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Prevalence of Near Esophoria among Young Adults in Imo State University Owerri, Nigeria.

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Abstract

Vergence anomalies describe the anomalous disjunctive movement of the eyes in which there is a resultant convergent or divergent movement of the eyes, causing the eyes to inaccurately fixate and stabilize an image on the retina. Basic heterophoria is a common vergence anomaly, with esophoria as a form of heterophoria characterized by the inward deviation of the eye towards the nose upon dissociation of binocular fusion. Esophoria may be expressed at far (6m) or at near (40cm) and is associated with various symptoms as diplopia, headaches, blurred vision, poor concentration, and eye strain. This cross sectional study assessed the prevalence of esophoria at near among young adults in the Imo State University community, with the objective to determine the influence of age and gender on near esophoria among the study population. This was done by conducting the Von Graefe phoria test at near on eligible consenting subjects, 400 students aged 18 – 30 years old, in the Optometry clinic of the Imo State University, Owerri. The study findings revealed a high prevalence of esophoria at near, confirmed in 47% of the study population. Analysis of the findings with the ANOVA statistical tool, revealed that esophoria at near showed no significant relationship with age or gender in this study. The findings of this study reveal that the presence of esophoria at near in the young adult may be more commonly present, thus the near phoria status in young adults especially engaged in near work ought to be carefully evaluated routinely by clinicians.

Key words: Binocular vision; Phoria; Esophoria; Symptoms; Young adults

Introduction

Vergence anomalies describe the anomalous disjunctive movement of the eyes in which there is convergence or divergence, causing the eyes to inaccurately fixate and stabilize an image on the retina.[1] These vergence dysfunctions include a wide range of motor disorders of the visual system, resulting in various symptoms as diplopia, headaches, and other forms of visual discomfort. Some vergence dysfunctions include convergence insufficiency,

convergence excess, divergence insufficiency, divergence excess, decompensated/basic heterophoria[1]. Millodot [2] defined heterophoria as "the tendency for the two visual axes of the eyes not to be directed towards the point of fixation in the absence of adequate stimuli to fusion". The phoria position of the eyes, also referred to as physiological position of rest, is the position that the visual axes take with respect to one another in the absence of all stimuli to fusion.[3] Heterophoria is classified into different forms based on the relative direction of the eyes these include esophoria, exophoria, exclophoria, incyclophoria, hyperphoria and hypophoria.[2] If the visual axes are found to be parallel when the patient views a distant object and all stimuli have been eliminated, the individual is said to have orthophoria; if the visual axes converges towards one another or away from one another when the eyes are dissociated the individual is said to have esophoria or exophoria respectively[3].

Esophoria and Exophoria depend upon the accommodation convergence relationship and may be altered chiefly by changes in accommodation. The incidence of near esophoria has been found to increase with increase in accommodative convergence and this causes asthenopic symptoms.[4] Most conditions of esophoria are accommodative in that it largely results from excessive accommodation due to uncorrected hyperopia or excessive close work. As a result of the accommodation-convergence link, excessive accommodation produces excessive convergence. However, some eso-deviations do not have this accommodative factor and are then known as non-accommodative or sometimes anatomical esophoria.[5] Esophoria is said to be due to a combination of anatomical, mechanical and innervation factors.[6] Anatomical factors may include eye position, orbit size and shape, eye size, tissue fat within the orbit etc. Mechanical factors refer to action of the extra ocular muscles and innervational factors refer to the neural impulses that guide eye movements. Diseases that affect the fusion pathways such as large uncorrected refractive errors, cataract, and optic neuropathies, may thus decompensate an existing esophoria.[7]

Esophoria and Exophoria represent the fusional vergence demands with esophoria as demand for negative fusional vergence and exophoria as demand for positive fusional vergence. Thus in order to maintain comfortable vision, Sheard's criterion (that the fusional vergence reserve must be twice as great as the fusional demand) must be fulfilled.[4] Esophoria and exophoria would only be regarded as a source of visual problem if the fusional reserves are insufficient.

According to the Duane-White classification of esophoria[1] based on whether the convergence is greater for distance or for near vision, esophoria may be classified as divergence weakness type, convergence excess type or basic. Divergence weakness type of esophoria shows decompensated esophoria for distance vision and compensated heterophoria in near vision. Convergence excess type of esophoria is characterized by an increased degree of esophoria for near vision, usually with a small degree of compensated heterophoria for distance vision and a higher degree of esophoria that is decompensated for near vision. This is in contrast to the normal physiological exophoria. Basic (or mixed or non-specific) esophoria shows decompensated esophoria of about the same degree in the distance and in near vision.

