Prevalence of Non-Strabismic Binocular Vision Dysfunction in A Hospital based Population

Rajib Mandal[1], Rajesh Kamath[2]

[1]Principal, Netra Jyothi Institute of Allied Health Sciences, Udupi, Karnataka, [2]Assistant Professor, Prasanna School of Public Health, Manipal Academy of Higher Education, Manipal, Karnataka, India

Abstract

This study was aimed towards finding the prevalence of non strabismic binocular vision dysfunctions (NSBVD) in the Indian population presenting with different symptoms pertaining to binocular vision disorders. **Method:** This retrospective study included one hundred and sixty one patients who presented to the out- patient department with symptoms of binocular vision dysfunction, during a period of one year. Patients were in the age group of 18 ±6.93, with 71 males and 90 females. Their binocular vision dysfunction was assessed via several diagnostic modules/tools designed for binocular vision assessment. **Results:** Results indicate that the most common binocular vision anomalies in this studied population are fusional vergence dysfunction with accommodative infacility (40.38%), convergence insufficiency with accommodative infacility (24.36%), Fusional vergence dysfunction (7.05%). Convergence Insufficiency and Accommodative infacility showed the same prevalence of 7.7%. **Discussion**: Accommodative and non-strabismic binocular vision dysfunctions are commonly underdiagnosed/undiagnosed in clinical practice. These disorders affect academic performance, sports activities and general quality of life. An appropriate detailed orthoptic examination and accurate diagnosis is necessary to manage these binocular vision dysfunctions.

Keywords: *Headache, Incidence, Non strabismic binocular vision disorders, Orthoptic evaluation, Focusing problem, accommodative insufficiency, fusional vergence dysfunction.*

Introduction

Binocular vision anomalies are the most common visual disorders. Patient complaints include decreased vision, headache, eyestrain, watering, blurred vision while doing near tasks, double vision (diplopia), a lack of concentration, difficulty focusing at near to far or vice versa and poor reading comprehension. These symptoms have a negative impact on academic performance.[1,2,3]

Purcell et al. established an indirect comparison figure for symptomatic binocular dysfunction. They reviewed the records of 120 patients at an optometry college clinic. The patients were between 25 to 35 years of age without strabismus, amblyopia, eye pathology or current contact lens wear. In addition to refractive error they found there were 30.8% patients were with the symptoms (ex: headache, eye strain, watering, redness, photophobia and double vision) of NSBVD who needed vision therapy treatment with prism, bifocals, or near point lenses. Other studies have established the correlation of accommodative and non-strabismic binocular dysfunctions to learning difficulties.[2,3,4,5,6] Successful treatment lead to a significant improvement in the quality of life of this group of patients.

These dysfunctions are generally missed out unless a complete orthoptic and binocular vision examination is performed. Vision therapy is a very useful treatment for these conditions with the help of lenses and prisms. In India, such epidemiologic studies on non-strabismic binocular dysfunction are lacking. We believe this is the first study in India providing valid epidemiologic information about the prevalence of non-strabismic binocular disorders in a clinic population.

Corresponding author:
Dr. Rajesh Kamath,
Assistant Professor, Prasanna School of Public health, Manipal Academy of Higher Education, Manipal, Karnataka, India-576104.

Methodology

It is a retrospective single centre study including patients presenting with symptoms of binocular vision anomaly at Karthik netralaya, Super-specialty Eye Hospital, Bangalore, India during the period of one year (January 2014 to January 2015). One hundred and sixty one (n=161) patients between the age group of 18 ±6.93 were screened. Exclusion criteria included strabismus, amblyopia, nystagmus, contact lens users, best corrected visual acuity <6/6 in each eye, cataract, ocular pathologies, neurological and myogenic disorders, psychological disorders and previous ocular surgeries which could affect the accommodation-vergence relationship. All patients underwent comprehensive ocular examination and were enrolled for detailed orthoptic evaluation. Findings and diagnosis were documented into excel spreadsheet. Visual acuity assessment was done for near (at patient's functional distance) and distance with Jaeger's Chart and Snellen's chart respectively. Objective refraction was done with the help of retinoscope (Welch allyn retinoscope) followed by subjective refraction with phoropter. Assessment of binocular vision disorder was performed by a standardized protocol which included detailed history of ocular symptoms, sensory evaluation of binocular vision for near distance with Worth 4 dot test at 40 cm and 6 meters respectively, Cover test with accommodative targets for near and distance, prism bar cover test, AC/A ratio, MEM retinoscopy, assessment of near point accommodation and near point of convergence, amplitude of accommodation, negative and positive fusional vergence and vergence and accommodative facility. The result of each of the tests were compared first with the population norms,[7,8] derived from Morgan's data.[9]

Results

Only symptomatic subjects with abnormal clinical findings were included. Of the 161subjects screened, 90 were females and 71 were males. Mean age was 18 ±6.93 years. 156 were diagnosed with Non strabismic binocular vision disorder.

