



Original Article

Ocular Dominance and Refractive Asymmetry

Author's Affiliation

Nida Tariq

Hafiz Muhammad Shahbaz

Correspondence Author:

Correspondence to:

Nida TariqInstitute of Ophthalmology and Allied
Vision Sciences (COAVS)/K.E.M.U
Lahore.

Email : kk905585@gmail.com

Objective: To find out degree and type of refractive error in dominant eye and to find out association of ocular dominance with refractive asymmetry.

Patients and Methods: The study was conducted in the month of October and November 2015. It was an institutional based study, conducted on 100 patients (including patient of every age) having refractive errors. This study includes individuals having mild to moderate amount of refractive error. Distance visual acuity was measured by using Snellen visual acuity chart and subjective verification done. Dominant eye was found out by Dolman method and refractive error of dominant was noted. Results were by filling a structured Performa.

Results: 56% were with right dominance and 44% were with left dominance. Dominant eye was with more myopic in myopic patients and less hyperopic in hyperopic patients.

Conclusion: All results concluded there is greater prevalence of right eye dominance and dominant eye have greater degree of myopia in myopic patients and less hyperopia in dominant eye in hyperopic patients



Introduction:

Ocular dominance refers to unequal functioning of two eyes. It is the ability of one eye to dominate over the second eye. Eye with more preference have clearer image quality than second non dominant eye. Dominant eye is always preferred for working than non dominant eye. Eye with dominance have sensory process before the non dominant eye¹.

Some visual task requires working with one eye like microscope, telescope. In such conditions some people prefer to close right eye and some people prefer to close left eye according to their dominant eye. This is because both hemispheres control both eyes. This is the very basis of classification as dominant eye and non dominant eye².

Dominant eye can also be classified as weak dominance or strong dominance and strongly caused by the strabismus or amblyopia³. In such cases dominant may strongly suppress the non dominant eye or weakly suppress the blur images of non dominant eye.

Ocular dominance is an important factor in cataract surgery. Ocular dominance was predicted before cataract surgery to indicate patient satisfaction with monovision concept. In conventional monovision concept dominant eye was corrected for distant vision and the non dominant eye for near vision. In crossed monovision dominant eye was corrected for near vision and non dominant eye corrected for distance vision because the dominant eye had better image clarity and quality than the non dominant eye. Dominant eye was corrected for distance because dominant eye cannot be easily suppressed by blur image⁴.

Ocular dominance can also be related to any ocular disease. In some diseases ocular dominance is prominent for one specific eye. Some diseases are often associated with the one eye dominance. As in case of Williams-Beuren syndrome left eye dominance was more than the right eye dominance⁵. Similarly, in patients of migraine, visual dominance was observed in left eye in most cases⁶.

Ocular dominance may also be related with gender. Most of the males have right dominance as compared to females. In males right eye dominance was present at all levels of refractive error. Both right and left eye has equal chances of dominance. However prevalence of right eye dominance was more than left eye dominance⁷.

Dominance of eye is more common than the dominance of left or right hand and ear. Dominance in eyes is much more adaptive than dominance of hand. There is no association between ocular dominance and hand dominance. The latter is also not associated with dominant eye in primary as well as in any gaze angle. Eye-hand dominance cannot be modified or adapted with skills however dominance can be modified with skills⁸.

Ocular dominance can depend on angle of gaze. Dominance of eye changes from primary position of gaze. Ocular dominance was generally not present at central vision but dominance occurs when gaze angle is off from center. Intraocular and interocular thickness, fovea-optic disc differences, number of visible foveal blood vessels is also not associated with the ocular dominance⁹.

Amount of refractive errors in both eyes can be of equal amount, symmetrical refractive condition. Symmetrical refractive condition occurs in small amount of refractive errors and in young adults. But in some cases amount of refractive error was not of equal amount, asymmetrical refractive condition. Refractive asymmetry mostly occurred in high ametropic persons, in infants and young adults. Refractive asymmetry was rare in young children¹⁰.

Dominant eye has effect on visual status including accommodation, contrast, refractive errors of eye. Dominance can show variation with time duration of presented selected target. Performance of eye with dominant eye was significantly better than the non dominant eye. Better performance of dominant eye was also associated with the longer stimulus duration. Visual processing activity was also different in dominant and non dominant eye. In binocular viewing, dominant eye has priority in visual sensory processing because it has inhibitory action over the non dominant eye¹¹.

