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Comparing Accommodative Function between the Dominant and Non-Dominant Eye

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Abstract

In this study, we aimed to compare the accommodative function between the dominant and non-dominant eye. Thirty-two female students [the mean (SD) age was 22.12 (0.96) years, range 18-25] from King Saud University were selected. The method design was a prospective cross-sectional study. The hole-in-the-card test has been used to determine the dominant eye. Visual acuity at near and distant was measured. Thereafter, the accommodative function has been measured by using flipper lenses to assess accommodative facility and the push-up method to assess accommodative amplitude. The right eye was dominant in 18 subjects (56.25%). The mean (SD) deviation in exophoric subjects (N =12 [37.5 %]) and esophoria subjects (N =4 [12.5 %]) was -4.25 (1.21) and 1.75 (0.96), respectively. All other subjects (N =16 [50 %]) were orthophoria at near. The mean (SD) of accommodative amplitude and accommodative facility in the dominant eye were 9.79 (3.14) diopters and 10.33 (5.01) cycles per minute, respectively. The mean (SD) of accommodative amplitude and accommodative facility in the non-dominant eye were 9.92 (3.01) diopters and 10.12 (5.09) cycles per minute, respectively. The mean (SD) difference in accommodative amplitude and accommodative facility between the dominant and non-dominant eye was -0.13 (0.61) diopters (P=0.225) and 0.21 (3.34) cycles per minute (P=0.728), respectively. Accommodative amplitude (AA) and accommodative facility (AF) did not reach statistical significance; their means showed a slight difference between the two eyes.

Keywords: Accommodative amplitude, Accommodative facility, Dominant eye, Non-Dominant eye

Introduction

Functional lateralization refers to the tendency of paired organs, such as the hands, legs, eyes, and cerebral hemispheres, to exhibit dominance of one side over the other (Linke *et al*., 2012). Ocular dominance, also known as eye dominance or eye-dness, describes the preference for visual input from one eye compared to the fellow eye. This phenomenon is present in the majority of individuals. Although humans receive visual information through two laterally separated eyes, the brain normally integrates the two retinal images into a single binocular perception with little awareness of the separate monocular contributions. In individuals with normal binocular vision, one eye is not usually perceived as contributing more strongly than the other. However, when binocular vision is disrupted, such as in cases of strabismus or unilateral cataract, one eye may become preferentially favored over the other.

Ocular Dominance

Divisions of Ocular Dominance

Ocular dominance is considered an important component of binocular vision. It refers to the tendency of one eye to lead the other in fixation, attention, or perceptual processing (Yuan *et al*., 2015). Ocular dominance can generally be classified into three major categories:

- Sensory dominance: preference based on image clarity, brightness, or color perception.
- Oculomotor dominance: preference related to fixation accuracy or the eye showing the least deviation.
- Directional dominance: preference for one eye when viewing through a small opening or aligning objects (Momeni-Moghaddam *et al*., 2014a).

The concepts of sensory and motor dominance were developed through early studies of ocular dominance, with motor dominance commonly assessed using tests such as the Hole-in-the-Card test.

Rosenbach's Theory

In 1903, Rosenbach proposed that most individuals possess a dominant eye, even when visual acuity is equal in both eyes. He also suggested that the dominant eye is not necessarily the eye with better visual acuity. Rosenbach introduced a simple sighting test in which subjects, with both eyes open, point one index finger toward a distant target. Because the finger lies outside Panum's fusional area, it appears doubled. Most individuals tend to prefer the image perceived by one eye over the other. Alternate occlusion can then identify the dominant eye: when viewing with the dominant eye, the finger remains aligned with the target, whereas viewing with the non-dominant eye causes the finger to appear displaced to one side (Kommerell *et al*., 2003; Linke *et al*., 2011).

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Approximately two-thirds of the population exhibits right-eye dominance, while one-third demonstrates left-eye dominance. A small percentage of individuals do not show clear dominance in either eye (Momeni-Moghaddam *et al*., 2014a). Ocular dominance tests, including pointing or aiming tasks, require the subject to select one eye for alignment. Alternation between the eyes is generally observed only in individuals with nearly equal visual preference between the two eyes. Even a slight preference for one eye may result in consistent dominance responses favoring that eye. These tests are characterized by limiting stereo disparity within Panum's area, thereby reducing the perception of diplopia and minimizing forced selection between double images (Kommerell *et al*., 2003).

