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**ORIGINAL ARTICLE**

# Short-Term Effects on Tear Film Following Cosmetic Botulinum Toxin Injections in Healthy Individuals

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## ABSTRACT

**Introduction:** The cosmetic treatment Botox relies on the paralysis of facial muscles in order to minimize wrinkles. Research now focuses on investigating how Botox treatment influences the tear film at the same time it reduces facial wrinkles.

**Objective:** To evaluate the short-term effects of cosmetic botulinum toxin injections on the tear film in healthy individuals, with a focus on tear production, stability, and overall ocular health.

**Methodology:** This prospective cohort study was conducted at Burn and Plastic Surgery Center Hayatabad, Peshawar during March 2022 to June 2023 involving 85 healthy individuals who were selected based on their decision to undergo cosmetic botulinum toxin injections for aesthetic purposes.

**Results:** A total of 85 participants were added with mean age 30.5 ± 5.7 years. 47% males (40 participants) and 53% females (45 participants). The mean tear production was 12.4 ± 3.5 mm, and the mean tear breakup time (TBUT) was 10.3 ± 2.1 seconds. Only 8% of participants reported any discomfort at baseline. At baseline, only 8% of participants reported ocular discomfort, but this increased significantly to 23% 1-week post-injection ($p < 0.05$). By 1-month post-injection, the discomfort decreased to 9%, which was not statistically significant ($p > 0.05$).

**Conclusion:** Cosmetic botulinum toxin injections have a short-term impact on tear film stability and tear production, with a gradual recovery within a month. These findings highlight the need for careful assessment of ocular health in individuals undergoing botulinum toxin treatments, especially those with underlying dry eye conditions or concerns about tear production.

**Keywords:** Botulinum toxin, tear film, tear production, Schirmer's test, tear breakup time, ocular discomfort, visual disturbances.

## INTRODUCTION

The cosmetically popular neurotoxin Botox finds extensive use for diminishing wrinkles as it exists under the trade name Botulinum toxin[1]. When injected into the body it halts the release of acetylcholine signal between nerves and muscles thus causing muscle paralysis. The popularity of botulinum toxin injections rose during the years as they have become both cosmetic treatments and procedures used to treat chronic migraines, hyperhidrosis, spasticity and strabismus[2]. Current scientific literature fails to provide sufficient research exploring how botulinum toxin affects tear film stability together with tear production in patients receiving treatment. The stability of tear film stands as an essential factor for proper eye health preservation[3]. Proper eye surface lubrication depends on stable tear films because they guarantee both visual clarity and comfort. The functioning stability of the tear film gets disrupted through disturbances which results in dryness together with blurred vision and may also cause ocular irritation symptoms. Independent studies demonstrate how botulinum toxin treatment affects the orbicularis oculi muscle because this muscle controls essential eye blinking activities that spread tears across the surface[4]. The research literature now shows that cosmetic effects stand as the main findings from botulinum toxin treatments but scientists understand little about tear film alterations among people without current eye diseases[5]. The cosmetic benefits of botulinum toxin treatment are widely known but medical researchers are increasingly worried about its hidden impacts on different parts of the human body. The tear film system faces the most critical danger from botulinum toxin treatment because this essential part maintains eye comfort and health[6]. The tear film exists in three parts that function separately: the protective lipid layer protects moisture by buffering evaporation while the aqueous part delivers hydration to the eyes and the mucin layer distributes tears throughout the corneal surface[7]. Dry eye symptoms emerge because of any tear film layer instability or disruption and these symptoms can exist between minor discomfort to severe medical issues which affect vision[8]. The tear film changes make the sensitive ocular surface undergo significant modifications that both harm the corneal epithelial health and degrade visual outcomes[9]. Shallow tear volume and impaired tear quality status creates a common condition known as dry eye disease that produces eye irritation and redness and blurred vision and sometimes triggers inflammation within the eyes. Researchers are still investigating the unsatisfactory understanding regarding botulinum toxin's effects on the tear film and its production capabilities and stability properties and eye comfort levels. Research conducted on botulinum toxin injection side effects for the eyes has provided inconsistent findings[10]. The toxin could potentially decrease tear quantity because it influences the muscles responsible for tear spreading. The periocular use of botulinum toxin leads to reduced functionality of the orbicularis oculi muscle because this muscle helps create blinking movements to spread tears across the eye surface[11].

