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RESEARCH ARTICLE

AN ASSESSMENT OF OCULAR DOMINANCE: A TERTIARY LEVEL HEALTH CARE CENTRE OBSERVATIONAL STUDY

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Abstract

Background: Ocular Dominance was first described by Rosenbach. Ocular Dominance is the tendency to physiological preference of one eye over another eye. However, the role of Ocular Dominance in processing of visual memory and analytic tasks is unknown. Research has showed significant effects of Ocular Dominance on visual perception, motor control, color vision and sports performance. The aim of present study was to determine Ocular Dominance by the Gundogan Method which is Near Far Alignment Test.

Method: This study attempts to assess Ocular Dominance and the relationship between Ocular Dominance, Gender and cerebral laterality. It is a cross sectional, comparative and analytic type of study which is carried out on 170 healthy young adults with normal visual acuity. Among them 101 subjects were male and 69 subjects were female. Detection of Ocular Dominance was done by Gundogan Test.

Result: Ocular Dominance was present in human beings. Ocular Dominance was most commonly present in Right Eye. Right Eye was dominant in (118) 69.4 % subjects and Left Eye was dominant in (52)30.6 % subjects. Gender based distribution of Right eye dominancy was 70.3%(n=71) for males and 68.1%(n=47) for females. Gender distribution For Left eye dominancy, was 29.7%(n=30) for males and 31.8%(n=22) for females (p value = 0.89).

Conclusion: Ocular Dominance markedly observed in human beings, and Right eye dominancy is more preponderant than Left eye. It was also concluded that gender is not a major factor to affect eye dominancy. We insinuate that Gundogen Performance Test was appear to be a more practical and fluently applicable performance Test.

Introduction:-

Ocular Dominance also known as Eye Dominance or eyed-ness. Ocular Dominance is the tendency of the visual system to give more preference to the processing of visual input signals from one eye over another eye. Approximately 75% of the people are Right-Eye Dominant and Left-Eye dominancy is present in 25%[1].

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Essentially, Dominant Eye relays information more accurately to our brain's visual cortex than the other eye. It's made up of bands of neurons which respond preferentially to input from one eye or the other. The Dominant Eye simply has more neural connections to the brain than the Non-Dominant Eye [2].

Ocular Dominance must ascend from the distinct processing of visual information from separate eye. Primary visual cortex partially separates the visual sensation from the Right Eye and Left Eye. Specifically ocular dominance columns are present in the primary cortex that may facilitate information for monocular processing and possibly Ocular Dominance [3].

The Dominant Eye may capture more visual attention readily making that eye more conditional for accurate positional information during binocular viewing. Hence the Dominant Eye plays a significant role in binocular vision [4].

There is substantiation that Ocular Dominance may have an inheritable base. Using a mathematical model, Annett (1999) suggested that genetically-linked asymmetrical laterality in human beings may account for right-sidedness above the 50% that would be expected by chance [5].

Ocular dominancy is also affected by gender as proven by Eser et al, who found 70% right eye dominant in males than 65% in female, determining gender to be a factor affecting ocular dominancy [6].

Ocular Dominance may be especially important in sports which require aim, such as archery, darts, shooting, baseball and golf [7]. Eye Dominance distribution is essential for targeting and shooting scores in military forces [8]. It is a significant role in prediction of patients satisfaction with monovision correction in cataract surgery, refractive surgery and wearing contact lens. The Dominant Eye was found to be superior to Non-Dominant Eye in visual acuity and motor functions [9]. The Dominance of eye also had a significant effect in color perception. Thus, identification of Dominant Eye is very important [10]. So present study is planned for assessment of Dominant Eye by the Gundogen method[2].