Ocular Dominance Tests

Several clinical methods are used to determine ocular dominance, including:

- *Miles Test:* The subject extends both arms forward and creates a small triangular opening between the hands. With both eyes open, the subject fixates on a distant object through the opening. When one eye is closed, the eye that continues to maintain alignment with the target is considered the dominant eye (Miles, 1928).
- *Dolman Method (Hole-in-the-Card Test):* The subject holds a card containing a small central hole and views a distant target through it using both eyes. The examiner alternately occludes each eye to determine which eye remains aligned with both the hole and the target. This eye is considered dominant (Linke *et al*., 2011).
- *Convergence Near-Point Test:* The subject fixates a target moved gradually toward the nose until one eye deviates outward. The eye that maintains fixation longer is considered the dominant eye. This method is regarded as an objective assessment of ocular dominance (Cheng *et al*., 2004).

Importance of Ocular Dominance

Ocular dominance plays an important role in various ophthalmic and optometric procedures. It contributes to clinical decision-making in spectacle and contact lens prescription, cataract surgery, refractive surgery, amblyopia therapy, strabismus management, and monovision correction for presbyopia. It has also been associated with reading performance and binocular visual control (Linke *et al*., 2012; Yuan *et al*., 2015).

Knowledge of ocular dominance is especially important in monovision correction strategies used in cataract and refractive surgeries for presbyopia management. In monovision, the dominant eye is typically corrected for distance vision, whereas the non-dominant eye is corrected for near vision. The dominant eye is believed to resist suppression more effectively when exposed to blurred images compared with the non-dominant eye. Therefore, accurate identification of ocular dominance before surgery may improve postoperative success and patient satisfaction. However, in patients with bilateral cataracts, unequal lens opacity between the two eyes may reduce the reliability of subjective ocular dominance tests (Yuan *et al*., 2015).

Accommodative Function

The Main Function of the Lens

The crystalline lens is a transparent structure located behind the iris. Its primary role is to refract light rays so that a clear image is focused on the retina. Because the lens is elastic, it can alter its shape according to viewing distance. The lens becomes thicker and more convex when focusing on near objects and flatter when viewing distant objects, a process known as accommodation.

Visual Accommodative System

The accommodative system is a visuomotor mechanism responsible for maintaining clear retinal images at varying viewing distances. Accommodation occurs through changes in the curvature of the crystalline lens produced by contraction of the ciliary muscle and relaxation of the zonular fibers. In the relaxed state, the lens is relatively flat and suited for distance viewing. During near viewing, ciliary muscle contraction reduces zonular tension, allowing the lens to become more rounded and increasing its refractive power (Banks, 1980).

The human eye can maintain sharp focus at only one viewing distance at a time. Accommodation enables the focal plane to shift by altering the curvature and refractive power of the lens. Increased curvature enhances refractive power and shifts the focal plane closer to the eye for near objects, while decreased curvature reduces refractive power for distant viewing. These adjustments collectively constitute visual accommodation (Banks, 1980).

Factors Affecting the Inequality of Accommodative Function

Previous studies have suggested that accommodative anomalies should be suspected when there is a difference greater than 0.50 diopters in accommodative amplitude or a difference of two cycles per minute or more in accommodative facility between the two eyes. Several factors may contribute to unequal accommodative function, including uncorrected refractive errors, anisometropia, amblyopia, iridocyclitis, ocular trauma, glaucoma, lens sclerosis, tonic pupil syndrome, and unilateral accommodative paresis. Ocular dominance may also contribute to accommodative inequality (Momeni-Moghaddam *et al*., 2014a).

If directional ocular dominance is established early in life, prolonged preferential use of one eye may result in superior accommodative performance in that eye. Since directional dominance measured by the Hole-in-the-Card test is associated with sensory dominance identified through binocular rivalry testing, differences in accommodative function may involve both sensory and motor mechanisms. Superior accommodative facility or amplitude in one eye, whether dominant or non-dominant, may also influence posture during near tasks, as individuals may adjust their head position to align the preferred eye with the reading material (Momeni-Moghaddam *et al*., 2014a).

