

Prevalence of Non Strabismic Binocular Vision Disorders in Patients with Asthenopia

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Abstract Non strabismic binocular vision disorders are highly prevalent conditions. Patients report to eye care practitioners with symptoms of eyestrain, headaches, blurred vision etc. These conditions are generally missed out unless a complete orthoptic and binocular vision examination is performed. Treatment of these conditions is very successful with vision therapy, lenses and prisms. Successful treatment leads to a significant improvement in the quality of life of the patients. This study was aimed towards finding the prevalence of non strabismic binocular vision disorders in patients complaining of asthenopia.

Keywords: Asthenopia, Prevalence, Non strabismic binocular vision disorders, Orthoptic evaluation

1. AIM

To find the prevalence of non strabismic binocular vision disorders in patients with asthenopia and to classify them.

2. METHODOLOGY

It is an interventional, prospective study done on the subjects with asthenopia symptoms at Sankara eye Hospital, Bangalore, India during the period of May 2011 to May 2012. One hundred and eighty two subjects, who presented to the OPD of Sankara eye hospital with a complaint of asthenopia and between the age group of 8 to 49, were screened. Patients with binocular vision anomalies, strabismus, amblyopia and anisometropia (more than 2D), ocular pathology, ocular surgery, neurological deficits were excluded from the study.

Each patient was explained about the purpose and procedures and the time involved for the completion of the course of action. Subjects enrolled in the study were not charged for the study related examination and tests. A written consent form was obtained from each patient prior to the enrolment in the study.

The methodology was divided into 3 steps as follows;

Step I: Enrolment of the subjects after a comprehensive ocular examination was finished as per the OPD protocol at SEH, Bangalore.

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Rao, D

Step II: Comprehensive orthoptic evaluation and documentation of the results done.
Step III: Analysis and securitization of the data collected for the statistical evaluation.
Step I: Complete ocular examination was carried out including comprehensive history including the type of asthenopic symptom.

Visual acuity assessment done with the help of LogMAR visual acuity charts at distance (3 meters) and near (at patient's functional distance).

Objective refraction was done with the help of retinoscope (Welch allyn retinoscope) followed by subjective refraction.

Binocular vision sensory status was evaluated for distance and near by worth 4 dot test at 6 meter and 40 cm respectively.

Cover and Alternate cover test was done for 6m distance and near distance at 40 cm with accommodative targets

3. STEP II

3.1 Orthoptic Evaluation included

Near point of convergence [NPC] was assessed by vertical streak target of RAF ruler. This test was repeated 10 times. Objective (divergence of any one eye after suppression) as well as subjective (patient reports two vertical lines) findings were recorded.

Monocular Estimation Method Retinoscopy [MEM]: It's an objective method to evaluate the accuracy of accommodative response depending upon the stimulus. MEM targets are selected according to the age. With distance correction on the patient is asked to read the MEM card and retinoscopy is performed and readings are collected.

Accommodative amplitude (minus lens method) [AA]: It is measured monocularly as well as binocularly. Patient is asked to read near target one line above best corrected visual acuity at 40 cms. Slowly minus lenses are added in 0.25 steps till the patient reports first sustained blur or double.

Negative and Positive relative accommodation [NRA and PRA]: It is used as part of near point evaluation of accommodation and binocular vision especially the fusional reserves. This test is done at 40 cm with the help of plus [NRA] and minus [PRA] lenses. The patient is asked to keep the near target clear and single while examiner increases the lens in steps of 0.25DS binocularly till the patient reports first sustained blur or double.

Fusional vergences [Base Out (PFV) & Base In (NFV)]: It is done with the help of prism bar and accommodative target (distance and near). Prism bar is placed in

front of one eye and power is gradually increased and patient is asked to report when the target becomes blur (Blur), when it becomes double (Break), and then power of prism is decreased till the patient reports the target single again (Recovery). All three values were noted down distance & near.

Prevalence of Non Strabismic Binocular Vision Disorders in Patients with Asthenopia

Accommodative facility [AF]: This is the evaluation of dynamics of accommodative responses under binocular condition. In the current study it was done with the help of ± 2 DS Flipper, near word rock chart, bar readers and anaglyphs. Using this as target, the examiner asked the patient to call out the word after each flip of the lens. Continue this for 1 minute and cycles per minute is calculated by number of flips (1 cycle minus plus minus).

AC/A ratio: To determine the change in accommodative convergence that occurs when the patients accommodates or relaxes accommodation by given amount. Current study had utilized gradient method for measurement of AC/A ratio.

Computer Assisted orthoptic evaluation: VTS3 software has been used to evaluate the Phoria, Fusional ranges, Accommodative facility and W4DT by the procedure explained earlier.

4. RESULTS

In the study, total 182 subjects were screened, out of which 142 were diagnosed with Non strabismic binocular vision disorder.