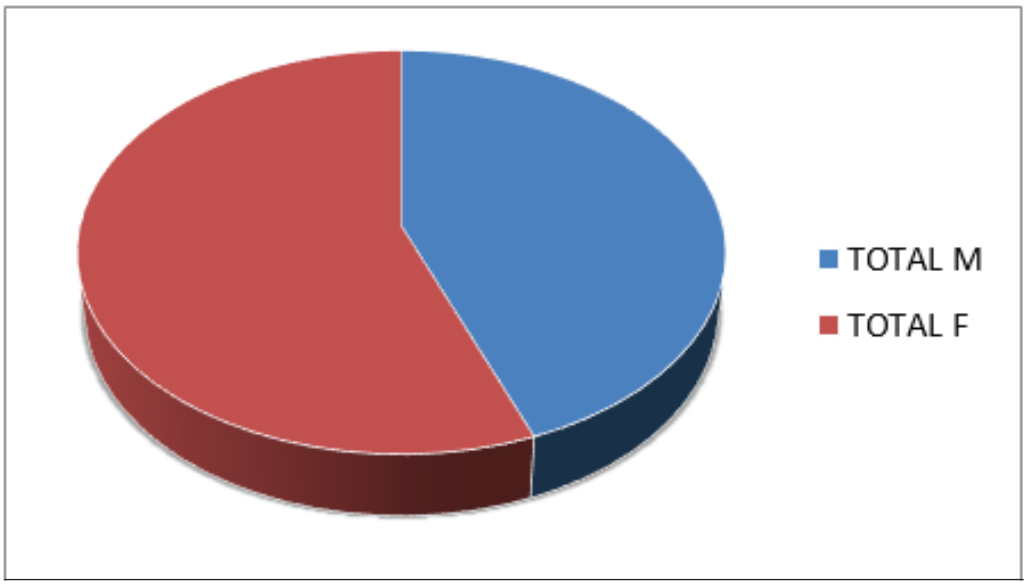

Fig 1: Graphical presentation of total patients male vs. female.

The most prevalent symptoms were frontal headache or asthenopia after prolonged near work (50.31%), followed by blurring of vision and difficulty in focusing when looking from near to far (20.50%). 9.31% had skipping lines or words while reading followed by blurness of vision (6.21%). 3.72% showed eyestrain while reading. 6.21% were not comfortable with spectacles and the remaining 3.72% presented watering, intermittent diplopia and loss of concentration. (see figure 2)

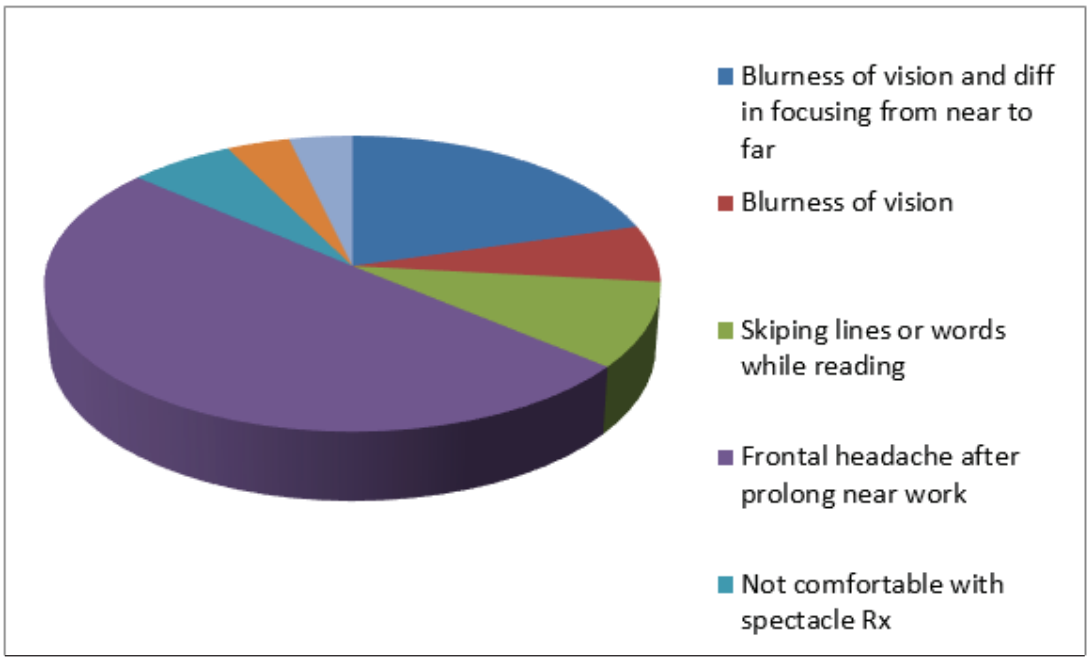

Figure 2: Graphical presentation of complain of NSBVD

The prevalence of non-strabismic binocular vision disorder detected in this age group was as follows:

Fusional vergence dysfunction with accommodative infacility (40.38%), convergence insufficiency with accommodative infacility (24.36%), fusional vergence dysfunction (7.05%). Convergence Insufficiency and accommodative infacility showed the same prevalence of 7.7%. Excluding these, other binocular dysfunctions have less prevalence, as shown in table no 1.

