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Ocular Muscle Balance Disorders and Associated Refractive status in School Children and Young Adults

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Abstract

Introduction: The Human race is supreme in hierarchy of animal kingdom by the acquisition of Binocular Single Vision 1 (BSV). It is important to have normal ocular muscle balance to have normal BSV. Any muscle balance disorder may lead to squint or amblyopia. Ocular muscle balance disorders shows an association with refractive error. Most of this research has focused on myopia. But hyperopia and astigmatism are also being examined in our study.

Methodology: A Prospective study conducted over period of 1 year 300 subjects were included 150 were selected from OPD and rest 150 by screening 1875 students of various schools in Raichur District who had vision less than 6\6 or with 6\6 vision and as the no pic symptoms. Visual Acuity was measured. Fund us examination, Squint evaluation and Type of squint was noted. AC/A ratio was calculated. Binocular Vision was assessed. Those who needed treatment were treated by spectacles ororthoptic exercises. Correlation was made between ocular muscle imbalance and refraction.

Results: The prevalence of refractive errors was 8% with mallet of emaleratio 1.9:1. Highest were between 17-20 yrs. Heterophori as were the most common Type of ocular muscle balance disorders (80%) followed by heterotropias (20%). Exophoria was highest (52.8%) followed by esophoria (46.6%). Strong association was noted between myopia and exophoria 43 out of 60 (p=0.042). Cases of mixed astigmatism were observed having esophoria for near and exophoria for far. Significant association was noted between hypermetropia and convergent squint (67 out of 81).

Conclusion: Myopia is mainly associated with divergent squint, Hypermetropia with convergent squint. Mixed astigmatism associated with exophoria for far, esophoria fornear.

Keywords: Refractive errors; Heterophoria; Heterotropia.

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INTRODUCTION

The Human race is supreme in the hierarchy of the animal kingdom by the acquisition of Binocular Single Vision.[1]

BSV is not present since birth but is acquired in early period of life. Development of BSV and fusion has been found to be developed by one to two months of age.[2] Stereops is develops between the

age three to six months and completed by five to six years of age.[3] Hindrance to the development of BSV occurs in case of presence of media opacities like cataract or corneal opacity, or in case of uncorrected refractive errors, or in case of ocular motility abnormalities.

For a child to develop into an effective adult so as to lead a normal life and to contribute his services for the family and country the presence of BSV is essential. The coordination of ocular movements and ocular refraction are interrelated.[4] Presence of refractive error cancause development of strabismus which hampers the BSV development. Early identification and correction of the refractive errors prevent the child becoming strabismic, amblyopic. It is the duty of every one in the health care industry to ensure the curbing of preventable causes of ocular morbidity by early diagnosis and treatment for better quality of life.

Hence this clinical study is intended to correlate the relationship between the type of refractive error and the ocular muscle imbalances in the individuals aged between 5-20 yrs and treatment of the same where verpossible.

The Objectives of the Study are

1. To determine the correlation between ocular muscle balance and the refractive status of eyes in children and young adults below 20 yrs.
2. To know the incidence of type of ocular muscle imbalance and their relation with refraction to treat wherever required.

MATERIAL AND METHODS

A prospective study (cross sectional) was carried out in 300 patients.

The Period of 1 year

150 students were selected from various schools in Raichur district by screening a total, of 1874 students.

Rest 150 were selected from the outpatient department of ophthalmology in Navodaya Medical College Raichur.

Clinical Examination

Visualacuity: It was measured by Snellen's chart method

1. ***Anterior Segment Examination:*** All the above selected children were examined with torchlight and slit lamp examination. Ocular movements were checked in all gazes both uniocular and binocular.
2. ***Cover test:*** Cover test is done when the child fixes object at 6 m and 40cm.
3. ***Maddox Rod Test:*** The Maddox rod test is done at both 6mt and 40 cm in a darkroom.
4. ***Synoptophore Test:*** After Maddox rod test each subject is subjected to synop to phoreto calculate the IPD and assess the 3 grades of Binocular single Vision.
5. ***Cycloplegics:*** All the children after synoptophore test were asked to putatropine eye ointment 1% in lower palpebral conjunctiva of both eyes twice daily for 3 days and were asked to comeon 4th day morning. Older childre were asked to use cyclopentolate drops every 15 mins once and were examined after 90 minutes.
6. ***Retinoscopy:*** Done by using streak retinoscope with accommodation of the subject a trest (static retinoscopy). It was done at adistance of 1mt.
7. ***Fundus Examination:*** Through the dilated pupils fundus was visualized and the subjects with normal fundus were included in the study.
8. ***Post Cycloplegic Test:*** According to the retinoscopy readings, the required strength of lens is placed in trial frame and finally what ever strength of lens required by the child to see the letters clearly on Snellens chart was considered as subjectively corrected lens.
9. ***Prism Bar cover test:*** All the children with manifest squint were tested for deviation of the eye by horizontal and vertical prism bars.
10. ***Calculation of AC/A Ratio:*** It was calculated by the following method. AC/A = IPD + (Δn - Δd/D) where IPD is the inter pupillary distance in cm, Δn is the near deviation, Δd is the distance deviation in prism dioptres, D is the fix at iondistance in dioptres.