Method:-

The present study was conducted in the Department of Physiology, in collaboration with the Department of Ophthalmology at S.M.S. Medical College, Jaipur after receiving the desired clearance from the Institutional Research Review Board (IRRB) and the Ethics committee of the Institution. The study design was of analytic type of observational study. The present study included 170 young adults in the age range of 18 to 25 years with normal visual acuity and normal color vision with similar educational background. Simple random sampling technique was used for the selection of the study population. An informed written consent was taken from all the enrolled subjects before commencement of the procedure. Subjects with normal visual acuity and normal ocular motility in the age group 18-25 years of either sex and giving written informed consent were included in the study. Subjects with a history of ocular surgery, presence of ocular diseases such as strabismus, nystagmus, retinal pathology and any other comorbidity like diabetes mellitus, hypertension etc. and subject not cooperative were excluded from the study. Each subject underwent a complete ophthalmologic examination that included best corrected visual acuity and fundoscopy. The Dominant Eye (DE) assessment was performed to all subjects in the same condition by the Gundogan method. The subject had to align two reference points in the horizontal eye-level plane. The first point as a Near Point (NP) was fixed at 40cm away from the eyes and two measuring schedules were placed on both sides of eye. The second point as a far point (FP) which is mobile and 3.0 m aside from the Eye on the wall. Then the subjects were asked to focus both eyes on the FP as the FP moved till it came at the same line with the NP. When the two points were superimposed in the same line, the subject was then intended to close one Eye without moving his or her head and Eyes. The subject was then asked whether points were shifting or not. If the NP shifted from the FP when one Eye was closed, subject was asked to read the shifting distance between two points from the transparent board where measuring schedule was placed on the two sides of the NP. The same procedure was repeated for the other Eye. The Eye representing minimum shifting distance between two points was accepted to be dominant.

Statistical Analysis

The results of tests were expressed as the number of observations and percentages (%). Qualitative data were expressed in form of proportion. Difference in proportions was analyzed using chi-square test. Tables, bar chart

&pie chart were made for descriptive analysis. Primer software were used for all statistical analysis. p-value < 0.5 is significant.

Results:-

Table 1:- Distribution of Dominant Eye According to the Right Eye and Left Eye with their percentages in Study Population.

	Number of subjects	Percentage
Right Eye	118	69.41
Left Eye	52	30.59
Total	170	100.00

Table 1 exhibits the total No. of Right Eye Dominant is 118 (69.4%). Similarly total No. of Left Eye Dominant is 52 (30.6%).

Figure 1:- Graphical representation of the Dominant Eye distribution in Right Eye and Left Eye in number with percentage suggesting the preponderance of Right Eye Dominancy.