Classification	**No of subjects**	**Prevalence (%)**
FVD with AInf	63	40.38
CI with AInf	38	24.35
Convergence insufficiency	12	7.70
Accommodative infacility	12	7.70
FVD	11	7.05
Accommodative insufficiency	5	3.20
AE with AInf	4	2.56
FVD with CI	2	1.28
AE with FVD	2	1.28
AI with CI	2	1.28
CE with AInf	2	1.28
Accommodative excess	1	0.64
Convergence excess	1	0.64
AI with FVD	1	0.64

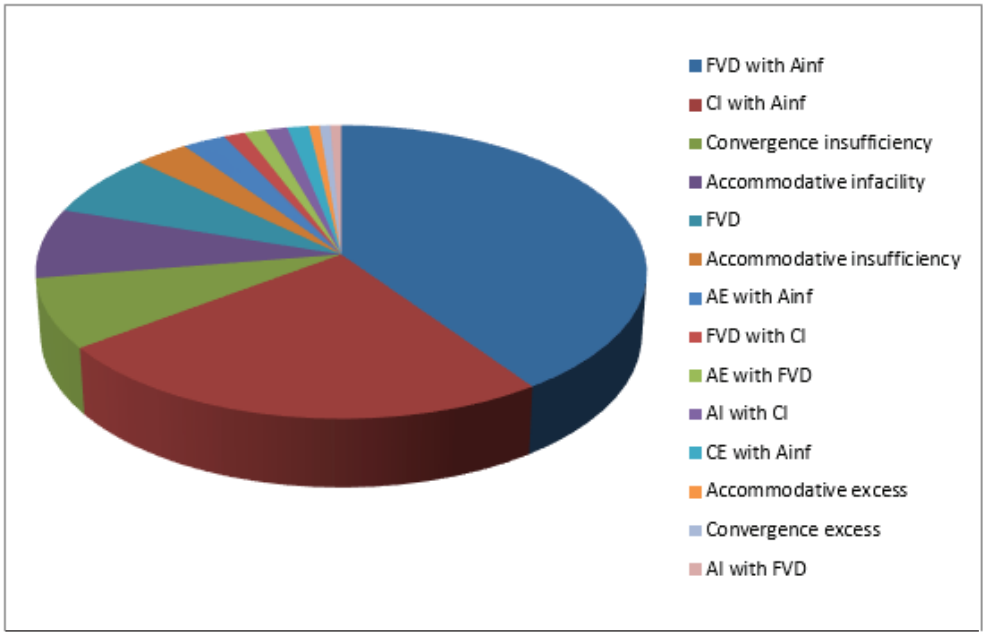

Figure 3: Graphical presentation of NSBVD

Discussion

This retrospective study was done using standard diagnostic criteria according to the population norms[8] derived from Morgan's data.[9] According to comprehensive optometric evaluation of the adult population in India, non strabismic binocular vision dysfunction was prevalent. Being a clinical population study, the prevalence of the dysfunction was expected to be higher than a general/normal population study, which was a limitation for this study. In this study fusional vergence dysfunction with accommodative infacility and convergence insufficiency with accommodative infacility had higher prevalence (40.38%). The ability of change of accommodation of eye at various distance with enough speed and accuracy bro maintain normal visual function is called as accommodative facility.

This can be measured as monocularly or binocularly. To measure this usually the accommodative object (a small target depends on the best corrected visual acuity) fixate alternately through plus and minus lens, which are interchanged as soon as the target appears clear.[10,11,12] The operation is repeated many times and results are commonly present in cycle per minute (one cycle indicates that both plus and minus lens have been cleared)[13]. This disorder is commonly associated with asthenopia. With accommodative infacility there is no over-action of accommodation, ciliary spasm, or spasm of the near reflex. There is normal amplitude of accommodation. However there is difficulty in clearing -2.00D and +2.00D with accommodative flipper, monocularly and binocularly. Positive and negative relative accommodation may be below normal value (PRA ≤1.25 D and NRA ≤1.50 D), as per results obtained in this study.

