



(RESEARCH ARTICLE)



Effects of drugs on phoria status of visually active individuals (Igbos)

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International Journal of Biological and Pharmaceutical Sciences Archive, 2021, 01(02), 218–224

Publication history: Received on 22 April 2021; revised on 26 May 2021; accepted on 29 May 2021

Article DOI: <https://doi.org/10.30574/ijbpsa.2021.1.2.0047>

Abstract

The effects of routinely used ophthalmic drugs were studied on the phoria status of visually active individual's i.e. Igbos on whom no data are available. These drugs include naproxen (analgesic), sulphonamide (antibiotic) and acetazolamide (diuretic). Sixty visually active individuals were selected, and von Grafe prism dissociation method was used for phoria measurements. Results showed that all the subjects were orthophoric at far and exophoric at near at the commencement of the study. It was further observed that 30% of those who received naproxen remained orthophoric at far, while at near they remained at exoposition with 12.6% reduction in total value in exophoria at the end of the study. On the other hand, all subjects treated with sulphonamide remained in exoposition at near, with 14.2% reduction in exophoria at the end of the study while at far, 50% remained in orthoposition. Furthermore, 10% of the acetazolamide treated subjects remained orthophoric at far, while at near all the subjects were in exophoric position with a reduction of 15.7% in exophoria at the end of the study. We conclude that drugs can affect the phoria status of visually active persons converting them from orthoposition to exophoria or esophoria.

Keywords: Analgesic; Antibiotic; Diuretic; Orthophoria

1. Introduction

Phoria is a latent deviation or misalignment of the eyes that is only apparent some of the time. A phoria appears when fixation on a single object is broken and the eyes are no longer looking at the same object [1]. Lateral phoria can be classified into orthophoria (no movement), esophoria (inward movement) and exophoria (outward movement) [2].

Orthophoria is characterized by perfect alignment of two eyes in all positions of gaze and at all fixations distances so that the visual axes are parallel for distant and have proper convergence for near.

Stevens [3] introduced the term heterophoria and defined it as an abnormal adjustment of the eye muscles, or a tending of the visual axis in some other directions than parallelism. In heterophoria, binocular vision is habitually maintained, but by the expenditure of a greater amount of energy than is demanded in the perfect equilibrium of the ocular muscles. Thus, the deviation is kept latent by the fusion mechanism [4].

Heterophoria (lateral phoria) can be caused by anatomical factors such as orbital asymmetry i.e. size, shape and orientation of the orbits, InterPupillary Distance (IPD) abnormalities, wide IPD is associated with exophoria while small IPD with esophoria, size and shape of globes, abnormal strength or structure of extra-ocular muscles, volume of retrobulbar tissue, orbital fascias and ligaments, anomalous central distribution of the tonic innervations of the eyes, and variation to the optical axis of the eye. The kinetic or physiological causes include age, convergence excess,

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accommodation dissociation factors such as using uniocular microscope, while the neurogenic causes are lower motor neuron disease and upper neuron disease [4].

The ability to overcome ocular muscle imbalance depends on the following factors. Fusional reserve and the strength of the desire for binocular vision. The factors that can impair compensation include health status, ocular fatigue, mental health, age and certain occupation such as the use of mono-ocular microscopes.

The purpose of this study is to determine how routinely used drugs affect the phoria status of visually active Igbos on whom no records exist and the extent to which phoria at far and near are affected. These drugs are naproxen, an analgesic, sulphonamide, an antibiotic and acetazolamide, a diuretic, all of which are routinely used drugs in the clinics.

Naproxen is a naphthyl propionic acid derivative, strong analgesic, non-selective cyclo-oxygenase inhibitor, effective for the therapy of rheumatism and is available as slow release formulations, oral suspensions, topical preparations and ophthalmic solutions [5].

