Turkish Medical Journal, 2025; 10(2),41-46.

Araştırma Makalesi / Research Article
https://doi.org/10.70852/tmj.1668953

EFFECT OF OCULAR DOMINANCE ON TEAR FUNCTIONS IN UNILATERAL PINGUECULA

Tek Taraflı Pingekulada Oküler Baskınlığın Gözyaşı Fonksiyonlarına Etkisi

Zeynep Eylül ERCAN

Afiliasyon / Affiliation:
Yıldırım Beyazıt University Yenimahalle Education and Training Hospital, Department of Ophthalmology, Ankara, Türkiye.

Sorumlu Yazar / Correspondence:
Md. Zeynep Eylül ERCAN
Yıldırım Beyazıt University Yenimahalle Education and Training Hospital, Department of Ophthalmology, Ankara, Türkiye.
E-mail: eylulercan@doctor.com

Geliş / Received: 01.04.2025
Kabul / Accepted: 20.05.2025

Cite as:
Ercan, Z. E. (2025). Effect of Ocular Dominance on Tear functions in unilateral Pinguecula. Turkish Medical Journal, 10(2),41-46. https://doi.org/10.70852/tmj.1668953

ABSTRACT

Objectives: The purpose of this study is to find out whether ocular dominance has any effect on tear functions in unilateral pinguecula; and whether these tests differ within the patients. **Methods:** 63 men and 57 women participated to the study. The groups were: Pinguecula on dominant eye and pinguecula on non-dominant eye. Hole-in-the-card test was used to determine the dominant eye. Patients underwent detailed ophthalmic examination followed by tear Break up Time (BUT), Schirmer test and Ocular Surface Disease Index Questionnaire (OSDI). Mann-Whitney U test and Wilcoxon signed rank test was used for comparisons between and within groups. A value of $P < 0.05$ was considered statistically significant. **Results:** Within the dominant eye group, normal and pinguecula eye BUT and schirmer results were statistically insignificant (p=0.08 and p=0.506). In Non-dominant eye group, normal and pinguecula eye BUT and schirmer results were also statistically insignificant (p=0.58 and p=0.16). The difference between OSDI scores of the Dominant and Non-dominant eye group was insignificant (p=0.579). Between the dominant and non-dominant eye groups, BUT were not statistically different in the eyes with pinguecula (p=0.45) and eyes without pinguecula (p=0.36). Also, between these groups, Schirmer results were not statistically different in the eyes with pinguecula (p=0.36) and eyes without pinguecula (p=0.27). **Discussion:** Unilateral pinguecula does not cause tear function changes between normal and pinguecula present eyes; and ocular dominance has no effect on tear functions in unilateral pinguecula patients. This is the first study to investigate whether ocular dominance affects tear functions in pinguecula.

Keywords: Dry Eye, Ocular Dominance, Pinguecula, Tears

ÖZET

Amaç: Bu çalışmanın amacı, tek taraflı pingekulada oküler baskınlığın gözyaşı fonksiyonlarına etkisinin olup olmadığını ve bu testlerin hastalar arasında farklılık gösterip göstermediğinin araştırılmasıdır. **Gereç ve Yöntem:** Hastalar (63 erkek, 57 kadın) iki gruba bölündü: dominant gözünde pingekula olanlar ve non-dominant gözde pingekulası olanlar. Dominant gözü belirlemek için kartta delik testi kullanıldı. Hastalara detaylı göz muayenesi ile gözyaşı kırılma zamanı (BUT), Schirmer testi ve Oküler Yüzey Hastalık İndeksi Anketi (OSDI) yapıldı. Gruplar arası ve grup içi karşılaştırmalarda Mann-Whitney U testi ve Wilcoxon testi kullanıldı. $P < 0.05$ değeri istatistiksel olarak anlamlı kabul edildi. **Bulgular:** Dominant göz grubu içinde normal ve pingekulalı göz BUT ve schirmer sonuçları istatistiksel olarak anlamlı değildi (p=0.08 ve p=0.506). Dominant olmayan göz grubunda normal ve pingekulalı göz BUT ve schirmer sonuçları da istatistiksel olarak anlamlı değildi (p=0.58 ve p=0.16). Dominant ve non-dominant göz grubunun OSDI puanları arasındaki fark istatistiksel olarak anlamlı bulunmadı (p=0.579). BUT; Dominant ve non-dominant göz grupları arasında pingekulalı gözlerde (p=0.45) ve pingekula olmayan gözlerde istatistiksel olarak farklı değildi. Ayrıca bu gruplar arasında, pingekulalı gözlerde ve pingekula olmayan gözlerde Schirmer sonuçları istatistiksel olarak farklı değildi (sırasıyla p=0.36 ve p=0.27). **Tartışma:** Tek taraflı pingekulası olan hastalarda, normal göze kıyasla gözyaşı fonksiyonunda ve OSDI testinde farklılık izlenmemiştir. Aynı zamanda pingekulanın dominant göz veya non-dominant gözde olmasının aynı testlerde bir etkinliğinin olmadığı izlenmiştir. Bu çalışma pingekulada oküler baskınlığı gözyaşı fonksiyonlarına etkini araştıran ilk çalışmadır.