Based on the above test results the correlation between refractive status and type of ocular muscle imbalance is established and treatment was given where verit was necessary.

Inclusion Criteria:

- Children and young adults aged between 5-20 yrs will be included.

Exclusion Criteria:

- All patients below the age of 5 years and above 20 years.
- Individuals with mental retardation.
- Individuals with optical media opacities.
- Macular/optic nerve disorders.
- One eyed individuals.

DATA ANALYSIS

Data was entered on excel spread sheet after coding and further processusing

SPSS version 19.0. (Statistical Package for Social Sciences). Chi square test was used and p value less than 0.0 5 was considered statistically significant.

RESULTS

Sex Incidence:

A total of 300 children were studied, out of which 198 were male and 102 were female. This shows that higher incidence of refractive error and squint among male children (66%) compared to females (34%). (Fig. 1)

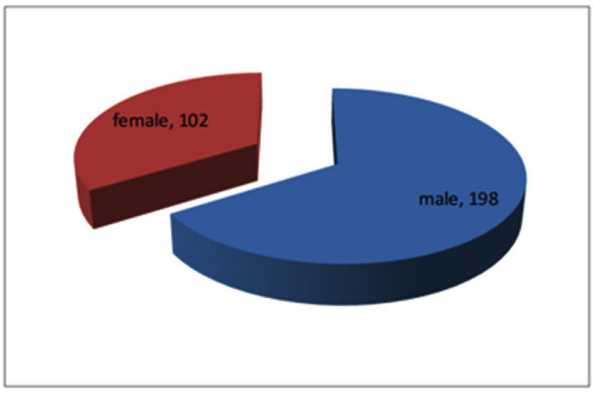

Fig. 1: Sex incidence

Age Incidence:

Out of 300 children studied the percentage of age group and sex Observation reveals maximum no. of subjects in age group 17-20 yrs constituting 22% and minimum no. of subjects in age group 5-8 yrs 8%. (Fig. 2)

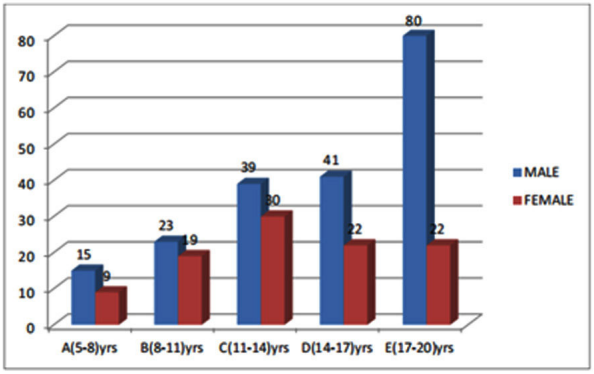

Fig. 2: Age incidence

Statistics with Respecttorefr Active Errors:

Different types of refractive errors with the inference that Anisometropia is the highest type of refractive error constituting 40% followed by hypermetropia 27%, myopia 20%, simplemyopic astigmatism and compound myopic astigmatism 5% each, mixed astigmatism, compoundhy permetropicastig matism, simplehy permetropic astigmatism 1% each. (Fig. 3)

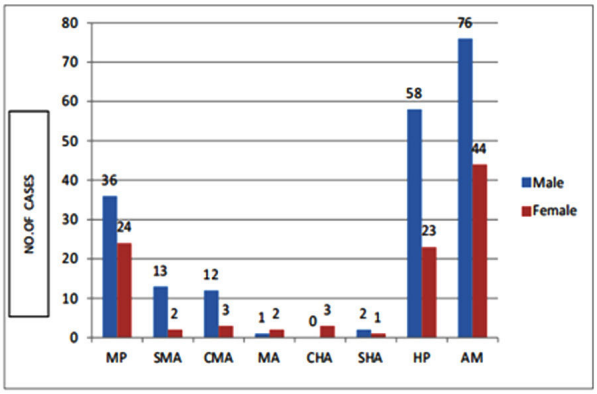

Fig. 3: Rate of incidence of different types of refract errors in males and females among 300 cases

Male children dominated with myopia, simplemy opicastigmatism, simplehy permetropic astigmatism, hypermetropia and anisometropia types of refractive errors.