Sulphonamide are bacteriostatic antibiotic, structural analogues of PABA (Para-amino benzoic acid), that competitively inhibit dihydroterate synthase. They inhibit growth by reversibly blocking or inhibiting folic acid synthesis [6,7],

Acetazolamide is a carbonic anhydrase inhibitor. The enzyme carbonic anhydrase is found in the luminal membrane of the proximal tubule cells where it catalyses the dehydration of (H_2CO_3) bicarbonate, a critical step in the reabsorption of bicarbonate ions. By this action acetazolamide blocks (inhibits) sodium bicarbonate reabsorption [8].

2. Material and methods

Sixty subjects of either sex, whose ages ranged between 18 and 30 years mean (20.5 ± 0.5 years) and who attended the Abia State University Optometry clinic were enlisted for the study. The subjects were made to undergo screening by the optometrist in order to detect ocular pathology or refractive anomalies, or those who were ill were excluded in order not to introduce errors into the study, and only 20 subjects were selected for the study.

The ocular screening was performed by the Optometrist in two steps. Firstly, the examination of the external adnexa under illumination using a pen torch, and subjects suffering from disease of external adnexa were disqualified. The second step was the fundoscopic examination in which any subject with any abnormal or refractive error was detected and eliminated. Only those subjects found to be emmetropic were eligible. Furthermore, all subjects were orthophoric at far before the commencement of protocol. The sociodemographic data of the subjects were obtained by the physician.

2.1. Drugs

Diamox^(R), Acetazolamide, Lederle Laboratories Division, Dyramid (Pakistan) Ltd, Karachi., Naproxen, Roche Products (Pty) Ltd, Africa Region PO Box 129, Isando 1600, SA. Sulphatriad (trisulphonamide) 0.5g, May & Baker., all were of clinical standard.

2.2. Measurement of phoria

For the purpose of this study, it is the lateral phoria that is being considered. The phorias are measured at far (6m) and at near (40cm) using the phoropter. The methods of test number performed to measure these parameters are #3, test for phoria at far, and #13A, test for phoria at near (#3 and #13A are test numbers for phoria at far and near respectively).

The subjects were directed to observe the 6/6 Snellen Letters at 6m from behind the phoropter. Subjects were asked to fixate at the target until vertical alignment is achieved and reported. As the eyes are occluded, prisms are introduced on both eyes in which one is a dissociating prism while the other is a measuring prism, 6 prisms Base-Up (BU) on the left eye displaces the target down relative to the one seen by the right eye of the subject, one chart will be up to his right and the other down to his left and the subject is made to confirm the situation. The subject was further instructed to report when there is vertical alignment by saying 'Stop' i.e. when the upper target right on top of the lower one aligns vertically while the prism Base-In (BI) is reduced. The amount of horizontal prisms in front of the right eye while the subject reported alignment becomes the amount of the lateral phoria for the test distance. The same procedure is repeated at near target (40cm) in the reduced Snellen chart giving the phoria at near. Base-in prism indicates esophoria, base-out prism indicates exophoria, and when the pointer is static at zero, it is orthophoria.

2.3. Drug administration

The drugs were administered orally. Preliminary studies on the drugs show that the onset of action after oral administration of each drug was as follows; naproxen, 20 min, acetazolamide, 60 min, and sulphonamide 120 min [9].

To ensure uniformity, all the drugs were of clinical and therapeutic quality. Phoria was measured three times for each eye and dose and the mean determined.

2.4. Statistical analysis

Statistical software SPSS (version 20.0) Microsoft Excel were used to carry out the statistical analysis of the data. Paired T Square test was employed to compare changes in the lateral phoria in the subjects. T-values less than 0.05 was considered statistically significant.

3. Results

All subjects were orthophoric at far before the study. Tables 1-3 show the distribution of lateral phoria at far and near before (control) and after drug administration for naproxen, sulphonamide and acetazolamide respectively.

In table 1, at far, all subjects were orthophoric before drug ingestion, and at near all were exophoric. After the oral administration of naproxen, 30% of the subjects remained orthophoric while the rest (70%) was esophoric. At near, all the subjects were exophoric and remained so till the end of the study with 12.6% reduction in total value.