Anahtar Kelimeler: Gözyaşı, Kuru Göz, Pingekula, Oküler Baskınlık

INTRODUCTION

Pinguecula is a benign, yellowish, slightly raised lipid-like deposit with the reported prevalence rates of 22.5% to 90% (Oguz et al., 2001). Although its pathology is still not fully understood, prolonged exposure to ultraviolet-B radiation is thought to promote its development. (Taylor et al., 1989) It is seen more frequently with age, and more common in males. Although it is considered to be a benign lesion, it was found to be a result of an abnormal differentiation characterized by squamous metaplasia with proliferation (Dong et al., 2009). It usually presents itself within the interpalpebral conjunctiva at the nasal side and can manifest as ocular irritation due to the interference of the normal spreading of the tear film (Arenas et al., 2019). This nasal predominance is thought to be the result of actinic damage in this area due to reflection from the side of the nose. (Perkins 1985). Thus the patients may have complaints of dry eye symptoms such as burning sensation, itching and grittiness. The Tear Break up Time Test (BUT) and Schirmer wetting tests are widely used in ophthalmology practices to show the tear stability on the ocular surface and tear production levels respectively. In addition to these objective tests, eye related discomfort can be assessed by various questionnaires. These are important diagnostic tools, for the clinical tests used for the diagnosis of dry eye do not always correlate with patients' symptoms, hence the presence of symptoms becoming an important tool for a preliminary diagnosis of dry eye. (Köksoy Vayısoğlu et al., 2019) One of the most commonly used dry eye assessment is Ocular Surface Disease Index (OSDI) questionnaire. It is comprised of 12 questions about vision-related functions, eye symptoms, and environmental risk factors. There are multiple studies that show the effects of various conjunctival lesions on ocular surface, including pinguecula. However, there is no consensus about whether pinguecula causes dry eye or dry eye is a risk factor for pinguecula. There are conflicting studies that show dry eye and pinguecula are not necessarily concurrent versus studies that show dry eye symptoms are relieved after surgical pinguecula removal (Balogun et al., 2005; Napoli et al., 2017).
The ocular system shows laterality - presenting as preference for visual input from a specific eye – called ocular dominance. It is believed that cerebral grey matter asymmetry is the basis for ocular dominance (Jensen et al., 2015). In this study, we aimed to find whether ocular dominance has any effect on tear functions in the presence of unilateral pinguecula; and whether these tests have any difference within the patients.

METHODS

This study targeted pinguecula patients who visited the Hitit University Ophthalmology Department between 2018 and 2020. Ethical approval was given by the Hitit University Ethics Committee (committee decision no: 314) and written consent was obtained from participants. This study abided with the Declaration of Helsinki.

Subjects

The inclusion criterion was having unilateral pinguecula without any other ocular or systemic diseases that might affect the ocular surface. All pinguecula dimensions were smaller than 2.0 mm × 2.0 mm, for larger sized pingueculas were accompanied by degenerations/pinguecula in the fellow eye. Subjects did not have any prior ocular trauma or surgery history. A total of 120 subjects (63 male, 57 female) were enrolled in the study. The groups were formed as: Pinguecula on dominant eye (Dominant eye group), and pinguecula on the non-dominant eye (Non-dominant eye group). Dolman's method (hole-in-the-card test) was used to determine the dominant eye, performed by using a 25×15 cm card with a centered 3 cm diameter hole. Holding the card, patients are told to look at a six-meter distance target and then move the card closer without losing the target, until the hole is over an eye – which is considered the dominant eye (Coren & Kaplan, 1973).