Female children dominated with mixed astigmatism and compound hypermetropic astigmatism types of refractive errors.

Statistics with Respect to Srabismus:

Different types of squint present in 300 subjects studied. Observation reveals that Heterophoria (80%) dominate over Heterotropia (20%) in thes tudy. (Fig. 4)

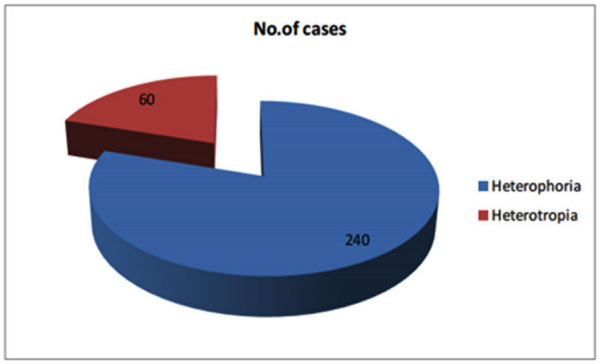

Fig. 4: Different types of squint present in 300 subjects

Number of Cases in different types of Heterophoria

Among phorias exophorias constitute the highest number of cases *i.e.* 125 (52.8%) followed by esophorias constituting 112 cases (46.66%), 3 cases (1.25%) were showing exophoria for far and esophoria fornear.

4 cases of hyperphoria were associated with esophoria and exophoria. 1 case of hypophoria was seen associated with exophoria. (Table 1)

Table 1: Number of cases in different types of heterophorias

Heterophoria	No of cases	Percentage (%)
Esophoria	112	46.66
Exophoria	125	52.80
Hyperphoria	4	Associated with Eso and Exophoria
Hypophoria	1	Associated with Exophoria
Exo for Far and Eso for near	3	1.25

Table 2: Number of cases in different types of heterotropias

Heterotrophia	No of Subjects	Percentage (%)
Esotrophia	34	56.66
Exotrophia	26	43.33
Hypertrophia	0	0
Hypotrophia	0	0

Number of cases in different types of Heterotropia

Out of 60 subjects with Heterotropias in this study Esotropia (56.6%) was leading followed by Exotropia (43.3%).

Statistics with Respect to Different Types of refractive Errors V/S Different Types of Squint. 1. Myopia V/S Squint

A strong association between myopia and divergent squint. (p=0.042). Among divergent squint there are 43 cases out of which 26 are male 17 are female subjects. Significant observation includes that there are no cases of esotropia. (Fig. 5)

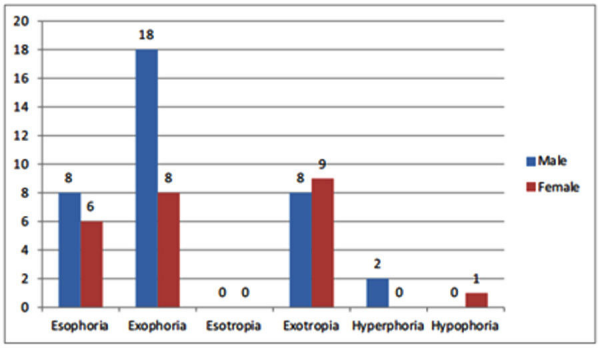

Fig. 5: Myopia V/S Squint in males & females among 60 subjects

Myopia is also associated with esophoria in 14 cases. Hyperphoria and hypophoria was also observed.