The mean age of subjects were found to be 27.648 ± 7.097 years

Out of 182 subjects, 75 were Emmetropes, 107 were having Ammetropes.

In the study, out of 182 subjects, 64 were females and 118 were males

Out of the 142 subjects who had a NSBVD, the prevalence of each condition was as shown in the fig. Below

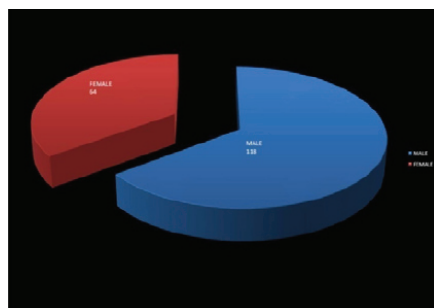
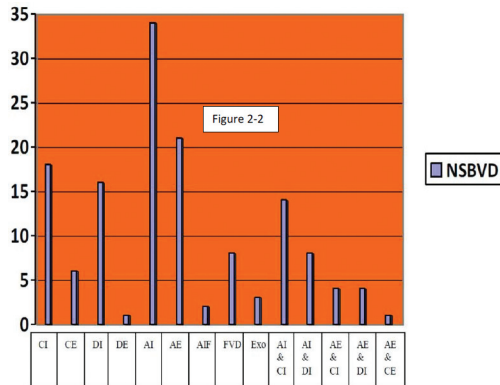


Figure 1

5. REFRACTIVE ERRORS



Figure 2



6. DISCUSSION

The studies reviewed fail to provide clear information on the prevalence of accommodative and non strabismic binocular disorders in patients with asthenopic symptoms as well as in general population. There is lack of consensus between authors due to the different population characteristics and diagnostic criteria used by each author with an important limitation of the lack of good epidemiological studies for different populations. There are several studies reporting the frequency of these visual conditions but they only represent specific clinical populations and are not symptom correlated.

We should take into account that we may only apply these arguments within the framework of this study. The information in the introduction covers the past 20 years and the articles analysed are taken from scientific journals in the languages considered. Accordingly, there may be data in other publications which we could have not been found.

The reasons of discrepancies about prevalence results found by different authors are due to the population characteristics of the studies and the diagnostic criteria used. According to population characteristics, the review represents 6568 patients examined. In addition to the wide dispersion of the sample size used in different studies which makes comparisons difficult. Another issue is the lack of homogeneity of the population studied. When it is tried to provide the prevalence to the scientific community by means of synthesising the international evidence base it is necessary to have studies with uniformity in diagnostic criteria and sample populations. But this review shows that this is not the case for accommodative and binocular disorders so that we can only establish ranges of prevalence for adult and children populations. Thus, of the articles reviewed most of them provide scientific information regarding children compared with adults. The differentiation of patients according to their age is important when considering prevalence values. It must be taken into account that in young children subjective responses of several tests may be not as reliable as those responses of adults. Obviously, most of clinical accommodative and binocular tests used for diagnosing these anomalies are made based upon subjective responses, as accommodative amplitude, monocular and binocular accommodative facility, near point of convergence, fusional vergences, etc. Nevertheless, this point of view must be taken into account to understand why we cannot compare prevalence of both different populations.

The most important issue related to population characteristics is the patient selection. When considering prevalence studies the sample must be randomized with sufficient number of subjects to be representative of the population examined so that prevalence results could be extrapolated to this population (Fletcher and Fletcher, 2007). However, this is not the case of the articles reviewed.

Of the 10 studies analysed, 5 of them included consecutive patients of clinical settings.[2,6,7,9,10] Although using consecutive patients is the method preferred by different authors as it is easy to find subjects for a research, [1] they do not represent a particular population as they are not selected in a randomized way. Furthermore, of these 5 studies, we can see that there are 2 reports [6,7] which examine small samples of patients that cannot be considered representative of the population examined.

Selected patients are less representative of population for prevalence purposes and this review shows that there are 2 studies in which patients were selected. One of them selected students who complained of asthenopia⁸⁷ so that the probability of having these conditions may increase the prevalence obtained in this study. The other report⁹³ selected a group of 2nd year university students without establishing why were selected those students and no others. They both also have the bias that the low number of patients examined cannot be considered representative of the population assessed.

Rao, D

The other 3 studies which are related to school-age populations [5,8,11] cannot also be considered representative for children. Certainly the population analysed at school is very similar to the general paediatric population. However to be representative, schools should also be randomized⁸⁴ and it has not been the case. These research studies not only do not mention this bias but even they establish their prevalence as values that may be applied to the general children population. We must consider however that they have examined a sufficient number of patients to be considered a representative sample for prevalence purposes.