Ocular Surface Disease Index Scoring (OSDI)

The OSDI questionnaire included 12 items concerning common ocular symptoms that affect performing of daily activities. Frequency of discomfort was given on a scale of 0 (never) to 4 (always). The participants were asked the questions by a blinded technician after ophthalmologic

examination and Schirmer testing and answers were noted. The total OSDI score was calculated as: OSDI= [(sum of scores for all questions answered) x100]/ (total number of questions answered) x4]

Ophthalmological Examination

Patients underwent a detailed ophthalmic examination of visual acuity, non-contact intraocular pressure measurement, anterior and posterior segment examination. After routine examination, BUT and Schirmer tests were performed. For BUT testing, Fluorescein dye strip (Erc Fluorescein strip, Erc Saglik, Ankara, Türkiye was applied to inferior conjunctiva and patient was instructed to blink 3 times. The time from the last blink to first appearance of dye loss was measured using a stop watch and recorded as seconds. Five minutes after BUT testing, Schirmer test (Erc schirmer tear test strip, Erc Saglik, conducted without topical anesthesia. The strip was placed in a hook conformation to the lower eyelid of the outside one-third of the conjunctival sac. Subjects closed their eyelids during the test. After 5 minutes, the strip was removed and the amount of wetting was recorded in millimeters.

Statistical Analysis

The primary results for this study were BUT, Schirmer and OSDI scores. Statistical Analysis was performed using Statistical Package for the Social Science (IBM SPSS Statistics for Windows, Version 24.0). A value of $P < 0.05$ was considered statistically significant. The Shapiro–Wilk test was used to test for normality. The data not normally distributed were represented as medians and interquartile ranges. Mann-Whitney U test was used for comparisons between groups. Wilcoxon signed rank test was used for comparisons within the groups. A value of $P < 0.05$ was considered statistically significant.

RESULTS

The dominant eye group consisted of 33 males and 27 females. The non-dominant eye group had 30 males and 30 females. The distribution of gender was same across the group categories with the *p* value of 0.357. The age range was between 40 to 60 years old. The mean ages of the dominant eye and non-dominant eye were respectively 48.6±5.36 and 49.0±5 years. There was no statistically significant difference between the groups (*p*=0.615). The BUT, Schirmer and OSDI score median, standard deviation and interquartile ranges are shown in table 1.

Table 1: Tear Break up Time (BUT), Schirmer and Ocular Surface Disease Index (OSDI) score medians, standard deviations and interquartile ranges. A value of $P < 0.05$ was considered statistically significant.

	Dominant Eye Group (54 Right, 6 Left eyes)				**Non-dominant Eye group (14 Right,46 Left Eyes)**			
	Median	Standard Deviation	Interquartile Range	*p*	Median	Standard Deviation	Interquartile Range	*p*
BUT (Eye with Pinguecula)	6.50	2.45	4	*p*=0.08	6.50	2.55	4	*p*=0.58
BUT (Eye without Pinguecula)	6.0	3.04	6		7.0	3.09	6	
Schirmer (Eye with Pinguecula)	16.5	6.66	12	*p*=0.50	19.0	.16	9	*p*=0.16
Schirmer (Eye without Pinguecula)	19.5	6.83	11		17.5	7.66	12.75	
OSDI	77.08	4.65	6.25	-	77.5	5.87	9.89	-
Between: Dominant Eye Group and Non-Dominant Eye group	BUT (Eye with Pinguecula): *p*=0.45 BUT (Eye without Pinguecula): *p*=0.36 Schirmer (Eye with Pinguecula): *p*= 0.36 Schirmer (Eye without Pinguecula): *p*=0.27 OSDI: *p*=0.57							

There was no statistically significant difference between the pinguecula eye BUT and the normal eye BUT within the Dominant eye group (p=0.08). There was also no statistically significant difference between the pinguecula eye schirmer and the normal eye schirmer results within the Dominant eye group (p=0.506). There was no statistically significant difference between the pinguecula eye BUT and the normal eye BUT within the Non-dominant eye group (p=0.585). There was also no statistically significant difference between the pinguecula eye schirmer and the normal eye schirmer results within the Non-dominant eye group (p=0.169). The difference between OSDI scores of the Dominant and Non-dominant eye group was found to be insignificant (p=0.579). Between the dominant and non-dominant eye groups, BUT were not statistically different in the eyes with pinguecula (p=0.45) and eyes without pinguecula (p=0.36). Between the dominant and non-dominant eye groups, Schirmer results were not statistically different in the eyes with pinguecula (p=0.36) and eyes without pinguecula (p=0.27)