Accommodative Amplitude

Accommodative amplitude refers to the maximum change in refractive power that the eye can achieve through accommodation. This ability gradually decreases with age and may also be influenced by systemic diseases and medications. Adolescents typically demonstrate accommodative amplitudes ranging from 12 to 16 diopters, whereas adults around 40 years of age exhibit amplitudes between 4 and 8 diopters. After the age of 50 years, accommodative amplitude usually declines to less than 2 diopters. Age-related lens hardening is considered the primary cause of this reduction, known as presbyopia. Common subjective methods for measuring accommodative amplitude include the push-up, push-down, and minus lens techniques (Momeni-Moghaddam *et al*., 2014b).

Accommodative Facility

Accommodative facility measures the speed and accuracy with which the accommodative system can change focus in response to blur stimuli. It is commonly assessed using alternating positive and negative lenses to stimulate and relax accommodation rapidly (Pandian *et al*., 2006).

Aims

The primary aim of this study was to compare accommodative function between the dominant and non-dominant eyes among female students at King Saud University (KSU) in Riyadh city.

Hypothesis

Ocular dominance is a manifestation of the brain's preference for one member of a paired organ system, such as the hands, ears, legs, or eyes. In vision, the dominant eye is the eye preferentially used for visual processing and fixation. Eye dominance may arise from several mechanisms, including sensory, oculomotor, and directional dominance. Sensory dominance refers to the preference for visual input from one eye due to differences in retinal image quality, such as clarity, brightness, or color perception. Oculomotor dominance is related to fixation control and is typically associated with the eye that demonstrates greater stability during fixation tasks. Directional, or sighting, dominance refers to the preferred eye used when aligning objects or viewing through a small aperture, such as during the Miles test.

Under normal conditions, accommodative function is generally balanced between the two eyes. However, variations in accommodative performance may occur due to differences in visual input, fixation preference, or neural control mechanisms. These variations can result in accommodative ocular dominance, where one eye exhibits superior accommodative ability compared to the fellow eye. Therefore, comparing accommodative function between the dominant and non-dominant eye may provide valuable insights into the relationship between ocular dominance and binocular visual performance.

So, we hypothesize that there is a significant difference in accommodative function between the dominant and non-dominant eye. The dominant eye is hypothesized to demonstrate superior accommodative performance, such as greater accommodative accuracy, stability, or amplitude, compared to the non-dominant eye due to neural and sensory preference mechanisms associated with ocular dominance.

Study Significance

This study may help determine whether accommodative function is better in the dominant or non-dominant eye and identify which eye demonstrates better near visual acuity. Understanding the relationship between ocular dominance and accommodative performance could provide useful clinical information for visual assessment and management. The findings may also have practical applications in monovision correction, where knowledge of the eye with superior accommodative and near visual performance can assist in selecting the most appropriate eye for near or distance correction. (Yuan *et al*., 2015).

Literature Review

Several studies have compared different visual and ocular characteristics between dominant and non-dominant eyes, including refractive error (spherical and astigmatic components, isometropia, and anisometropia), fusional reserves, strabismus, visual acuity (VA), anterior segment parameters, vergence and accommodative dynamics, and intraocular pressure (IOP). However, only a limited number of studies have specifically investigated accommodative function, particularly accommodative amplitude and accommodative facility.

A study conducted by Momeni-Moghaddam H. (2014) evaluated accommodative amplitude (AA), accommodative facility (AF), and accommodative lag in dominant and non-dominant eyes. The study included 70 students aged 18–25 years from Zahedan University, including 22 males and 48 females. All participants had best-corrected visual acuity (BCVA) of 20/20 or better at both 6 m and 40 cm, with less than 0.50 D spherical equivalent anisometropia. Subjects with a history of ocular trauma, pathology, or ocular deviation were excluded. Refraction and ocular dominance were assessed using the Hole-in-the-Card method.