Another issue related to patient selection is that there is no study about prevalence of general population as it has been done for other visual conditions as refractive errors. [6,12,13,14] Most of the studies reviewed examine particular samples of children or adult populations in clinical settings.[2,6,7,9,10] However prevalence values obtained from optometric clinics are biased data as patients have been selected. Patients who visit an optometry clinic are more likely to have complaints of a visual anomaly than if they would have been selected at random from general population. So this may contribute to an increase of prevalence values being therefore less representative of the general population. For convergence insufficiency, the greater prevalence value[6] is offered for children examined in clinical settings and the less value is referred to elementary schools.⁹¹

In spite of the lack of studies for general population, this bias is not often mentioned by the authors. Only two reports[2,6] refer to this issue as a limitation of their results and the other authors discuss other limitations. Two studies [9,10] only concentrate their conclusions in the samples examined, supporting that binocular vision problems are prevalent in their rural sample[9] and university populations[10], without discussing that their results cannot be valid for general university or rural population. Other authors[7,10] discuss their results as clinical prevalence values giving confusion in their conclusions. And even there is one study[4] in which is not specified if the sample is derived from clinical setting or schools. Anyway, both studies of prevalence in the general population and clinical population provide information to the clinician. Prevalence studies in the general population provide information of these conditions in a country or area so that their results will be more important for public health purposes. However, prevalence studies in the clinical population will offer information about how common or rare are these conditions for those subjects who usually present to clinical setting.

In addition to the limitations of both studies of prevalence and clinical population including different ages of sample populations and patient selection by consecutive or randomization methods, the limitation of both types of studies is the lack of uniformity of diagnostic criteria which limits the ability to compile and compare results of different studies. The review shows that different diagnostic criteria are used for each anomaly, not only in the tests but also in the number of signs with the

limitation that they use different cut-offs to establish when a patient fails a particular test. Examples of these discrepancies occur with the conditions which show greater differences of prevalence accommodative insufficiency and convergence insufficiency.

Several authors diagnose accommodative insufficiency simply on the basis of a below accommodative amplitude for the age[4,5] while others use 5 different signs and even using different cut-offs for each test. Similarly, when diagnosing convergence insufficiency the authors apply a wide range of clinical signs ranging between 1 and 5 clinical signs. It also highlights the six different cut-offs used for near point of convergence or the three different cut-offs for the exophoria at near. These discrepancies in both cut-offs and number of signs used may cause that patients could be differently diagnosed depending on the study in which they were included. This fact should be considered one of the main factors which had accounted for these varying prevalence figures between studies. In this regard, we could expect a relationship between the number of signs used and the prevalence of the anomaly, so that as mentioned by some authors[7] the greater number of clinical diagnostic signs used, the lower prevalence. This review shows that it only occurs for convergence insufficiency for which there is a tendency to relate greater prevalence to a lower number of signs used.

Although the lower prevalence does not coincide with the use of a higher number of signs, the second highest value is obtained with a single diagnostic sign.[4]

This relationship cannot be established for other conditions because several studies do not report the number of clinical signs used. For accommodative insufficiency although we observe that the highest value of prevalence is obtained with only the criterion of failing accommodative amplitude,[4] prevalence results do not seem to confirm this relationship. Nevertheless we must take into account that the small number of studies for this anomaly may difficult this assertion.

Other biases and limitations according to the methodology used by different studies may also affect prevalence results. They are related to clinical tests assessed in a non-normalised way. There is one study in which accommodative amplitude is considered binocularly instead of monocular result.[4] And there are two reports [5,11] in which the authors assess the positive fusional vergence at distances not normalised.

As a result of the biases and limitations of designs discussed above we can conclude that there is a lack of clear information about the prevalence of accommodative and nonstrabismic binocular anomalies. Existing epidemiological studies are only estimations of selected clinical or school populations with no data being representative of their populations. Prevalence results vary due to the sample population and the lack of uniformity in diagnostic criteria so that it is difficult to compile the prevalence.

Rao, D

More research is needed following well-designed epidemiological studies and uniform diagnostic criteria.

Prevalence information of these binocular vision anomalies in patients with asthenopia would enable optometrists to help and support health policies with the aim of improving visual health of patients.

7. CONCLUSIONS

There is a lack of proper epidemiological studies about the prevalence of accommodative and nonstrabismic binocular anomalies in subjects with asthenopic symptoms. Studies reviewed examine consecutive or selected patients in clinical settings and schools but in any case they are randomized and representative of their populations with no data for general population and not symptom specific. The wide discrepancies in prevalence figures are due to both sample population and the lack of uniformity in diagnostic criteria so that it makes difficult to compile results. Biases and limitations of reports determine that prevalence rates offered are only estimations from selected populations.

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Prevalence of Non
Strabismic Binocular
Vision Disorders
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