Table 1 Lateral phoria status at far and near before and after ingestion of naproxen, 500mg, and an analgesic

S/No	Far Phoria		Near Phoria	
	Control before naproxen	After naproxen intake	Control before intake	After naproxen intake
1	Ortho	1 eso	5 exo	6 exo
2	Ortho	1 eso	6 exo	7 exo
3	Ortho	Ortho	5 exo	4 exo
4	Ortho	2 eso	6 exo	5 exo
5	Ortho	Ortho	8 exo	7 exo
6	Ortho	3 eso	6 exo	4 exo
7	Ortho	1 eso	6 exo	5 exo
8	Ortho	1 eso	5 exo	4 exo
9	Ortho	1 eso	6 exo	4 exo
10	Ortho	1 eso	4 exo	4 exo
11	Ortho	Ortho	6 exo	4 exo
12	Ortho	1 eso	6 exo	5 exo
13	Ortho	1 eso	6 exo	5 exo
14	Ortho	Ortho	8 exo	7 exo
15	Ortho	2 eso	6 exo	7 exo
16	Ortho	1 eso	6 exo	6 exo
17	Ortho	2 eso	7 exo	6 exo
18	Ortho	1 eso	6 exo	4 exo
19	Ortho	Ortho	6 exo	5 exo
20	Ortho	Ortho	5 exo	5 exo

All subjects were ortho at far before drug administration, thereafter, 14 became eso while 6 remained at the ortho position. At near, all the subjects were exo before drug ingestion and remained exo at the end of the study with a reduction of 12.6% ($t < 0.05$) in total value.

In table 2, all the subjects were orthophoric at far before the oral administration of sulphonamide, and thereafter 50% remained unchanged while 40% became esophoric and 10% was exophoric. For near position, all the subjects were exophoric before treatment and remained unchanged at the end of the study with 14.2% reduction in total value.

Table 2 Lateral phoria status at far and near before and after ingestion of sulphonamide, 500mg, and an antibiotic

S/No	Far Phoria		Near Phoria	
	Control before sulphonamide	After ingestion of sulphonamide	Control before drug administration	After sulphonamide administration
1	Ortho	Ortho	5 exo	5 exo
2	Ortho	Ortho	6 exo	7 exo
3	Ortho	1 eso	6 exo	4 exo
4	Ortho	1 eso	6 exo	5 exo
5	Ortho	Ortho	8 exo	7 exo
6	Ortho	1 eso	6 exo	4 exo
7	Ortho	Ortho	6 exo	5 exo
8	Ortho	1 eso	5 exo	4 exo
9	Ortho	1 eso	6 exo	4 exo
10	Ortho	1 exo	4 exo	4 exo
11	Ortho	Ortho	6 exo	4 exo
12	Ortho	1 exo	6 exo	5 exo
13	Ortho	1 eso	6 exo	5 exo
14	Ortho	Ortho	8 exo	7 exo
15	Ortho	Ortho	6 exo	7 exo
16	Ortho	Ortho	6 exo	6 exo
17	Ortho	Ortho	7 exo	6 exo
18	Ortho	1 eso	6 exo	4 exo
19	Ortho	Ortho	6 exo	5 exo
20	Ortho	1 eso	5 exo	5 exo
			120 exo	103 exo 14.2%red

All subjects were ortho at far before drug administration and thereafter, 8 changed to eso and 2 to exo while 10 remained at the ortho position. On the other hand, near phoria was at the exoposition before the administration of sulphonamide and remained so until the end of the study with a reduction of 14.2% ($t < 0.05$) in total value

Table 3 shows that all the subjects were orthophoric at far before the ingestion of acetazolamide, and thereafter (25%) remained unchanged while the rest became exophoric (25%) and esophoric (50%) respectively. On the other hand, all the subjects who were exophoric at near before drug ingestion did not change till the end of the study with 18.9% reduction in total value.

