± Standard deviation

Discussion

The objectives of present study was to investigate the effect of yoga eye exercises on refractive errors and reaction time in school going children between 10-17years of age.

The common reasons for refractive errors in school going children of this age group is, because of their affection towards television, computer games, mobiles etc. Understanding the mechanism of the cause may help to

identify the methods of rehabilitation for various refractive errors. Visual acuity was assessed using the Snellen's chart because it was found to be more reliable method than any other methods like SPVER (sweep pattern visual evoke response) and interferometer [7, 8]. Improvement seen in both, within the group and between group comparison for Group A and for Group B this improvement in visual acuity may be attributed to yoga eye exercises. The probable mechanism could be due to decrease visual discomfort on eyes, which increases relaxation and reduces strain on eyes [9]. It has been posited that yoga eye exercises helps in improves visual perceptual sensitivity in turn reduces causing relaxation effect [10, 11]. Improvement in visual acuity may be due to increase in functional efficacy of intra and extra ocular muscles, may enhances the metabolism of rods and cones through dark and light adaptation and more determination from children with refractive errors than children without refractive error [12]. Similar results were obtained by performing eye exercises of acupoints, May had modest effect on relieving near vision symptoms [13]. In a group of young adults two weeks of eye exercises has shown small true treatment effects on convergence and accommodation [14].

Typing master game was used to check the precision of letter recognition in school going children. Both the Groups revealed significant improvement in post intervention values. This improvement in letter recognition is due to increased neuronal activity in frontal and parietal regions and superior coliculus during and after eye exercises [15-17]. A total of 12 sessions of eye exercises showed improvement in letter recognition and reaction time using rapid serial visual presentation [18]. Both the groups showed improved reaction time which was measured using drop ruler test. Improvement in attention may be the result of individualized attention given to each child during eye exercise. There was betterment found in visual reaction time following Mukha Bhastrika in mentally challenged adolescents and there was appreciable improvement in visual and auditory reaction time after 3weeks of eye exercises and slow and fast pranayama [19].

Limitation

The chronicity of refractive errors, duration of spectacle usage and post school hour activities was not considered anywhere and post intervention long term effects were also not assessed in this study.

Conclusion

The results of the present study for letter recognition and reaction time using Snellen's chart, typing master game and drop ruler test respectively, showed the statistically significance which had a positive effect on strength of eye muscles, strain in eyes and refractive index. Hence, yoga eye exercises is effective and beneficial for school going children with and without refractive errors and may be used as a conventional treatment for reducing and preventing refractive errors respectively.

Future scope

A randomized clinical trial can be taken up to evaluate the effectiveness of yoga eye exercises for different age group and population, with increased duration of intervention simultaneously by controlling the limitations of this study.

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