Convergence insufficiency can be described as a condition with near exophoria (greater than distance), receded near point of convergence with low AC/A ratio and reduced positive fusional vergence. In literature, the frequency of convergence insufficiency in pediatric clinical population differs greatly, with scheiman et al. reporting 4.6% Rouse et al. reporting 6.0%, shin et al. reported 28%, dwyer reporting 33%, though all these reports show significant prevalence. Our study shows similar data with 7.7% convergence insufficiency and 24.35% of convergence insufficiency with accommodative infacility[10,11,12]. Our study also supports all these study by showing the prevalence of convergence insufficiency 7.7% and convergence insufficiency with accommodative infacility 24.35%. But all these above mention studies mainly focused on the pediatric age group while this study involved the young adult age group.

Prevalence of fusional vergence dysfunction was 7.05%. Fusional vergence dysfunction is a sensory motor disorder of the visual system characteristic by reduced PFV (positive fusional vergence) and NFV (negative fusional vergence) measured at near and distance for at least one of three –blur, break, and recovery. Minimum normative NFV is ≤9/17/8 for blur, break and recovery and minimum normative PFV is ≤ 12/15/4 for blur, break and recovery. As per textbook definition accommodative spasm or excess is a clinical state of excess accommodation (lens focusing); spasm of near reflex is the tired of excess accommodation, excess convergence and excess miosis. This condition often triggered by stress or prolonged reading.[14] In a study Esteban Porcar et al. showed that accommodative and non-strabismic binocular vision problems were prevalent (32.3%) in a population of university students. Accommodative excess was the most common dysfunction detected (10.8%).[15] But our study did not support this study result. In this study we got a lower prevalence of accommodative excess (2.56%). Accommodative and non-strabismic binocular vision dysfunctions are commonly under-diagnosed / undiagnosed in clinical practice. It is already proved that these disorders affect academic performance, sport activities and general quality of life. Findings of our study suggest that an appropriate detailed orthoptic examination and accurate diagnosis is necessary to manage these binocular vision dysfunctions.

Non strabismic binocular dysfunctions have a significant prevalence in society and have a bearing on the quality of life. Hence these disorders need detailed evaluation and appropriate management by clinicians. Data presented in this study has a relatively small sample size; and a large scale epidemiological study will further reflect the status of binocular dysfunctions in the Indian population.

No Funding

No Conflict of Interest

Institutional Ethical clearance obtained

References

1. Borsting E, Rouse MW, Deland PN, et al. Association of symptoms and convergence and accommodative insufficiency in school-age children. Optometry 2003;74:25-34.
2. Shin HS, Park SC, Park CM, Relationship between accommodative and vergence dysfunction and academic achievement for primary school childer. Ophthal Physiol Opt 2009;29:615-24.
3. Grisham D, Powers M, Riles P. Visual skill of poor readers in high school. Optometry 2007;78:542-9.
4. Buzzelli AR, Stereopsis, accommodative and vergence facility. Do they relate to dyslexia? Optom Vis Sci 1991;68:842-6.
5. Hoffman LG. Incidence of vision difficulties in children with learning disabilities. J Am Optom Assoc 1980;51:447-51.
6. Maples WC. Visual factors that significantly impact academic performance. Optometry 2003;74:35-49.
7. Purcell LR, Nuffer JS, Clements SD, Clausen LR, Schuma DO,Yolton RL. The cost effectiveness of selected optometric procedures. J Am Optom Assoc 1983;54:643-7.
8. Schiman M, Wick B. Clinical Management of Binocular Vision: Heterophoric Accommodative and Eye Movement Disorders. Philadelphia: JB Lippincott Company, 1994:3-31.
9. Morgan MW. The clinical aspects of accommodation and convergence. Am J Optom Arch Am Acad Optom 1944;21:301-13.
10. Scheiman M, Gallaway M, Coulter R, et al Prevalence of vision and ocular disease conditions in a clinical population. J Am Optom Assoc 1996;67:193-202.
11. Rouse MW, Hyman L, Hussein M, et al. Frequency of convergence insufficiency in optometry clinic settings. Opt vis Sci 1998;75:88-96.
12. Dwyer PS. The prevalence of vergence accommodation disorders in a school- age population. Clin Exp Optom 1991;75:10-8.
13. Dictionary of optometry and vision science by Michel Millodot. Edition- 7, Page 8, paragraph 3.
14. Peter K. Kaiser, Neil J. Friedman, Roberto Pineda , The Massachusetts Eye and Ear Infirmary Illustrated Manual of OphthalmologyTop of Form. February 28, 2014,Edition:4 page:555.
15. Esteban Porcar,Antonio Martinez-palomera, Prevalence of General Binocular Dysfunctions in a population of university students.Optometry and vision sience.Vol,74,NO.2, PP.111-113.