Cheng C. Y. (2004) investigated the relationship between ocular dominance and the degree of myopia in anisometropic patients. The study included 55 subjects with non-amblyopic anisometropic myopia. Refractive error and axial length were measured for each participant, while ocular dominance was determined using the Hole-in-the-Card test and convergence near-point test. The findings demonstrated a threshold level of anisometropia at 1.75 D. In subjects with high anisometropia (>1.75 D), dominant eyes showed significantly greater myopic spherical equivalent values and longer axial lengths compared with non-dominant eyes ($P < 0.001$). However, in the low anisometropia group (≤1.75 D), no significant differences were observed between dominant and non-dominant eyes (Cheng *et al*., 2004).

Lopes-Ferreira D. (2013) evaluated the distribution of ocular dominance and its association with high- and low-contrast LogMAR visual acuity in 44 presbyopic subjects, including 29 females and 15 males aged 41–56 years. None of the participants had amblyopia or anisometropia. Ocular dominance was assessed using both sighting dominance (Hole-in-the-Card test) and the +1.50 D blur method. Subjects were classified into four dominance types according to the combination of sensory and sighting dominance. Baseline refractive error was similar between the right eye (−0.36 ± 1.67 D) and left eye (−0.35 ± 1.85 D) with no statistically significant difference (P = 0.930) (Lopes-Ferreira *et al*., 2013).

Pekel G. (2014) compared contrast sensitivity between dominant and non-dominant eyes in 45 healthy middle-aged individuals, including 30 males and 15 females aged 40–60 years. All subjects had uncorrected visual acuity of 20/25 or better. Ocular dominance was determined using the Hole-in-the-Card test, while contrast sensitivity was measured using Functional Acuity Contrast Testing (F.A.C.T.) under both photopic and mesopic conditions with spectacle correction. The results showed that 96% of participants had right-eye dominance. Under mesopic conditions, contrast sensitivity values in dominant eyes were slightly higher than those in non-dominant eyes across all spatial frequencies; however, statistical significance was found only at the 18 cpd spatial frequency (P = 0.035). Under photopic conditions, no statistically significant differences were observed between dominant and non-dominant eyes (Pekel *et al*., 2014).

Wang Q. (2016) conducted a prospective controlled study to evaluate the relationship between ocular dominance and the degree of myopia in anisometropic patients, as well as to investigate visual evoked potential (VEP) characteristics in high anisometropia. The study included 1771 subjects aged 18–42 years, including 790 anisometropic patients who underwent LASIK or LASEK procedures between 2011 and 2013. Subjects outside the range for laser correction and those with amblyopia, ocular disease, or previous refractive surgery were excluded. Examinations included visual acuity, refraction, VEP, ocular dominance, and wavefront aberration analysis. Right-eye dominance was observed in 62.2% of subjects, left-eye dominance in 36.1%, while 1.75% showed no clear dominance (Wang *et al*., 2016).

Linke S. J. (2011) investigated the association between ocular dominance, anisometropia, age, and sex in 10,264 myopic subjects aged 18–68 years. Ocular dominance was assessed using the Hole-in-the-Card test, and only subjects with corrected distance visual acuity (CDVA) better than 20/22 were included. Individuals with amblyopia, ocular disease, or previous ocular surgery were excluded. Right-eye dominance was present in 61.7% of subjects and left-eye dominance in 35.6%. In subjects with spherical equivalent anisometropia <0.5 D, the non-dominant eye was more myopic in 51.8% of cases (Linke *et al*., 2011).

Similarly, Linke S. J. (2012) studied the association between ocular dominance and refractive error in 1274 hyperopic subjects. Ocular dominance was evaluated using the Hole-in-the-Card test, and participants with amblyopia, ocular disease, or previous ocular surgery were excluded. Right-eye dominance was observed in 57.4% of subjects, whereas left-eye dominance was observed in 40.5%. Cycloplegic refraction demonstrated a tendency for the non-dominant eye to be more hyperopic and more astigmatic, although this trend was not statistically significant overall.

Materials and Methods

Thirty-two female students from King Saud University, aged between 18 and 25 years, were invited to participate in this study. All participants had best-corrected visual acuity (BCVA) of 20/20 or better in each eye at both 6 m and 40 cm.