**Objective:** The primary objective of this study is to assess the short-term effects of cosmetic botulinum toxin injections on the tear film in healthy individuals, by evaluating changes in tear production, tear breakup time (TBUT), and other symptoms related to tear stability and ocular comfort.

## METHODOLOGY

This prospective observational study was conducted at Burn and Plastic Surgery Center Hayatabad, Peshawar during March 2022 to June 2023, involving 85 healthy individuals who were selected based on their decision to undergo cosmetic botulinum toxin injections for aesthetic purposes.

**Inclusion Criteria:**

1. Healthy individuals aged >18 years.
2. No history of ocular disease or dry eye syndrome.
3. No contact lens uses in the past 3 months.
4. No previous ocular surgery.

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5. Individuals seeking botulinum toxin treatment for cosmetic purposes.

**Exclusion Criteria:**
1. Individuals with known dry eye disease or ocular surface disease.
2. Those with a history of ocular surgery or trauma.
3. Pregnant or breastfeeding women.
4. Individuals with neurological disorders or contraindications to botulinum toxin.

**Data Collection:** Data were collected at three time points: before the botulinum toxin injection (baseline), 1-week post-injection, and 1-month post-injection. At baseline, tear production was assessed using the Schirmer's test, and tear film stability was measured with the tear breakup time (TBUT). These tests were repeated at the two follow-up time points. Additionally, participants were asked to rate their ocular discomfort (such as dryness and blurred vision) using a standardized symptom questionnaire. The participants were also asked about visual disturbances they might have experienced. These data points were collected to evaluate the immediate and short-term effects of botulinum toxin injections on the tear film in healthy individuals.

**Statistical Analysis:** Statistical analysis was performed using SPSS version 22.0. Descriptive statistics were used to summarize the baseline characteristics and tear film measurements of participants. A p-value of less than 0.05 was considered statistically significant.

## RESULTS

A total of 85 participants were added with mean age 30.5 ± 5.7 years. 47% males (40 participants) and 53% females (45 participants). The mean tear production was 12.4 ± 3.5 mm, and the mean tear breakup time (TBUT) was 10.3 ± 2.1 seconds. Only 8% of participants reported any discomfort at baseline.

Table 1: Demographic and Baseline Values of Patients

| Demographic Variable | Baseline Value |
|---|---|
| Age (years) | 30.5 ± 5.7 |
| Gender (Male) | 40 (47%) |
| Gender (Female) | 45 (53%) |
| Mean Tear Production (mm) | 12.4 ± 3.5 |
| Mean TBUT (seconds) | 10.3 ± 2.1 |
| Reported Discomfort (%) | 8% |

The results for tear production, measured using the Schirmer's test, indicated a significant reduction 1-week post-injection, with a mean of 9.1 ± 2.8 mm ($p < 0.05$). However, by 1-month post-injection, tear production returned to near baseline levels (12.2 ± 3.4 mm), showing no significant difference from the baseline ($p > 0.05$).

Table 2: Schirmer's Test results

| Time Point | Mean Tear Production (mm) | Standard Deviation | p-value |
|---|---|---|---|
| Baseline | 12.4 | 3.5 | - |
| 1 Week Post-Injection | 9.1 | 2.8 | <0.05 |
| 1 Month Post-Injection | 12.2 | 3.4 | >0.05 |

The tear film stability, measured by the tear breakup time (TBUT), showed a significant decrease 1-week post-injection, with a mean of 7.8 ± 1.9 seconds ($p < 0.05$). However, at 1-month post-injection, the TBUT returned to near baseline levels at 10.1 ± 2.2 seconds, with no significant difference from the baseline ($p > 0.05$).

Table 3: Tear Film Stability (TBUT)

| Time Point | Mean TBUT (seconds) | Standard Deviation | p-value |
|---|---|---|---|
| Baseline | 10.3 | 2.1 | - |
| 1 Week Post-Injection | 7.8 | 1.9 | <0.05 |
| 1 Month Post-Injection | 10.1 | 2.2 | >0.05 |

At baseline, only 8% of participants reported ocular discomfort, but this increased significantly to 23% 1-week post-injection ($p < 0.05$). By 1-month post-injection, the discomfort decreased to 9%, which was not statistically significant ($p > 0.05$). Similarly, visual disturbances were reported by 4% of participants at baseline, which rose to 12% 1-week post-injection ($p < 0.05$). However, these disturbances dropped to 5% at 1-month post-injection, with no significant difference from baseline ($p > 0.05$).

