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RESEARCH PAPER

PREVALENCE OF ACCOMMODATIVE INSUFFICIENCY AND ACCOMMODATIVE INFACILITY AMONG JUNIOR HIGH SCHOOL STUDENTS IN A GHANAIAN TOWN

Mohammed Abdul-Kabir, **David Ben Kumah**, **Nana Yaa Koomson** and **Clement Afari**
Department of Optometry and Visual Sciences
KNUST, Kumasi

ABSTRACT

This study sought to determine the prevalence of accommodative dysfunctions among Junior High School students in the Sunyani Municipality in the Brong Ahafo region of Ghana. All the 204 students who were present in the randomly selected Junior High School on the day of the data collection participated in the study. The eye examinations performed on all participants included visual acuity tests, refraction (objective and subjective), and Ophthalmoscopy. The demographic variables of the participants as well as their medical and ocular history were taken during interviews. Donder's Push-Up method was employed using the Royal Armed Forces (RAF) rule to determine the Amplitude of Accommodation (AA) of the pupils. The accommodative facility test was performed using the +2.00/-2.00 flipper. Among the 204 participants, 65 (32%) were found to have accommodative insufficiency whilst 54 (26%) had accommodative infacility. Eighty (39%) out of the 204 participants had at least one of the two dysfunctions with 39 (19%) participants having both dysfunctions. Accommodative anomalies were common among the Junior High School students. Since accommodative and vergence functions are necessary for accurate and efficient reception of visual input, it is therefore necessary for these functions to be tested in all basic school children. Effects of accommodative dysfunctions on academic performance need to be studied.

Keywords: *Amplitude of Accommodation, Accommodative Insufficiency, Accommodative Infacility, Dysfunctions, Eye*

INTRODUCTION

Accommodation is the facility enabling the change in dioptric power of the crystalline lens thereby altering the focus of the eye. It is the ability of the eye to change focus from one object to another and to maintain clear focus of the object. Accommodative ability is highest in amplitude at infancy and tends to deteriorate as one ages due to the lens losing its elasticity (Grosvenor, 2007). Malfunctions of the eye's

accommodative system are termed accommodative dysfunctions. Various forms of accommodative dysfunctions exist and these include accommodative insufficiency, accommodative lag or lead, paralysis of accommodation, accommodative spasms, accommodative infacility and fatigue of accommodation (Grosvenor, 2007). Scheiman and Wick (2002) also classified accommodative dysfunctions under three main umbrellas; accommodative insufficiency, accommodative excess and accommodative infacility.

Academic demands of reading and writing tasks become higher as one goes higher on the academic ladder and hence the presence of an accommodative dysfunction becomes manifest when near visual tasks are carried out for extended periods. Some children may not be able to complete reading task or assignments and may be easily distracted or be inattentive in class as a result of accommodative dysfunctions (American Optometric Association (AOA), 2001). Some sufferers may not exhibit symptoms because of task avoidance. In spite of the magnitude of accommodative dysfunctions and their far-reaching academic, vocational, avocational and psychosocial impact, few studies have been conducted to determine the prevalence of accommodative dysfunction in the general population (AOA, 2001). The impacts of these major challenges to the visual system are therefore not likely to be fully appreciated and remedied. This study sought to determine the prevalence of some accommodative dysfunctions among junior high school students in the Sunyani Metropolis of the Brong Ahafo region of Ghana.

METHODS

The study was a descriptive cross-sectional one that sought to determine accommodative dysfunctions in a public Junior High School in the Sunyani Municipality. Sunyani Municipality is the capital of the Brong Ahafo region, one of the ten regions in Ghana. All the 204 students who were present in the randomly selected school on the day of the data collection participated in the study. The eye examinations performed on all participants included visual acuity tests, refraction (objective and subjective), and Ophthalmoscopy. The demographic variables of the participants as well as their medical and ocular history were taken during interviews. Donder's Push-Up method was employed using the Royal Armed Forces (RAF) rule to determine the Amplitude of Accommodation of the students. The accommodative facility test was performed using the +2.00/-2.00 flipper at 40cm. The measurements of the amplitude of accommodation and the accommodative facility were done upon distance subjective correction. The study protocol and all the questionnaires were approved by the ethical research committee of the Kwame Nkrumah University of Science and Technology in Kumasi, Ghana. All participants had informed consent forms signed by their guardians after seeking their personal assents. In the analysis, any student whose Amplitude of Accommodation was less than Donder's age expected value by two Dioptres was deemed to have accommodative insufficiency. Accommodative infacility on the other hand is a situation where the subjects complete less than 5 cycles per minute in the accommodative facility test (Carlson and Kurtz, 2004).The data was analyzed by the use of Statistical Package for Social Sciences (SPSS) software version 16.00 and Microsoft Excel 2007.

RESULTS

Out of the 204 pupils who participated in the study, 112 (55%) were males and 92 (45%) were females. Their ages ranged from 13 to 17 years. Only 25 (12%) had some form of refractive error with only 4 (2%) being significant (myopia > 0.50 and hyperopia > 1.50). All those with significant refractive errors were found to be myopic (myopia greater than 0.50D). The highest amplitude of accommodation measured from this study was 25D, and this was recorded by three students, whilst the lowest score was 4D. The mean test score was 11.28D with a standard deviation of +/- 2.74.