Difference between types of refractive error, different degree of refractive error was observed in dominating and non dominating eye. In case of myopia, dominant eye tends to have greater degree of myopia or progression of myopia occurred in dominant eye. In case anisometropia, dominant eye was with more degree of refractive error. In case of astigmatism, dominant eye has less degree of myopic astigmatism¹². Dominant eye and the intraocular pressure have no significant relation. However in some cases intraocular pressure was greater in the dominant eye than the non dominant eye. This occurs because the dominant was more active and mostly used than the non dominant eye. And in some studies association of the handedness and intraocular pressure is also present. In right handed persons, intraocular pressure is greater was the right eye. But in left handed persons, intraocular pressure was not significantly associated with hand dominance. Intraocular pressure was symmetrical only in case of right handedness¹³.

Dominance of eye can be measured by different methods. Dominance tests can be qualitative and quantitative. Binocular rivalry test is used to identify dominant eye qualitatively and quantitatively. Dominant eye measured by hole in the card test was similar to result of binocular rivalry^{14,15}.

Binocular visual functions also affected by the



dominant and non dominant eye. Differences in visual function observed when the dominant eye corrected for distance vision and when dominant eye corrected for near vision. When dominant eye was corrected for distant vision, visual acuity was good as compare to visual acuity when dominant eye corrected for near vision¹⁶.

Accommodation associated with dominant and non dominant can be symmetric or asymmetric. In asymmetric accommodation, amount of accommodation exerted was of unequal amount between dominant and non dominant eye. During binocular viewing accommodation was asymmetric where non dominant eye exerts less amount of accommodation as compared to dominant eye, which showed greater amount of accommodation¹⁷.

Ocular dominance affected all visual functions including accommodation, contrast sensitivity. Dominance was also present in condition of ametropia. Contrast sensitivity also affected by the dominance of eye. Contrast sensitivity frequency was greater for the dominant eye under conditions of the dark light and in traffic light situations. And the less contrast in the non dominant eye in dark light conditions. But contrast sensitivity frequency was similar in dominant and non dominant eye is case of lightning condition as in day light condition¹⁸.

Anterior segment parameters also changed with the dominance of eye. Dominant eye has different values for anterior segment parameters. Values of dominant eye for anterior segment parameters are different from that of non dominant eye. Variability in anterior segment parameter values was more in dominant eye. However in non dominant eye, values of different parameters in anterior segment were not of large differences¹⁹.

Color vision also associated with the dominant eye. When color vision was measured with fransworth-muller 100 hue test, frequency of color vision was observed in dominant and the non dominant eye. Dominant eye was with the higher frequency of color vision. This concluded that dominant eye has better visual function and preferred for visual tasks²⁰.

Results:

The data was arranged in tabulated form as well as graphical and diagrammatic form for the analysis of variables.

Table No 1: Dominance in right eye vs. Type of refractive error

		Ref Error in dominant Eye					Total
		more myopic	less myopic	more hyperopic	less hyperopic	more myopic astigmatic	
dominance _OD	Yes	31	15	4	5	1	56
	No	21	11	4	8	0	44
Total		52	26	8	13	1	100

Table No 2: Dominance in left eye vs. type of refractive error

		Ref Error in dominant Eye					Total
		more myopic	less myopic	more hyperopic	less hyperopic	more myopic astigmatic	
Dominance OS	Yes	21	11	4	8	0	44
	No	31	15	4	5	1	56
Total		52	26	8	13	1	100

patients have left eye dominant. In right eye dominance, out of 56 patients 31 patients were with greater amount of myopia as compare to non dominant eye. While in dominant eye hyperopes have less degree of error. In left eye dominance, out of 44 patients 21 patients were with greater degree of myopia as compare to non dominant eye. And in hyperopes, less degree of refractive error was associated with dominant eye.

In my search I concluded that, dominant eye has greater degree of myopic refractive error in dominant eye and



less degree of hyperopic refractive error. Asymmetry of refractive error is present is present between dominant and non dominant eye.