Subjects who fulfilled the following inclusion and exclusion criteria were recruited into the study.

Inclusion Criteria

- Best-corrected visual acuity of 20/20 or better in each eye at 6 m and 40 cm.
- Presence of ocular dominance.

Exclusion Criteria

- Presence of ocular deviation at either 6 m or 40 cm as determined by the cover test.
- Amblyopia.
- More than 0.50 D spherical equivalent anisometropia.
- History of ocular or head trauma.
- Presence of any ocular pathology.

This study was designed as a prospective cross-sectional study. Ethical approval was obtained from the Research Committee before data collection. The purpose and procedures of the study were explained to all participants, and informed consent was obtained before participation.

A detailed history was obtained from each subject to exclude individuals with a history of ocular or head trauma, ocular disease, or any condition that could affect accommodative function.

The methodology included the following procedures:

- Measurement of distance and near visual acuity using the Snellen chart.
- Assessment of phoria and ocular deviation using the cover test.
- Measurement of refractive error using an auto-refractor.
- Determination of ocular dominance using the Hole-in-the-Card test.
- Evaluation of accommodative function, including accommodative facility and accommodative amplitude.

Distance and near visual acuity were measured for all participants using a Snellen chart. Subjects with visual acuity worse than 20/20, even with correction, were excluded to avoid the influence of amblyopia or significant anisometropia on the study results. Refractive error was assessed using an auto-refractor to identify subjects with more than 0.50 D spherical equivalent anisometropia.

The cover test was performed to detect the presence of ocular deviation. During the test, the subject fixated on a near target while one eye was briefly occluded and then uncovered, while ocular movement was observed. The procedure was repeated for both eyes at both near and distance fixation. Subjects demonstrating ocular deviation were excluded from the study.

Ocular dominance was determined using the Hole-in-the-Card test while subjects wore their best distance correction. Participants were instructed to focus on a small optotype on the 6 m visual acuity chart through a 3 cm hole in a card held at arm's length using both hands. Each eye was then alternately occluded to determine which eye remained aligned with both the hole and the distant target. The aligned eye was considered the dominant eye.

Accommodative function was evaluated under monocular viewing conditions by measuring accommodative facility and accommodative amplitude. To minimize testing order bias, odd-numbered subjects were tested first with the dominant eye, whereas even-numbered subjects were tested first with the non-dominant eye. Each accommodative test was performed three times, and the average value was recorded as (Eser *et al*., 2008).

Accommodative Facility

Accommodative facility was assessed using ±2.00 D flipper lenses. A vertical row of approximately 20/30-sized "E" letters at a distance of 40 cm was used as the accommodative target. Subjects were instructed to maintain the target as clear as possible while the examiner alternated the flipper lenses between plus and minus powers. One complete cycle consisted of clearing the target through both the plus and minus lenses. The number of cycles completed in one minute was recorded. The test was repeated three times, and the average value was recorded in cycles per minute (Eskridge *et al*., 1991).

Accommodative Amplitude

Amplitude of accommodation was measured using the push-up method with the RAF near point rule. Subjects wore their best refractive correction in a trial frame under normal room illumination. A reduced Snellen chart displaying the 20/20 line was positioned initially at 40 cm and then moved slowly toward the subject. Participants were instructed to keep the target clear and report the point at which sustained blur first occurred and could not be cleared within 2–3 seconds. The distance from the spectacle plane to this point was measured in millimeters and converted into diopters. The procedure was repeated three times for each eye, and the average value was recorded as (Grosvenor, 2007).

Statistical Methods

After data collection, statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS version 20). Descriptive statistics, including the mean and standard deviation, were calculated for all study parameters. Comparisons between dominant and non-dominant eyes were performed using the paired t-test. A P-value of less than 0.05 was considered statistically significant. Scatter plots were also used to evaluate and illustrate correlations between the studied parameters (McAlinden *et al*., 2011; Momeni-Moghaddam *et al*., 2014a).

Results and Discussion

A total of 44 female subjects were initially recruited for this study. However, 12 subjects were excluded because they did not meet the study inclusion criteria. Therefore, 32 subjects aged between 18 and 25 years participated in the study. The mean (SD) age of the participants was 22.12 (0.96) years.