Extremes of 2 and 12 cycles per minute (2cpm and 12cpm) were recorded in the accommodative facility test. The mean accommodative facility score was 6.49cpm with a standard deviation of +/- 3.85.

Among the 204 participants, 65(32%) were found to have accommodative insufficiency whilst 54 (26%) had accommodative infacility (Fig 1). Eighty (39%) out of the 204 participants had at least one dysfunction with 39 (19%) participants having both dysfunctions (Fig. 1).

A little less than half, 39 (49%) of the 80 participants who had at least one of the dysfunctions had both, close to one out of five,15 (19%) had accommodative infacility alone, while a little below one out of three 26 (32%) having only accommodative insufficiency. It can therefore be inferred from Fig. 1 that 65 (81%) out of the 80 participants who had at least one of the dysfunctions had accommodative insufficiency as against 54 (66%) who had accommodative infacility.

Among the 80 participants who had at least one of the dysfunctions, 39(49%) were males and 41(51%) were females. Table 1 gives the percentage distribution of the dysfunctions by gender. More than half (54%) of the male respondents had both dysfunctions as against a little above two out of five (44%) for female respondents. Also higher percentage (39%) of females had only accommodative insufficiency than males (26%). With regards to accommodative infacility, more males (20%) had the anomaly than females (17%) as depicted in Table 1.

DISCUSSION

A study done by Porcar and Martinez in 1997 showed the existence of a corresponding rise of binocular vision anomalies as visual task becomes more challenging. It was therefore not surprising to see almost two out of five (39%) of the respondents having at least one of the two accommodative dysfunctions considered for this study. This high rate of accommodative anomalies could be attributed to the level of the subjects on the academic ladder as far as the basic education in Ghana is concerned. All the participants were Junior High School students (grade 7 to 9) where the educational system requires more work in terms of reading and

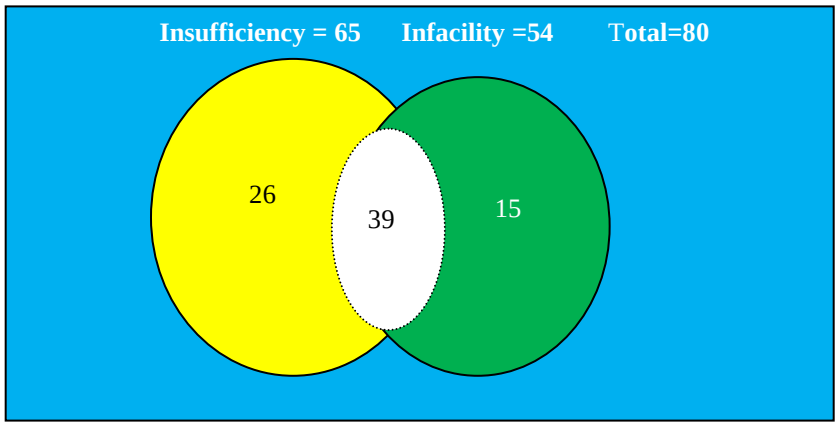

Fig 1: Distribution of accommodative dysfunctions

Table 1: Distribution of the dysfunctions by gender

Dysfunction	Males	Females	Total
Insufficiency only	10(26%)	16(39%)	26(32%)
Infacility only	8(20%)	7(17%)	15(19%)
Both dysfunctions	21(54%)	18(44%)	39(49%)
Total	**39(100%)**	**41(100%)**	**80(100%)**

and writing. As such the task on near vision demand becomes more intense with the likelihood of corresponding manifestation of binocular vision anomalies (Porcar and Martinez, 1997).

Out of the two accommodative dysfunctions considered for this study, accommodative insufficiency registered a higher rate (32%) than accommodative infacility (26%) as far as the general study population is concerned. Among the 80 pupils diagnosed for one form of the dysfunctions or the other, 65 (81%) had accommodative insufficiency whilst 54 (66%) had accommodative infacility. This trend was also found when we looked at the gender specific rate of the dysfunctions. Among the 39 males who had at least one of the dysfunctions, 31 (79%) had accommodative insufficiency as against 29 (74%) for accommodative infacility. Also for the 41 females having at least one of the dysfunctions, 34 (83%) had accommodative insufficiency as against 25 (61%) for accommodative infacility. This is in conformity to a study by Nishanee in 2011 which showed accommodative insufficiency to be the commonest accommodative dysfunction. Daum (1983) in his study revealed that 84% of the individuals diagnosed with accommodative dysfunction had accommodative insufficiency. Accommodative dysfunction has been reported to occur in 60 to 80 percent of patients with binocular vision problems (Hokoda, 1985).

Hokoda (1985) also reported that 55% of patience with accommodative dysfunction had accommodative insufficiency. This can be attributable to the fact that Accommodative Insufficiency has been found to be affected by or mimics convergence insufficiency. Hokoda detected that convergence insufficiency was found in 20% of individuals with accommodative insufficiency.

CONCLUSION

Accommodative anomalies were common among the Junior High School students. Since accommodative and vergence functions are necessary for accurate and efficient reception of visual input, it is therefore necessary for these functions to be tested in all basic school children. Effect of improvement of accommodative and vergence functions on academic performance need to be studied. Studies should also be conducted to compare the accommodative dysfunctions between school going and non-school going children.

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