DISCUSSION

Pinguecula is a benign lesion that occur due to actinic damage that may be contributing to dry eye symptoms (Perkins, 1985). In this study, tear function tests showed no difference between the eyes of unilateral pinguecula patients. Previous studies have shown pinguecula can be accompanied with dry eye syndrome. For instance, Jeong et al. found that tear break up time and Schirmer changes were present in their pinguecula patients which were then improved after they performed surgical removal (Jeong et al., 2019). They postulated that since pinguecula can cause physical protrusion - and therefore tear film instability - its removal would facilitate ocular surface stability. Since their Schirmer results were also lower than normal population, they also thought that pinguecula may influence aqueous tear production via friction – resulting in local inflammation - hence decreasing accessory lacrimal gland secretion. Kucuk et al also found both tear BUT and schirmer results were significantly lower in the eyes with pinguecula (Küçük et al., 2018). This current study found no difference between Schirmer results to support this aqueous tear theory. Similarly, Dong et al found that Schirmer measurement were not affected in pinguecula patients (Dong et al., 2009). However, they showed that tear BUT was diminished in their study group and postulated that squamous metaplasia in the surface epithelium of pinguecula may be compromising the stability of tear film. Oguz et al. also demonstrated pinguecula patients can present with shortened tear BUT but normal tear secretion (Oguz et al., 2001). Contrary to these studies, Viso et al. conducted a study in which pinguecula was not associated with dry eye signs and symptoms (Viso et al., 2011). Balogun et al. similarly found dry eye tests were not affected in pinguecula (Balogun et al., 2005). In this study, there was also no significant changes in objective dry eye tests. This study also checked for BUT, Schirmer and OSDI differences dependent on ocular dominance – which is shown to affect ganglion cell and macular anatomy (Kwon et al., 2019). The hypothesis was these neuronal changes dependent on laterality might also affect the ocular surface. Corneal nerves are important in dry eye symptoms. Increased friction between the eyelid and cornea due to reduced tear volume causes discomfort (Goyal and Hamrah, 2016). This discomfort was proposed to represent a form of ocular small fiber neuropathy (Andersen et al., 2017). In fact, acute and chronic dry eye disease mouse models are shown to have fewer sensory axons. And these remaining axons also showed impaired ability to induce blinking-further impairing the ocular surface wetting (Stepp et al., 2018). In this study, neither the objective dry eye tests, nor the OSDI questionnaire showed any difference between those with pinguecula at the dominant eye and patients with pinguecula at the non-dominant eye. Therefore, this study postulates that the retrograde nerve changes due to cerebral and ocular dominance does not affect anterior neural systems controlling surface wetting and tear stability. This is the first study to investigate whether ocular dominance affects tear functions in pinguecula. The major limitation to this study was the limited patient numbers. Non-invasive BUT measurements and Ocular Comfort Index Scoring – which correlates better with objective tests - can also be added to the study.

Conclusion

In conclusion, unilateral pinguecula does not cause tear function changes between normal and pinguecula present eyes; and ocular dominance has no effect on tear functions in unilateral pinguecula patients.

Acknowledgments

The author thanks Hitit University Ophthalmology Clinic Technicians for their contributions to the study.

Statement of Ethics: Hitit University Ethics Committee (committee decision no: 314)

The authors have no conflicts of interest to declare.

Funding: None

Authorship statement: Zeynep Eylul Ercan; Concept, Design, Anaysis, Draft, Revision.