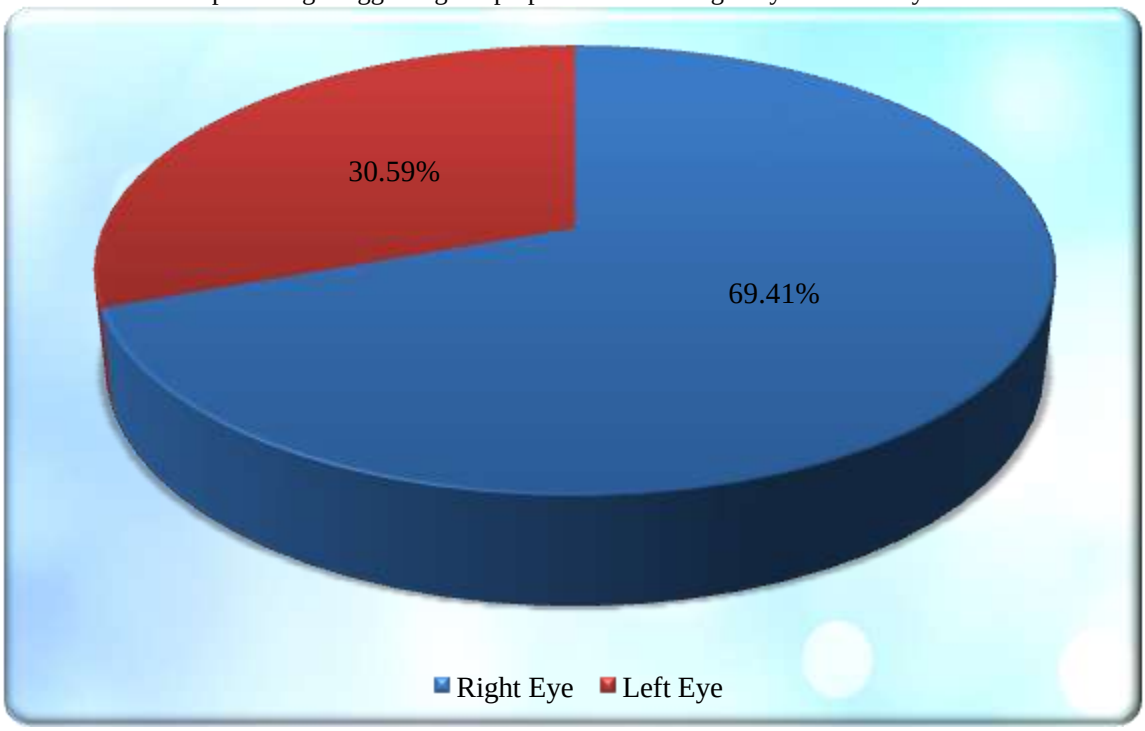
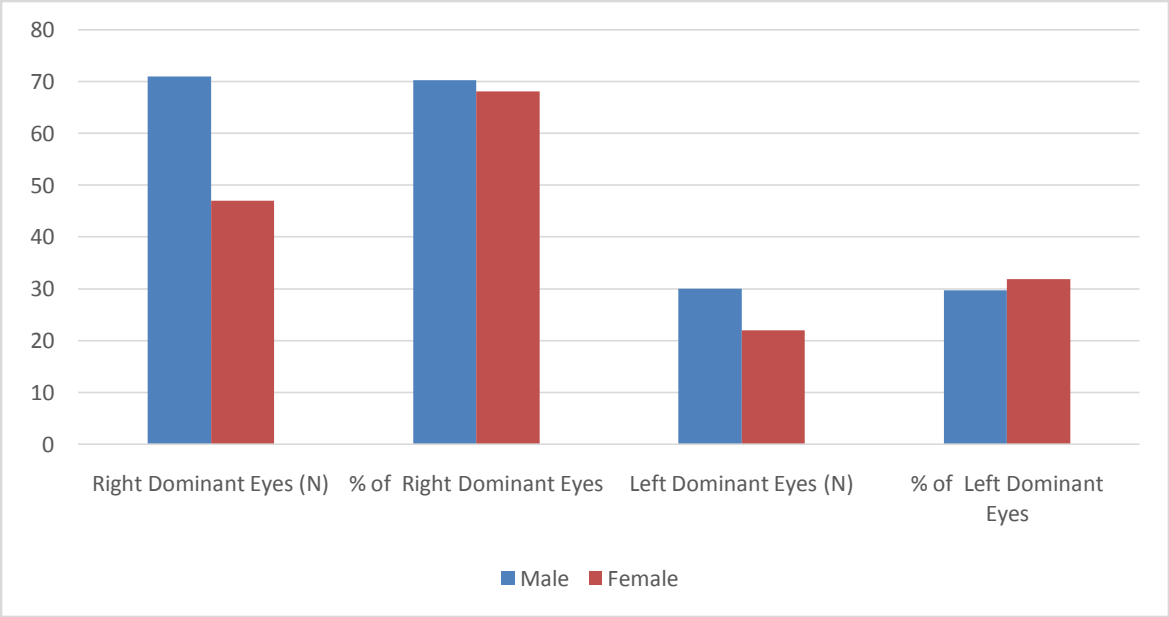


Table 2:- Gender based Distribution of Right and Left Eye Dominancy with their percentages in Study Population.