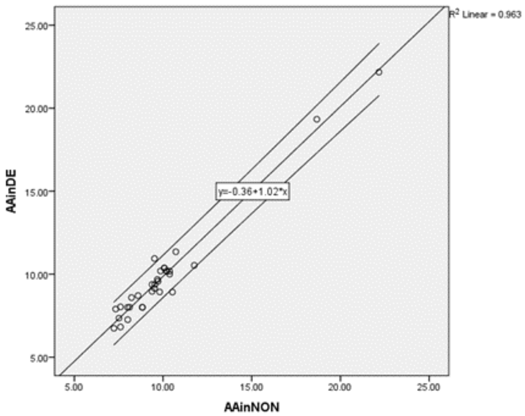
Following examination, right-eye dominance was identified in 18 subjects (56.25%), while left-eye dominance was found in 14 subjects (43.75%).

The mean (SD) near deviation for all subjects was −1.38 (2.44) prism diopters (95% CI: −2.26 to −0.49), where the negative value indicated exophoria. Among subjects with exophoria (N = 12; 37.5%), the mean (SD) deviation was −4.25 (1.21) prism diopters (95% CI: −5.02 to −3.48). In subjects with esophoria (N = 4; 12.5%), the mean (SD) deviation was 1.75 (0.96) prism diopters (95% CI: 0.23 to 3.27). The remaining subjects (N = 16; 50%) demonstrated orthophoria at near fixation (Constantin *et al*., 2022; Mojsak *et al*., 2022; Delcea *et al*., 2024; Essah *et al*., 2024; Frost *et al*., 2024; Kajanova & Badrov, 2024; Lee & Ferreira, 2024; Rosellini *et al*., 2024; Umarova *et al*., 2024; Uneno *et al*., 2024).

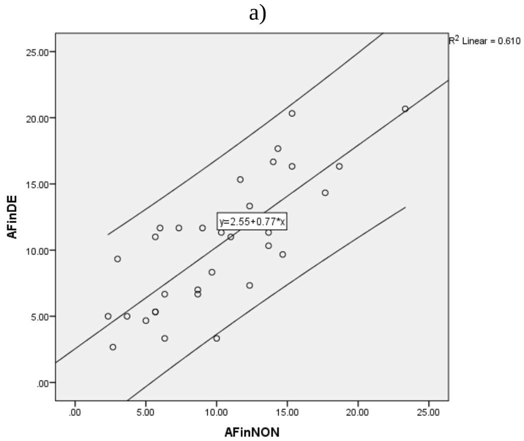
The mean (SD) accommodative amplitude (AA) and accommodative facility (AF) values in the dominant and non-dominant eyes are presented in **Table 3** and illustrated in the scatter plots shown in **Figures 1a and 1b**. Statistical analysis using the paired t-test revealed no significant difference in accommodative amplitude or accommodative facility between dominant and non-dominant eyes (P > 0.05) (Genc *et al*., 2023; Ku *et al*., 2023; Tsiganock *et al*., 2023; Ribeiro *et al*., 2024; Sanlier & Yasan, 2024).

The mean (SD) refractive error and near visual acuity (VA) measurements for both eyes are presented in **Tables 1 and 2**, respectively. The paired t-test showed no statistically significant difference in spherical equivalent refraction between dominant and non-dominant eyes (P > 0.05). However, the data demonstrated a trend toward a difference in near visual acuity between dominant and non-dominant eyes, although this difference did not reach statistical significance (P = 0.09) (Al Abadie *et al*., 2023; Almutairi *et al*., 2023; Guzek *et al*., 2023; Lee *et al*., 2023; Ncube *et al*., 2023; Oran & Azer, 2023; Simonyan *et al*., 2023; Szklener *et al*., 2023; Tsvetkova *et al*., 2023; Ceylan *et al*., 2024; Maralov *et al*., 2024; Snodin & McCrossen, 2024).

The mean (SD) values and P-values for accommodative amplitude and accommodative facility in relation to refractive error and near visual acuity are presented in **Table 4** and illustrated in **Figures 2a and 2b**. Statistical analysis demonstrated a strong, significant association between accommodative function (AA and AF) and both refractive error and near visual acuity between dominant and non-dominant eyes (P < 0.05).