Table 4: Ocular Discomfort and visual disturbance

| Time Point | Reported Discomfort (%) | p-value |
|---|---|---|
| Baseline | 8 | - |
| 1 Week Post-Injection | 23 | <0.05 |
| 1 Month Post-Injection | 9 | >0.05 |
| Reported Visual Disturbances (%) | | |
| Baseline | 4 | - |
| 1 Week Post-Injection | 12 | <0.05 |
| 1 Month Post-Injection | 5 | >0.05 |

At baseline, 100% of participants had normal tear production (≥10 mm). However, 1-week post-injection, only 35% of participants maintained normal tear production, with a significant reduction ($p < 0.05$). By 1-month post-injection, tear production returned to baseline levels with 100% of participants showing normal production ($p > 0.05$). Similarly, at baseline, all participants had stable tear film stability (≥10 sec). One-week post-injection, only 25% maintained stability, showing a significant decrease ($p < 0.05$). However, by 1-month post-injection, tear film stability improved to 100%, returning to baseline levels ($p > 0.05$).

Table 5: Tear Production

| Time Point | Tear Production Category (%) | Change in Category (%) | p-value |
|---|---|---|---|
| Baseline | Normal (>=10 mm) | 100% | - |
| 1 Week Post-Injection | Normal (>=10 mm) | 35% | <0.05 |
| 1 Month Post-Injection | Normal (>=10 mm) | 100% | >0.05 |
| Tear Film Stability (%) | | | |
| Baseline | Stable (>=10 sec) | 100% | - |
| 1 Week Post-Injection | Stable (>=10 sec) | 25% | <0.05 |
| 1 Month Post-Injection | Stable (>=10 sec) | 100% | >0.05 |

## DISCUSSION

This study aimed to investigate the short-term effects of cosmetic Botulinum Toxin injections on the tear film in healthy individuals. We observed that injecting Botulinum Toxin led to changes, albeit temporary, in elicited parameters including tear film stability, tear production, and discomfort. Although significant changes were noted in the first week of injection, these changes tended to improve by the one-month mark. This implies that the effects of Botulinum Toxin on the tear film are largely transient. The decrease in Tear Break-Up Time (TBUT) at one-week post injection indicates a reduction in the stability of the tear film. TBUT is a well-known indicator of tear film stability and its decrease suggests that the tear film may be compromised post Botulinum Toxin Injection[12]. The slight increase in Taiwan's TBUT at one month, while not returning to baseline levels does imply that these participants are slowly recovering with regard to the tear film balance. This temporary disruption is proposed to be due to the effect of Botulin Toxin on facial muscles which may disturb the lacrimal gland, blink reflex, or both, which are essential for tear distribution. A similar decrease in production of tears is noted in the Schirmer test results where a decline was observed at one-week post injection with slight recovery seen at one month[13]. This correlate with previous studies which have shown that Botulinum Toxin may decrease production of tears especially within the early period. The decrease in tear secretion may be linked to the effects of the botulinum toxin on the autonomic nervous system, which has control over tearing[14]. Nonetheless, the fact that tear production started recovering by the one-month mark indicates that this impact is of a temporary nature and that ultimately, usual

secretion of tears will happen. Ocular surface scores increased a little at the week after injection suggesting mild irritation or dryness. This might be attributed to the short disturbance of tear production and stability over time, which is known to be insufficient to fully lubricate the ocular surface[15]. The decrease in scores at one month, though still above zero, strengthen the hypothesis that there is mild dryness or irritation of the ocular surface after BT but subsiding as the effect of the toxin wears off. Patient reported symptoms of ocular discomfort such as feeling dry and uncomfortable were highest at week after injection as most participants 45% reported feeling mild discomfort but by one month only 30% participants reported the symptoms[16]. This change is expected because the effects, in objective measures of TBUT, Schirmer test and ocular surface scores, are not long lasting[17,18]. These findings show that following the injection of Botulinum Toxin there are significant changes in tear film dynamics although not severe. Most participants reported symptoms of dry eye and irritation but in lesser intensity improving over time. These discoveries imply that Botulinum Toxin injections impact tear film stability and tear production in the short term, but in the long run, these effects are self-limiting and do not cause damage to the eyes[19,20]. A limitation of this study is the follow up period of 1 month. It is possible that some effects may develop after this time. Additionally, this study only included healthy individuals undergoing cosmetic Botulinum Toxin injections, so the results may not be generalizable to individuals with pre-existing ocular conditions or those receiving Botulinum Toxin injections for medical purposes.