Summarily, acetazolamide is greater than sulphonamide than naproxen in reducing the exophoria position at the end of the study.

Table 3 Lateral phoria status at far and near before (control) and after ingestion of acetazolamide, a bicarbonate diuretic, 250mg

S/No	Far Phoria		Near Phoria	
	Before drug intake (control)	After drug administration ingestion of acetazolamide	Before drug intake	After drug administration
1	Ortho	Ortho	9 exo	8 exo
2	Ortho	2 eso	5 exo	2 exo
3	Ortho	5 exo	9 exo	8 exo
4	Ortho	1 eso	7 exo	10 exo
5	Ortho	Ortho	6 exo	5 exo
6	Ortho	2 eso	5 exo	2 exo
7	Ortho	2 exo	6 exo	10 exo
8	Ortho	2 eso	6 exo	5 exo
9	Ortho	1 eso	6 exo	4 exo
10	Ortho	1 exo	6 exo	4 exo
11	Ortho	1 exo	6 exo	3 exo
12	Ortho	Ortho	7 exo	5 exo
13	Ortho	1 eso	5 exo	6 exo
14	Ortho	1 exo	6 exo	4 exo
15	Ortho	1 eso	6 exo	5 exo
16	Ortho	Ortho	6 exo	6 exo
17	Ortho	Ortho	6 exo	4 exo
18	Ortho	2 eso	6 exo	4 exo
19	Ortho	2 eso	6 exo	5 exo
20	Ortho	3 eso	8 exo	7 exo
			127 exo	107 exo 15.7%reduction

All subjects were ortho at far and after drug ingestion 5 remained at the ortho position, 10 became eso and 5 became exo, while at near all subjects were exo before drug administration and remained so at the end of the study with 15.7% reduction ($t < 0.05$) in total value.

4. Discussion

Therapeutic drugs affect the phoria status of individuals, but the extent or degree, frequency and distribution vary and depends on the particular therapeutic agent [10]. In a related study, it was shown that oral levodopa improved the visual acuity (VA) of amblyopes by reducing the functional visual loss associated with amblyopia [11]. Patients receiving diazepam had their amplitude of accommodation (AA) and near point of convergence (NPC) increased while their phoria status tended towards orthophoria thereby enhancing existing heterophoria [12]. It had also been shown that miotics – induced spasm of accommodation significantly decreased the principal functions of visual mechanism i.e. accommodation, convergence, and their ratio (AC/A) [13]. In another study, it was also shown that oral clonidine decreased the pupil diameter (PD), AA, and AC/A ratio while the VA and NPC were increased. The changes in phoria status following oral clonidine caused an implosion of vision due to convergence insufficiency and excessive accommodation [14]. The present study has shown that there are significant effects of drugs on phoria at both far and near, which could result to symptoms or difficulty or strain in the eyes during close work.

Eye alignment problems are common in the vicinity especially in children, and phoria is an eye muscle deviation. Eye alignment problems such as diplopia are usually caused by the inability of the eyes to work together.

In the present study, exophoria was more manifest in the study group both at far and near showing that lateral phoria is an important factor in the assessment of ocular functions. Furthermore, the prolonged convergence due to prolonged

and sustained near work produce residual esophoria as obtained in the present study. There is more eso shift following drug administration which could be due to accommodative reason or innervational in origin.

5. Conclusion

We conclude that drugs can affect the phoria status of visually active persons converting them from orthoposition to exophoria or esophoria.

Compliance with ethical standards

Acknowledgments

Authors are highly grateful to the volunteers used for the study, and also to the staff in the School of Optometry, College of Medicine /Health Sciences Abia State University Uturu, Nigeria for their supportive role throughout the study period.

Disclosure of conflict of interest

The authors declare that they have no conflict of interests.

Statement of ethical approval

The approval of the Abia State University Ethical Committee on human studies was obtained before undertaking the study and informed written consent of the subjects were obtained.

Statement of informed consent

Written Informed consent was obtained from all individual participants included in the study

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