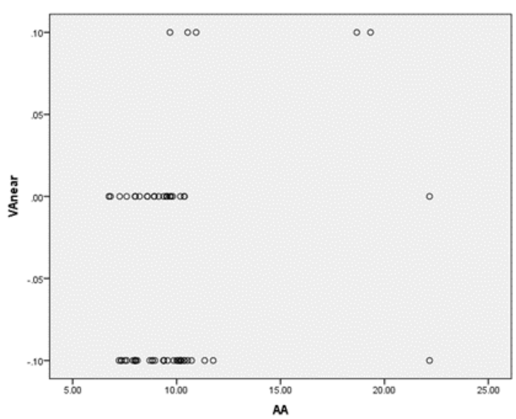


a)

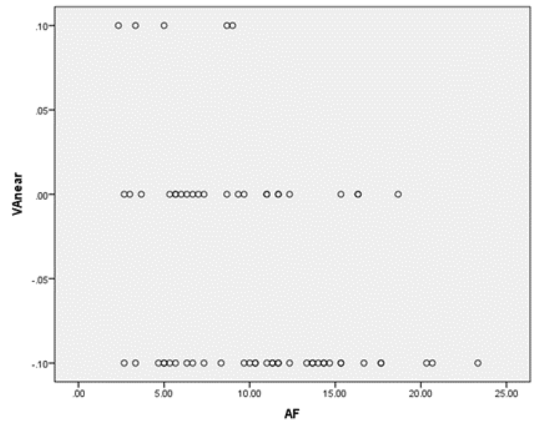


b)

Figure 1. a) Comparing the accommodative amplitude in the dominant and non-dominant eye. b) Comparing the accommodative facility in the dominant and non-dominant eye.



a)



b)

Figure 2. a) Comparing between accommodative amplitude and visual acuity at near. b) Comparing between accommodative facility and visual acuity at near.

Table 1. The mean (SD) for spherical equivalent (SE) refraction

Table 1 Refraction (SE)	Dominant Eye	Non-dominant eye	Mean Difference	Paired *t*-test *P*-value
Mean (SD)	-1.08 (1.72)	-1.09 (1.74)	0.01 (0.37)	0.905
95% CI	-1.71 to -0.46	-1.71 to -0.47	-0.12 to 0.14	

Table 2. The mean (SD) for Visual Acuity at near

Table 2 VA for near	Dominant Eye	Non-dominant eye	Mean Difference	Paired *t*-test *P*-value
Mean (SD)	-0.06 (0.06)	-0.04 (0.07)	-0.01 (0.05)	0.096
95% CI	-0.08 to -0.03	-0.06 to -0.02	-0.03 to 0.00	

Table 3. The mean (SD) for accommodative amplitude and accommodative facility in the dominant and non-dominant eye.

Table 3		Dominant Eye	Non-dominant eye	Mean Difference	Paired *t*-test *P*-value
AA	Mean (SD)	9.79 (3.14)	9.92 (3.01)	-0.13 (0.61)	0.225
	95% CI	8.65 to 10.92	8.83 to 11.00	-0.35 to 0.09	
AF	Mean (SD)	10.33 (5.01)	10.12 (5.09)	0.21 (3.34)	0.728
	95% CI	8.52 to 12.14	8.29 to 11.96	-0.99 to 1.41	

Table 4. The accommodative amplitude and facility in comparison with refraction and visual acuity at near.

	Table 4	VA at near	RE
AA	Pearson Correlation	0.30	-0.04
	P-value (2-tailed)	0.05	0.75
AF	Pearson Correlation	-0.34	-0.11
	P-value (2-tailed)	0.01	0.36

In addition to assessing variations in near visual acuity and refractive error between the two eyes, the current study compared accommodative function between the dominant and non-dominant eyes. The study included 32 female subjects with a mean age of 22.12 years. The mean near deviation for all participants was −1.38 prism diopters, with the negative value indicating exophoria. These findings demonstrated that exophoria was more common (37.5%) than esophoria (12.5%), while orthophoria represented the highest percentage of subjects (50%).