The expected values of near phoria according to Grosvenor[4] is about 1 – 3 prism diopters of esophoria and 3 – 6 prism diopters of exophoria, though it is not unusual for near phoria to be as high as 4 – 5 prism diopters of esophoria or 10 – 12 prism diopters of exophoria. This implies that high degrees of phoria at near is not regarded as a visual problem if the deviation is held in control by compensating fusional impulses. Lateral phorias appear to have higher prevalences both at far and at near than vertical phorias.[8] The Studies by Wajuihan[9] on the prevalence of heterophoria among 1,056 high school students in South Africa, revealed that esophoria was less prevalent at near than exophoria at 12.1% and 51.1% respectively. Hashemi *et al*., [10] in their study on the prevalence of phoria and tropia in the student population in Iran, found exophoria was more prevalent than esophoria; 11.7% of the students were exophoric while 1.2% of them were esophoric. Near esophoria however, was higher in prevalence (0.47%) than distant esophoria (0.34%).[10] Hong *et al*., [11] also report that among 486 children on whom they carried out phoria assessment at near, 479 were exophoric while 7 were esophoric. These outcomes are however not supported by the studies carried out by Makgaba[8] in his retrospective analysis of heterophoria values in clinical population aged 18-30 years, he found out that esophoria was more prevalent at near than exophoria.

Phorias can be detected using diagnostic tests such as alternate cover test, Maddox rod test, Von Graefe test.[12] The Von Graefe's technique is used to estimate the magnitude of phoria (by measuring the angle of deviation) in addition to detecting the presence of the phoria using the dissociation method. It can be used to measure any type of classification in heterophoria such as exophoria, hyperphoria, hypophoria and esophoria. This technique (Von Graefe's) involves the placement of dissociating prism in front of one eye and the measuring prism in front of the other eye.[12]

Phoria conditions are generally considered benign and any phoria condition that becomes symptomatic is considered to be a phoria condition that has become decompensated.[7] Symptoms associated with esophoria may range from simple headache to severe asthenopia and may include eyestrain, headaches, blurred vision, diplopia, sleepiness, difficulty concentrating, loss of comprehension over time.[7]

The management of esophoria can be done using spherical lens correction to correct any hyperopia, orthoptic training to improve negative fusional vergence, and correction with prism in base out direction.[13]

Many young adult students present with complaints of visual discomfort, including inability to read for long period of time, asthenopic symptoms and diplopia not solely due to obvious refractive errors. These may contribute to undermining the quality of life and academic performance in those affected.[9]

The study was aimed at determining the prevalence of esophoria at near, among young adults aged 18 – 30 years, in Imo State University, with the objective to determine the influences of age and gender on esophoria at near. The outcome of this research contributes to data on prevalence of binocular vision anomalies in the study area and informs relevant recommendations in the care patterns of the study population.

Methodology

This cross sectional experimental study was carried out in Imo State University, Owerri, Nigeria at the Optometry clinic and designed to quantify esophoria at near among the students aged 18 – 30 years hence determine its prevalence among the study population. The study was approved by the Research and Ethics committee of the Imo State University; all the procedures used in this study were done in accordance to the principles of the Helsinki Declaration regarding research on human subjects. Only subjects who voluntarily gave their written informed consent to participate were enrolled in this study.

All intending subjects were pre-screened to determine their eligibility for participation in this study; from case history and visual pre-assessment (visual acuity, external exam, ophthalmoscopy, and refraction), subjects with systemic conditions, using any systemic medications, having obvious binocular vision anomalies such as suppression, strabismus, nystagmus or other ocular disease were excluded from the study. The sample size for this

research was 400; derived using the Yamane[14] formula with a 95% confidence interval, drawn from the student population of the University and recruited from the various faculties to participate in the study.

Horizontal phoria for all the eligible subjects was assessed at near (40cm) using the Von Graefe method on a phoropter with their refractive corrections in place and the examination room well-illuminated. While the subject focused at the best visual acuity line on the visual acuity chart at 40cm), the dissociating prism (6^{Δ} base up) was positioned before the left eye and a measuring prism (15^{Δ} base in) before the right eye using rotary prisms. When diplopia was confirmed, the subject was asked to report once the two images aligned vertically and then the examiner slowly reduced the 15^{Δ} base in till the participant reported vertical alignment of the test target. The residual prism value was recorded as the phoria status of the participant at the specified test distance - with base in for exophoria, base out for esophoria, 0 for orthophoria. [12] For this study, any amounts of residual base out values were recorded as esophoria at near.

The results recorded were analyzed using descriptive statistics and presented as means, standard deviations and medians and analyzed using analysis of variance.

The distribution of variables was presented using tables and the corresponding 95% confidence intervals presented as an estimate of the prevalence.