Dominancy	Total	Right Dominant Eyes (N)	% of Right Dominant Eyes	Left Dominant Eyes (N)	% of Left Dominant Eyes	p value
Male	101	71	70.30	30	29.70	
Female	69	47	68.11	22	31.88	0.89
	170	118		52		

Table 2 exhibits that among 101 male subjects 71 shows Right Eye Dominancy(70.3%) and 30 subjects shows Left Eye Dominancy(29.7%).Similarly among 69 female subjects 47 shows Right Eye Dominancy(68.1%) and 22 subjects shows Left Eye Dominancy(31.9%). On comparison both male and female were preponderance to Right Eye.

Figure 2:- Graphical representation of Gender based Distribution of Right and Left Eye Dominancy with their percentages in Study Population.



Discussion:-

The present study was designed to evaluate the underlying neurophysiological phenomenon of ocular dominance by Gundogen method. It was showed that Right Eye was present more constantly as a Dominant Eye. The percentage of Right Eye Dominant is 69.4. Consistently research published in the literature report that the Right Eye is the Dominant Eye in the majority of subjects. Ferreira et al (2013) documented a relationship between the Dominant Eye and its higher visual capabilities in terms of resolution. This might be of critical relevance of determining Ocular Dominance correctly and deciding which contact lens or surgical procedures to apply to each eye. Correct selection of dominance might be critical for optimization of near and distance visual tasks under low contrast conditions [11]. The present results might be useful for its application in the field of intraocular lens implantation for monovision in presbyopic patients [12]. Erdogan et al (2002) calculate the visual cortex areas by using scenograms, by Cavalieri's method and shows that the subjects with Right-Eye Dominance, the right visual cortex was larger than the left visual cortex, and conversely in the subjects with Left-Eye Dominance and concluded that the human eyes are predominantly controlled by the ipsilateral visual cortex [13]. Jung et al (2017) demonstrate first neural evidence of the Dominant Eye's effects on the Left Visual Field superiority for faces. They found that the Dominant Eye may be better able to meditate the Left Visual Field superiority phenomenon for processing of face images [14]. Rice et al (2008) concluded that tests available for dominant eye examination is not perfect to a great extent when compared withother tests and results of Ocular Dominance tests seems to vary depending on both the testing distance and the specific activity performed as part of the testing method [15]. Gundogen Test is reliable method because in this method measuring schedule scale is attached for accurate measurement of shifting distance. Elghorab et al (2020) shows 63% of the participants had a Dominant Right Eye [16]. In our study 69.4% subjects points in the direction of the Right Ocular Dominance while 30.6% subjects accounted for Left Eye Dominant.

Momeni et al (2014) reported that most subjects (75.7%) were Right Eye Dominant while the rest (24.3%) were Left Eye Dominant [17]. Finally, in previous studies Right-Eye Dominance was displayed to be more prevalent than Left-Eye Dominance by a ratio of roughly 3:1respectively[18].

Wang et al (2016) demonstrate that in males Right Eye Dominancy was 62.9% and Left Eye Dominancy was 37.1%. In females Right and Left Ocular Dominance was 64.2% and 35.8% respectively. Right Ocular Dominance was present in both males and females. There were no significant differences in Right and Left Ocular Dominance according to gender. The present study alsofindsimilar results [19].

Conclusion:-

From this study we draw inferences from the data so collected by Gundogen Test that Ocular Dominance markedly observed in human beings, and Right eye dominancy is more preponderant than Left eye. We insinuate that Gundogen Performance Test was appear to be a more practical and fluently applicable performance Test. Ocular Dominance may be beneficial in monovision correction of certain ophthalmic surgeries like, cataract surgery, refractive surgery and in contact lens wear and beneficial in sports. Ocular Dominance depends on genes, environmental factors, childhood training, asymmetry of visual cortex. Ocular Dominance may be related to neurophysiological and underlying neural plasticity explaining the functionality and laterality of human brain.

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Conflict of interest:
None.

Ethical Approval:
The study was approved by the Institutional Ethics Committee

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