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RESEARCH ARTICLE

CLINICAL PROFILE AND ASSOCIATIONS OF ACCOMMODATIVE DYSFUNCTION AT A BINOCULAR VISION THERAPY CLINIC OF A TERTIARY EYE CENTRE IN NORTH INDIA

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ABSTRACT

Background: The aim of this study was to review the incidence of Accommodative dysfunctions, Clinical features, and their association with Binocular Vision disorders at a Binocular Vision Therapy Clinic of a tertiary Eye centre in North India. **Methods:** A retrospective study was conducted with review the record of 527 symptomatic patients with binocular vision and/or accommodative dysfunction related problems who were referred between march 2019 to march 2020, to a binocular vision therapy clinic. Patients with any ocular surgery, manifest strabismus, amblyopia, anisometropia (more than 2.00 dioptres), ocular pathology, neurological disorders & Prepresbyopic patient were not included in the review. Accommodative dysfunctions were defined and results of each of test in the record were compared with the normative values and diagnostic criterion used by F Lara *et al* specified in Clinical Management of Binocular Vision, by Scheiman and Wick. **Results:** Of the 527 symptomatic patients examined, 103 patients (19.4%) presented some kind of accommodative dysfunctions. Among the 103 accommodative dysfunction patients, 59 were females and 44 were males. Most of them diagnose with accommodative excess (37%) followed by accommodative in facility (29%), accommodative insufficiency (28%), ill sustained accommodation (5.8%) and no patients had paralysis of accommodation. **Conclusion:** Incident accommodative excess was more than accommodative insufficiency. A diagnosis of accommodative and/or binocular disorder depends not only on a few clinical findings of some accommodative and binocular investigations but on a whole battery of tests, in order to produce diagnosis of the type of dysfunction of the patient.

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INTRODUCTION

During accommodation the dioptric power of the eyeball is altered, by change in lens shape resulting from the action of ciliary muscle on the zonular fibers in order to obtain clear images upon the retina, however the normal accommodative system is quite flexible and resistant to fatigue (Daum, 1983; Berens, 1944; Lancaster, 1914; Berens, 1932; Berens, 1932). And also the accommodation and convergence are coupled physiologically. Through this coupling, when the eyes accommodate, they also converge and when the eyes converge, they also accommodate (Maddox, 1886; Morgan, 2020). Accommodative dysfunction, interferes with the ability of the eyes to focus clearly on objects at various distances, resulting in the lack of clear retinal image (<https://www.aoa.org/documents/optometrists/QRG-18.pdf>).

The occurrence of accommodative dysfunction in clinics is relatively common (Griffin, 1976; Walsh, 1969). In most of the studies higher prevalence of accommodative insufficiency is reported (1,11). However in the most recent study, F Lara *et al.* (2001) have shown a higher percentage of accommodative excess (6.4%) in a population of 265 patients studied from an optometric clinic. Unlike the previous studies where diagnostic tests were limited, F Lara *et al.* (2001) studied a whole range of accommodative and binocular tests to reach a diagnosis and also clearly unmasked the multiple signs to be present to classify the each accommodative dysfunctions. To the best of our knowledge, there is no data of clinical profile of accommodative dysfunction in the Indian literature. Therefore, our study aims to review the incidence of Accommodative dysfunctions, Clinical features, and their association with Binocular Vision disorders at a Vision Therapy Clinic of a tertiary Eye Institute in North India.