Results

A total of 400 subjects from the young adult student population were assessed for heterphoria at near using the Von Graefe method, consisting of both male (172) and female (228) with a mean age of 23.22.

A total of 188 (47%) subjects exhibited esophoria at near, 198 (48.5%) exhibited exophoria at near and 14 (3.5%) exhibited orthophoria at near (Figure 1).

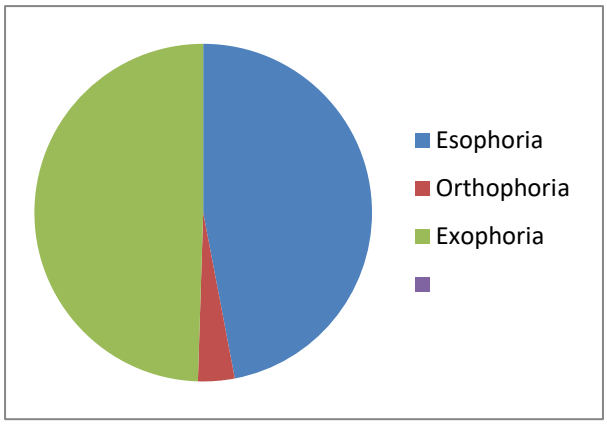

Figure1: Distribution of esophoria at near among young adults

Subjects who tested positive to esophoria at near upon classification into 3 different age groups viz 18 – 21, 22 – 25 and 26 - 30 showed mean values of near esophorias of 3.88 (± 1.6), 2.68 (± 1.7) and 2.64 (± 1.9) respectively (Table 1).

Table 1: Mean values of near esophoria and standard deviation of different age groups.

Age (Years)	**Mean near esophoria and standard deviation**
18-21	3.88 ± 1.6
22-25	2.68 ± 1.7
26-30	2.64 ± 1.9

Among the male subjects, 85 (49% of males subjects) were esophoric at near and 103 females (45% of the female subjects) were esophoric at near. The mean values of near esophorias in males and females were 3.21 (± 1.7) and 3.4 (± 1.7) respectively (Table 2).

Table 2: Mean values of near esophoria and standard deviation for gender

Gender	**Mean near Esophoria**
Male	3.21 ± 1.7
Female	3.4 ± 1.7

Testing the relationship between age and the prevalence of esophoria at near using analysis of variance (ANOVA), revealed that there is no significant relationship between the occurrence of near esophoria and age among the study population (Appendix). Using the t-test, there was no significant relationship revealed between the occurrence of near esophoria and gender among the study population.

Discussion

The results obtained in this study revealed that esophoria at near had a high prevalence (47%) among the study population comprising of young adults. Such high prevalence of esophoria at near is not totally unlikely in young adults, especially those who are likely to be frequently doing more of near work. Studies by Hashemi *et al.*[10] reported a higher prevalence of near esophoria than far esophoria.

However, majority of prevalence studies on lateral phorias report higher incidences of exophoria at near that esophoria at near.

These findings however, do not agree with some other similar studies which found exophoria[9], [15, 16] and orthophoria [17, 18] to be more prevalent at near, although Chen *et al.* [18] recorded a near esophoria prevalence of 16.1%. The higher counts of esophoria at near may be related to the young adult age bracket being assessed in this study as most prevalence studies on esophoria at near cited [10, 16, 17, 18] were focused on young and school aged children. Several other variations may be due to the diagnostic criteria for esophoria, as well as the methods of esophoria assessment.[19] This study used the Von Graefe method of dissociation unlike some related studies that used other methods or combination of methods[16]. It has been observed that different differences in methods (dissociation technic), as well as factors such as illumination and examiner experience may contribute to influence the eventual prevalence reports.[9] The use of means has thus been recommended as a reliable way of comparing variables.[9]

Indeed the discrepancies in prevalence figures due to population demography, diagnostic criteria and methods of assessment suggest that current prevalence rates of near esophoria are estimations from select populations [19].

In this study, no significant relationship was identified between the distribution of esophoria at near and age or gender. This agrees with reports from reviews by Makgaba[8] and studies by Wajuihan[9] that also reveal no significant association between age and incidence of esophoria.

However, it has been suggested that mean near phoria becomes more exophoric with increasing age[16]. This study contributes to the existing body of knowledge about the distribution of lateral phoria at near among young adults, and especially the prevalence of esophoria with respect to age and gender among the study population.

Patients with decompensating esophoria slowly deteriorate and become esotropic when their divergent fusional amplitudes are depleted.[7] This study highlights the importance of routine assessment of phoria status at near for young adults, especially those actively engaged in frequent near work.

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