The paired t-test showed no statistically significant difference in accommodative amplitude (AA) or accommodative facility (AF) between dominant and non-dominant eyes (P > 0.05). Although the dominant eye demonstrated a slightly lower mean accommodative amplitude, the non-dominant eye showed a slightly lower mean accommodative facility **(Table 3)**; these differences did not reach statistical significance. This may be attributed to the relatively small sample size included in the study. In addition, during accommodative facility testing, the accommodative target was not maintained at a constant distance for all subjects because of instability in the participants' hand positioning, which might have affected how accurate the measurements were.

As a secondary outcome, near visual acuity (VA) and refractive error were compared between dominant and non-dominant eyes, as shown in **Tables 1 and 2**. No statistically significant differences were identified between the two eyes (P > 0.05). However, the P-value for near visual acuity (P = 0.09) suggested a possible trend toward a difference between dominant and non-dominant eyes, although this did not achieve statistical significance.

Interestingly, a strong statistically significant relationship was found between accommodative facility and near visual acuity (P < 0.01). In addition, a statistically significant association was identified between accommodative amplitude and near visual acuity (P = 0.05), as presented in **Table 4** and **Figures 1a and 1b)**. In contrast, no significant relationship was observed between refractive error and accommodative amplitude or accommodative facility (P > 0.05).

Allen *et al*. (2010) investigated the effects of accommodative facility training in myopic and emmetropic individuals and reported that accommodative facility improved during near fixation tasks (Allen *et al*., 2010). Similarly, Kasthurirangan and Glasser (2005) studied the relationship between accommodative amplitude and accommodative dynamics and found that accommodative responses were greater during near viewing conditions (Kasthurirangan & Glasser, 2005). These findings support the relationship observed in the current study between accommodative function and near visual performance.

The present study also demonstrated that right-eye dominance was more common among participants, which is consistent with the findings reported in previous studies (Cheng *et al*., 2004; Eser *et al*., 2008; Linke *et al*., 2011; Linke *et al*., 2012).

Chen *et al*. (2009) measured accommodative amplitude in subjects with anisohyperopia, hyperopia, and emmetropia. Their results showed a significant difference in accommodative amplitude between dominant and non-dominant eyes only in the anisohyperopic group, while no significant differences were found in the other groups (Chen *et al*., 2009). In contrast, other studies reported significant differences in accommodative amplitude and accommodative facility between dominant and non-dominant eyes (Chia *et al*., 2007; Momeni-Moghaddam *et al*., 2014a). The discrepancy between those findings and the present study may be related to differences in sample characteristics, testing procedures, or sample size.

Which could have affected the precisionMansour *et al*. (2003) found that the dominant right eye tended to be slightly more myopic than the left eye 22 in terms of refractive error. Linke *et al*. (2012) discovered that the non-dominant eye was typically more hyperopic than the dominant eye in hyperopic participants. On the other hand, the results of the current investigation of the measures are similar with the findings of Linke *et al*. (2011) and Eser *et al*. (2008), who did not find any significant refractive variations between dominant and non-dominant eyes (Eser *et al*., 2008; Linke *et al*., 2011).

Conclusion

The results of this study demonstrated no statistically significant differences in accommodative amplitude (AA) or accommodative facility (AF) between dominant and non-dominant eyes. However, slight variations in the mean values were observed between the two eyes. The dominant eye demonstrated a slightly lower mean accommodative amplitude, whereas the non-dominant eye showed a slightly lower mean accommodative facility.

In addition, no statistically significant difference was found between ocular dominance and near visual acuity (P > 0.05). Nevertheless, the P-value obtained for near visual acuity suggested a possible trend toward a difference between dominant and non-dominant eyes.

Limitation and Recommendations

Several limitations were encountered during data collection. One limitation was the relatively small sample size, which may have reduced the ability to detect statistically significant differences. Another limitation was the instability of the accommodative target distance during accommodative facility testing because subjects held the target manually, which may have affected measurement accuracy.

Therefore, further studies with larger sample sizes are recommended. Future research should also use a fixed accommodative target position to improve measurement consistency and obtain more reliable and accurate results.

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