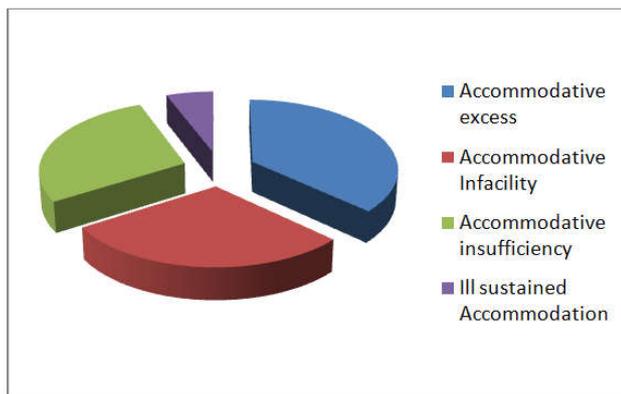


Figure 1. Incidence of Accommodative dysfunctions

METHODS

In this retrospective study, the clinical record of all the patients of accommodative dysfunction was obtained from Electronic Medical Record (EMR). We reviewed the record of 527 symptomatic patients with binocular vision and/or accommodative dysfunction related problems who were referred between March 2019 to March 2020, to binocular vision therapy clinic. Out of which 103 patients (19.4%) who had accommodative dysfunction were included in the study. Patients with any ocular surgery, manifest strabismus, amblyopia, anisometropia (more than 2.00 dioptres), ocular pathology, neurological disorders, were not included in the review. Pre presbyopic patient also excluded from this study. All clinical assessments were done by one of the two experienced optometrists. In binocular vision therapy clinic, a detail case history, reflecting the full range of symptoms, best corrected visual acuity for distance using log MAR chart, near N notation converted to log MAR, Version and duction, pupillary status, Sensory examination (including stereo-acuity at near using titmusstreefly, Worth Four-dot test at distance and near), direction and magnitude of the Distance (6 meter) and near (30 cm) phoria with loose prism, Distance (3 meter) and Near (30 cm) horizontal fusional vergence amplitude (step vergence) using horizontal prism bar, AC/A calculated by Gradient Method, Near Point of Accommodation (NPA) and Near point of convergence (NPC) by RAF (Royal Air force) rule, Monocular and Binocular Accommodative facility with ± 2 lens of flipper, Accommodative response by Monocular Estimation Method (MEM), NRA (Negative Relative Accommodation) and PRA (Positive Relative Accommodation) by loose lenses from trial set. For the purpose of this study accommodative dysfunctions were defined and results of each of test in the record were compared with the normative values and diagnostic criterion used by F Lara *et al.* (2001) specified in Clinical Management of Binocular Vision, by Scheiman and Wick (Daum, 1983)

RESULTS

Five hundred and twenty seven patients were referred to the binocular vision therapy Clinic. Patients who have symptoms and abnormal findings in the accommodative and binocular test were classified as patients with accommodative and/or binocular disorders. When symptomatic patients has normal clinical findings then they considered as normal patients.

Of the 527 symptomatic patients examined, 103 patients (19.4%) presented some kind of accommodative dysfunctions. Among the 103 accommodative dysfunction patients, 59 were females and 44 were males. Patient's ages ranged from 4 to 38 years. The mean age was 18.5 years (standard deviation = 8.6 years). Most of them diagnose with accommodative excess (37%) followed by accommodative infacility (29%), accommodative insufficiency (28%), ill sustained accommodation (5.8%) and no patients had paralysis of accommodation. Figure 1 shows the incidence of the different type of accommodative dysfunctions. Association of accommodative dysfunctions with binocular dysfunctions is given in table 1. Of the 38 patients with accommodative excess, 27 of them it was associated with convergence insufficiency. Similarly out of 29 accommodative insufficiency patients, 21 of them it was associated with convergence insufficiency. The most prevalent symptoms among the patients (see table 2) were 50% with headache, 42.6% with intermittent blur vision at Near and distance, followed by 31% with asthenopia, 26% had ocular pain or eye strain, 16% had poor facility, 10.6% had poor focusing, 6.8% showed sensitivity to light, 4% presented dizziness, with similar percentage reporting intermittent diplopia.

DISCUSSION

Of the 527 patients examined in this study, 103 patients (19.4%) presented some kind of accommodative dysfunctions. The most common accommodative dysfunction was accommodative excess. It can be observed that our results differ from those of authors who found more accommodative insufficiencies in their clinical populations [Daum, 1983; Hokoda, 1985]. but are closer to the findings of F Lara [Lara, 2001]. Our study shows different in the incident rate of the accommodative dysfunctions which is may be due to different diagnostic criterias used in different studies in different populations or may be due to the difference in the target used. Daum [Daum, 1983] in his study of 114 patients with accommodative dysfunctions found that 96 subjects (80%) of the total sample had accommodative insufficiencies. Daum diagnosed accommodative insufficiency simply on the basis of only amplitude of accommodation.