Simple Myopic Astigmatism v/s Squint

There were only 15 cases of simple myopic astigmatism of which 13 were male, 2 were female. 13 subjects were exophoric and 2 were esophoric (Fig. 6)

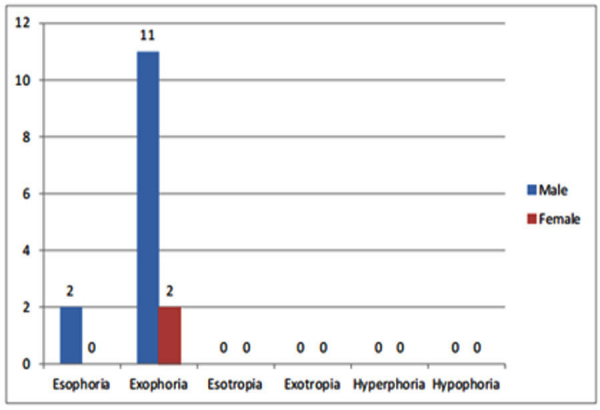

Fig. 6: Simple myopic astigmatism V/S Squint in male and female among 15 subjects.

Compoudmyopic Astigmatism v/s Squint

In compound myopic astigmatism out of 15 cases, 10 cases were exophoric, 4 were esophoric. 1 male child with exophoria was associated with hyperphoriain righteye (Fig. 7).

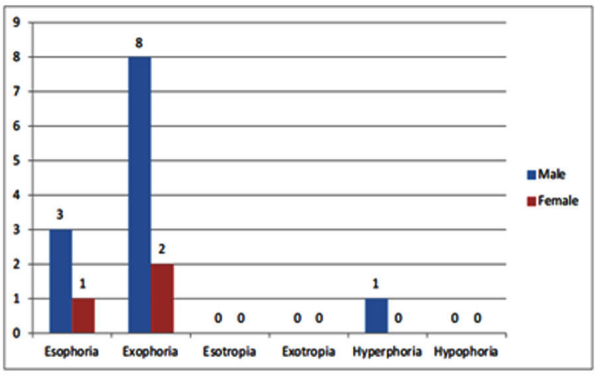

Fig. 7: Compound myopic astigmatism V/S Squint in male and female among 15 subjects

Mixed Astigmatism v/s Squint:

Out of 300 cases studied only 3 subjects had mixed astigmatism of which 1 was male, 2 were females. They had exophoria forfar and esophoria fornear.

Compound Hypermetropic Astigmatism v/s Squint:

Out of 300 subjects studied 3 females had compound hypermeteropic astigmatism. One had exotropia and other two were exophoric.

Simple Hypermetropic Astigmatism v/s Squint:

Out of 300 subjects 2 males and 1 female had this refractive error and were esophoric. No other types of squint were found.

Hypermetropia v/s squint

Out of 300 cases 81 were hypermetropic. Among the m 58 were males and 23 were females. Majority cases showed convergent squint (67). Only 1 case had hyperphoria (rt) (Fig. 8)

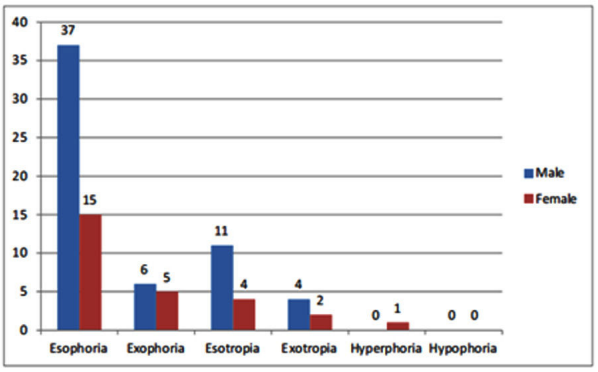

Fig. 8: Hypermetropia V/S Squint in male and females among 81 subjects.

Anisometropia v/s Squint:

Among 300 cases 120 cases had anisometropia. Of them 76 are males and 44 are females. Again males dominated over females. Out of 120 cases of anisometropia divergent squint was noted in 64 subjects (Fig. 9)

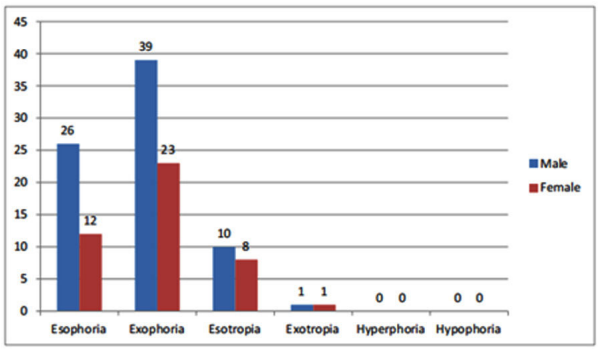

Fig. 9: Anisometropia V/S Squint in male and female among 120 subjects

Statistics with Reference Tobinocul Arsinglevision:

Out of 300 studied 240 cases had heterophoria and 60 cases had heterotropia. Among the cases of heterophoria 228 cases had normal BSV rest had poor fusion amplitude. Among heterotropias none of the cases had normal BSV

DISCUSSION

In this study a total of 300 subjects participated between age group of 5-20 years. Of those children 150 were picked up from school screening of total of 1874 children. Remaining 150 were selected from the out patient department of our hospital.