References:

1. Lopes-Ferreira D, Neves H, Queiros A, Faria-Ribeiro M, Peixoto-de-Matos SC, Gonzalez-Meijome JM, et al. Ocular Dominance and Visual Function Testing. *BioMed research international*. 2013;2013:7.
2. Momeni-Moghaddam H, McAlinden C, Azimi A, Sobhani M, Skiadaresi E. Comparing accommodative function between the dominant and non-dominant eye. *Graefes Arch Clin Exp Ophthalmol*. 2014;252(3):509-14.
3. Handa T, Shimizu K, Mukuno K, Kawamorita T, Uozato H. Effects of ocular dominance on binocular summation after monocular reading adds. *Journal of cataract and refractive surgery*. 2005;31(8):1588-92.
4. Seijas O, Gomez de Liano P, Gomez de Liano R, Roberts CJ, Piedrahita E, Diaz E. Ocular dominance diagnosis and its influence in monovision. *American journal of ophthalmology*. 2007;144(2):209-16.
5. Van Strien JW, Lagers-Van Haselen GC, Van Hagen JM, De Coo IF, Frens MA, Van Der Geest JN. Increased prevalences of left-handedness and left-eye sighting dominance in individuals with Williams-Beuren syndrome. *Journal of clinical and experimental neuropsychology*. 2005;27(8):967-76
6. Aygul R, Dane S, Ulvi H. Handedness, eyedness, and crossed hand-eye dominance in male and female patients with migraine with and without aura: a pilot study. *Perceptual and motor skills*. 2005;100(3 Pt 2):1137-42.
7. Eser I, Durrie DS, Schwendeman F, Stahl JE. Association between ocular dominance and refraction. *Journal of refractive surgery*. 2008;24(7):685-9.
8. Dalton K, Guillon M, Naroo SA. Ocular Dominance and Handedness in Golf Putting. *Optometry and vision science*. 2015;92(10):968-75.
9. Pekel G, Acer S, Ozbakis F, Yagci R, Sayin N. Macular asymmetry analysis in sighting ocular dominance. *The Kaohsiung journal of medical sciences*. 2014;30(10):531-6.
10. Barrett BT, Bradley A, Candy TR. The relationship between anisometropia and amblyopia. *Progress in retinal and eye research*. 2013;36:120-58.
11. Shneur E, Hochstein S. Effects of eye dominance in visual perception. *Int Congr Ser*. 2005; 1282: 719–723.
12. Cho K-J, Kim S-Y, Yang S-W. The refractive errors of dominant and non-dominant eyes. *Journal of the Korean Ophthalmological Society*. 2009;50(2):275-9.
13. Dane Ş, Gümüştekin K, Yazici AT, Baykal O. Correlation between hand preference and intraocular pressure from right-and left-eyes in right-and left-handers. *Vision research*. 2003;43(4):405-8.
14. Handa T, Mukuno K, Uozato H, Niida T, Shoji N, Shimizu K. Effects of dominant and nondominant eyes in binocular rivalry. *Optometry and vision science : official publication of the American Academy of Optometry*. 2004;81(5):377-83.
15. Handa T, Uozato H, Higa R, Nitta M, Kawamorita T, Ishikawa H, et al. Quantitative measurement of ocular dominance using binocular rivalry induced by retinometers. *Journal of cataract and refractive surgery*. 2006;32(5):831-6.
16. Nitta M, Shimizu K, Niida T. [The influence of ocular dominance on monovision--the interaction between binocular visual functions and the state of dominant eye's correction]. *Nippon Ganka Gakkai zasshi*. 2007;111(6):435-40.
17. Yang HK, Hwang JM. Decreased accommodative response in the nondominant eye of patients with intermittent exotropia. *American journal of ophthalmology*. 2011;151(1):71-6 e1.
18. Pekel G, Alagoz N, Pekel E, Alagoz C, Yilmaz OF. Effects of ocular dominance on contrast sensitivity in middle-aged people. *ISRN ophthalmology*. 2014;2014:903084.
19. Domenech B, Mas D, Illueca C. Influence of ocular dominance in the variability of the eye's anterior segment measurements. *Optik-International Journal for Light and Electron Optics*. 2010;121(24):2221-3.
20. Koctekin B, Gundogan NU, Altintas AG, Yazici AC. Relation of eye dominance with color vision discrimination performance ability in normal subjects. *International journal of ophthalmology*. 2013;6(5):733-8.