Patient was classified as having accommodative insufficiency if the patients had an amplitude of accommodation 2 D below the minimum established by Hofstetter's formula. For instance, binocular dysfunction may be associated with accommodative dysfunction and so they may be considered as mixed accommodative and binocular dysfunction. Hokoda [Hokoda, 1985] analyzed a sample of 119 patients and found that the most common dysfunction was accommodative insufficiency, found in 11 patients. The criteria used by Hokoda for diagnosing accommodative insufficiency were the accommodative amplitude and positive relative accommodation (PRA) findings, so that when patients had an amplitude of accommodation below the lower limit of the expected amplitude for a particular age and a PRA value < 1.50 D, that patient was classified as having accommodative insufficiency. In a more recent study, F Lara *et al.* examined 265 patients, finding that 59 patients (22.3%) had some form of accommodative or binocular dysfunctions [Lara *et al.*, 2001]. F Lara *et al.* used more diagnostic test such as PRA (positive relative accommodation), NRA (negative relative accommodation), monocular accommodative facility,

Table 1. Association of accommodation dysfunctions with binocular dysfunctions

Dysfunctions	No. of Subjects	Percentage (%)
Accommodative infacility	30	29.1
Convergence insufficiency with Accommodative excess	26	25.2
Convergence insufficiency with Accommodative insufficiency	9	8.7
Accommodative insufficiency with convergence insufficiency	12	11.6
Accommodative insufficiency	8	7.8
Accommodative Excess	11	10.6
Accommodative Excess with convergence insufficiency	1	0.97
Ill Sustained Accommodation	6	5.8
Accommodative paralysis	0	0
TOTAL	103	100

Table 2. Symptoms in Accommodative dysfunctions

Symptoms	frequency	percentage
Distance blur	12	11.6
Headache	51	50
Ocular pain	27	26
Near Blur	32	31
Poor Focusing	11	10.7
Poor facility	17	16
Asthenopia	32	31.1
Photophobia	7	6.8
Dizziness	4	4
Intermittent Diplopia	4	4

binocular accommodative facility and MEM retinoscopy for diagnosing different type accommodative dysfunctions. With these diagnostic criteria, they found that, there was a higher incidence of accommodative excess (6.4%) than accommodative insufficiencies (3.0%). So it can be observed that the prevalence of accommodative insufficiency is not particularly large. F Lara *et al.* (2001) used similar criteria for diagnosing different type of accommodative dysfunctions to those used in our study and the results obtained were more similar to those reflected in our study with similar diagnostic criteria. It is observed that the greater number of signs used to diagnose a accommodative dysfunctions, the decreased in frequency of the anomaly. This fact is evident in the study of Porcar and MartõÁnez-Palomera (Scheiman, 1996), who used whole range of accommodative and binocular tests to reach a diagnosis, although they did not clearly report how many signs had to be present to be classified under each dysfunction . They examined 65 university students, 32.3% of whom proved to have accommodative and/or binocular dysfunctions. The subjects used in their study were all university students, a population inclined to visual dysfunction due to their occupational demands. The results showed higher prevalence of accommodative excess than accommodative insufficiency, a finding that coincides with the results obtained in ours. It would appear that incidence of accommodative excess is more common than accommodative insufficiency in a pre-presbyopia population, results from the criteria adopted for diagnosing each dysfunction. When few diagnostic criteria's are used for detecting dysfunctions, the result may be an inappropriate diagnosis. So due to using very less accommodative and binocular test, incidence of accommodative insufficiency is very high in some of the studies discussed.

CONCLUSION

In conclusion, our study demonstrated that of the 527 symptomatic patients examined, 19.4% (103 patients) showed accommodative binocular dysfunctions. Incidence of accommodative excess was more than accommodative

insufficiency. A diagnosis of accommodative and/or binocular disorder depends not only on a few clinical findings of some accommodative and binocular investigations but on a whole battery of tests, in order to produce diagnosis of the type of dysfunction of the patient. For this reason optometrists should systematically complement their routine examination with a whole battery of accommodative and binocular tests that would help to avoid the non-detection of these anomalies in daily optometric practice.

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