The prevalence of refractive error in our study was found to be 8% in school children. Male to femal eratio in our study was 1.94:1.

In a study done by Dr. Surinder Singh during 1974 the prevalence rate of refractive errors was found to beas high as 35%.[5]

In a similar study done by Dr. A. Panda *et al* in 1985 showed the incidence of refractive erroras 13.25%.[6]

In the present study it was found that refractive errors in males was 66%, Females 34%. Among them anisometropia was 40%, 27% hypermetropia, 20% myopia, and remaining 13% were astigmatic.

With respect to muscle imbalance, our study showed 80% heterophorias and 20% heterotropias. It is contradictory to astudy done by Dr. Lahaneet. alwhere heterophorias was 33.20% and tropias was 66.80%.[7]

In the present study Exophoria is 52.8% followed by esophoria 46.6% followed by esophoria for near and exophoria forfar in 1.25%.

Esotropia is 56.66% and exotropia is 43.33%. This shows that different types of squints are associated with different types of refractive errors.

Among 60 cases of myopia 46 cases are associated with divergent squint. 2 cases associated with hyperphoria and exophoria and 1 case associated with exophoria and hypophoria.

Esophoria in Myopia is Relatively Rare

Persons who develop progressive myopia have increasingly less need to accommodate when viewing near objects. Thus accommodation convergence reflex becomes weaker. If there refractive error remains uncorrected exophoria tends to occur, fist for near then for distance. This may eventually lead to intermittent squint and later as manifest divergent squint. Hence myopia should be corrected as early as possible to prevent development of diver gent squint.

From caese of Simple Myopic Astigmatism 13 cases had exophoria and 2 cases had esophoria. Compound myopic astigmatism was associated with 10 cass of exophoria and 4 with esophoria and 1 case had hyperphoria associated with exophoria for far and esophoria fornear.

Among 81 cases of hypermetropia 67 cases had convergent squint (p=0.04). It indicates that there is a significant association between hypermetropia and convergent squint. It is because they use more accommodation than required leading to increased convergence and tendency to develop convergent squint.

The patient with uncorrected hypermetropia can see either a single blurred image or a double image in which 1 is clear and the other is blurred. Over a period of 87 time the eye with blurred image undergoes suppression leading to amblyopia. If glasses are worn faithfully, fusional pattern is maintained.

Aniosmetropia forms the largest group of refractive errors in this study *i.e.* 120 cases. Among them phorias are 100 and 20 are tropias. Among phorias 39 are esophoric and 61 are exophoric. Among tropias 18 are esotropic and 2 are exotropic.

In anisometropia of moderate degree, in which one eye is myopic and other eye is hypermetropic, the myopiceye is used fornear fixation and hypermetropic for distant in which an alternating strabismus may develop. In unilateral myopia of moderate degree the myopic eye may diverge.

Anisometropia is more commonly associated with amblyopia than isometropia. Early identification, correction of refractive errors lead to proper maintenance of visual axesleading to decreased development of amblyopia.

CONCLUSION

The following conclusions were conferred from this study. Males have higher incidence of refractive errors than females.

Anisometropia is the most common type of refractive state followed by hypermetropia, myopia, simple myopic astigmatism, compound myopic astigmatism, simple hypermetropic astigmatism, compound hypermetropic astigmatism followed by mixed astigmatism.

Heterophoria sarecommont hanheterotropias

Myopia is associated significantly with divergent squint (exophoria and exotropia). Hypermetropia is associated significantly with convergent squint (esophoria and esotropia).

Binocular single vision is affected in heterotropias. In few cases of heter ophoria with high erfractive errors the fusional amplitude is poor indicating high chances of conversion of phoriain to tropia.

Early diagnosis of refractive errors and their correction along with orthoptic exercises in cases with poor fusional reserveprevents the progression of phorias totropias which canlead to hampered BSV, amblyopia.

Hence there is need for every school going child to undergo screening regularly for refractive errors at eleastonce in 6 months.

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