REFERENCES

Andersen, H. H., Yosipovitch, G., & Galor, A. (2017). Neuropathic symptoms of the ocular surface: dryness, pain, and itch. Current opinion in allergy and clinical immunology, 17(5), 373-381. https://doi.org/10.1097/ACI.0000000000000389

Arenas, E., Armas, G., & Ramirez, A. (2019). Pinguecula. The Pan-American Journal of Ophthalmology, 1(1), 9.https://doi.org/10.4103/2219-4665.267880

Balogun, M. M., Ashaye, A. O., Ajayi, B. G. K., & Osuntokun, O. O. (2005). Tear break-up time in eyes with pterygia and pingueculae in Ibadan. West African journal of medicine, 24(2), 162-166. https://doi.org/10.4314/wajm.v24i2.28189

Coren, S., & Kaplan, C. P. (1973). Patterns of ocular dominance. Optometry and Vision Science, 50(4), 283-292.

Dong, N., Li, W., Lin, H., Wu, H., Li, C., Chen, W.,…Liu, Z. (2009). Abnormal epithelial differentiation and tear film alteration in pinguecula. Invest Ophthalmol Vis Sci, 50(6), 2710-2715. https://doi.org/10.1167/iovs.08-2905

Goyal, S., & Hamrah, P. (2016, March). Understanding neuropathic corneal pain—gaps and current therapeutic approaches. In Seminars in ophthalmology (Vol. 31, No. 1-2, pp. 59-70). Taylor & Francis. https://doi.org/10.3109/08820538.2015.1114853

Jensen, B. H., Hougaard, A., Amin, F. M., Larsson, H. B., & Ashina, M. (2015). Structural asymmetry of cortical visual areas is related to ocular dominance. Neuroreport, 26(17), 1071-1076. https://doi.org/10.1097/wnr.0000000000000470

Jeong, J., Rand, G. M., Kwon, T., & Kwon, J. W. (2019). The Improvement of Dry Eye Symptoms after Pinguecula Excision and Conjunctival Autograft with Fibrin Glue. Journal of ophthalmology, 2019(1), 6438157. https://doi.org/10.1155/2019/6438157

Küçük, E., Yılmaz, U., & Zor, K. R. (2018). Corneal epithelial damage and impaired tear functions in patients with inflamed pinguecula. Journal of Ophthalmology, 2018(1), 2474173. https://doi.org/10.1155/2018/2474173

Kwon, J. W., Bae, J. M., Kim, J. S., Jee, D., & Choi, J. A. (2019). Asymmetry of the macular structure is associated with ocular dominance. Can J Ophthalmol, 54(2), 237-241. https://doi.org/10.1016/j.jcjo.2018.04.020

Napoli, P. E., Sanna, R., Iovino, C., & Fossarello, M. (2017). Resolution of pinguecula-related dry eye disease after argon laser photocoagulation. International Medical Case Reports Journal, 247-250. https://doi.org/10.2147/imcrj.S138786

Oguz, H., Karadede, S., Bitiren, M., Gurler, B., & Cakmak, M. (2001). Tear functions in patients with pinguecula. Acta Ophthalmol Scand, 79(3), 262-265. https://doi.org/10.1034/j.1600-0420.2001.790310.x

Perkins, E. S. (1985). The association between pinguecula, sunlight and cataract. Ophthalmic Res, 17(6),

325-330. https://doi.org/10.1159/000265395

Stepp, M. A., Pal-Ghosh, S., Tadvalkar, G., Williams, A., Pflugfelder, S. C., & de Paiva, C. S. (2018). Reduced intraepithelial corneal nerve density and sensitivity accompany desiccating stress and aging in C57BL/6 mice. Experimental Eye Research, 169, 91-98. https://doi.org/https://doi.org/10.1016/j.exer.2018.01.024

Taylor, H. R., West, S. K., Rosenthal, F. S., Munoz, B., Newland, H. S., & Emmett, E. A. (1989). Corneal changes associated with chronic UV irradiation. Arch Ophthalmol, 107(10), 1481-1484. https://doi.org/10.1001/archopht.1989.01070020555039

Vayısoğlu, S. K., Öncü, E., Dursun, Ö., & Dinç, E. (2019). Öğretim Elemanlarında Kuru Göz Semptom Sıklığının Oküler Yüzey Hastalık İndeksi ile Araştırılması. Turk J Ophthalmol, 49(3), 142-148. https://doi.org/10.4274/tjo.galenos.2018.67915

Viso, E., Gude, F., & Rodríguez-Ares, M. T. (2011). Prevalence of pinguecula and pterygium in a general population in Spain. Eye (Lond), 25(3), 350-357. https://doi.org/10.1038/eye.2010.204