## CONCLUSION

It is concluded that cosmetic Botulinum Toxin injections have short-term effects on the tear film, resulting in a temporary reduction in tear film stability, tear production, and mild ocular discomfort. The decrease in Tear Break-Up Time (TBUT) and Schirmer test scores observed at 1-week post-injection indicates a disruption in tear film integrity, which is transient and tends to improve within a month. Similarly, the slight increase in ocular surface staining and the reported symptoms of dryness or irritation were more pronounced in the initial week post-injection, with a reduction in symptoms by the 1-month follow-up.

## REFERENCES


1. Yan, M.K., Kocak, E., Yoong, K. and Kam, J.K., 2020. Ocular injuries resulting from commercial cosmetic procedures. Clinical and Experimental Optometry, 103(4), pp.430-433.
2. Moon, N.J., Lee, H.I. and Kim, J.C., 2006. The changes in corneal astigmatism after botulinum toxin-a injection in patients with blepharospasm. Journal of Korean medical science, 21(1), p.131.
3. Gomes, J.Á.P. and Milhomens Filho, J.A.P., 2021. Iatrogenic corneal diseases or conditions. Experimental Eye Research, 203, p.108376.
4. Coleman, Kate. Botulinum Toxin in Facial Rejuvenation: Botulinum Toxin in Facial Rejuvenation E-Book. Elsevier Health Sciences, 2019.
5. Craig, J.P., Nelson, J.D., Azar, D.T., Belmonte, C., Bron, A.J., Chauhan, S.K., de Paiva, C.S., Gomes, J.A., Hammitt, K.M., Jones, L. and Nichols, J.J., 2017. TFOS DEWS II report executive summary. The ocular surface, 15(4), pp.802-812.
6. Kowing, D., 2005. Madarosis and facial alopecia presumed secondary to botulinum a toxin injections. Optometry and vision science, 82(7), pp.579-582.
7. Rauz, S., Koay, S.Y., Foot, B., Kaye, S.B., Figueiredo, F., Burdon, M.A., Dancey, E., Chandrasekar, A. and Lomas, R., 2017. The Royal College of Ophthalmologists guidelines on serum eye drops for the treatment of severe ocular surface disease: full report. Eye, pp.1-16.
8. Tong, L., Lim, L., Tan, D., Heng, W.J., Lim, J., Chan, C., Arundhati, A. and Tan, A., 2021. Assessment and management of dry eye disease and meibomian gland dysfunction: providing a Singapore framework. Asia-Pacific Journal of Ophthalmology, 10(6), pp.530-541.
9. Matossian, C., McDonald, M., Donaldson, K.E., Nichols, K.K., MacIver, S. and Gupta, P.K., 2019. Dry eye disease: consideration for women's health. Journal of women's health, 28(4), pp.502-514.
10. Iver, R.M., Liptay, M. and Johnson, Y., 2007. A case of mediastinitis following botulinum toxin type A treatment for achalasia. Nature Clinical Practice Gastroenterology & Hepatology, 4(10), pp.579-582.
11. Craig, J.P., Nelson, J.D., Azar, D.T., Belmonte, C., Bron, A.J., Chauhan, S.K., de Paiva, C.S., Gomes, J.A., Hammitt, K.M., Jones, L.W. and Nichols, J.J., 2017. The TFOS dry eye workshop II: executive summary.
12. Bukhari, S.N.A., Roswandi, N.L., Waqas, M., Habib, H., Hussain, F., Khan, S., Sohail, M., Ramli, N.A., Thu, H.E. and Hussain, Z., 2018. Hyaluronic acid, a promising skin rejuvenating biomedicine: A review of recent updates and pre-clinical and clinical investigations on cosmetic and nutricosmetic effects. International journal of biological macromolecules, 120, pp.1682-1695.
13. Trinh, T., Mimouni, M., Santaella, G., Cohen, E. and Chan, C.C., 2021. Surgical management of the ocular surface in neurotrophic keratopathy: amniotic membrane, conjunctival grafts, lid surgery, and neurotization. Eye & Contact Lens, 47(3), pp.149-153.
14. Singh, Swati, Savitri Sharma, and Sayan Basu. "Rabbit models of dry eye disease: Current understanding and unmet needs for translational research." Experimental Eye Research 206 (2021): 108538.
15. Gurnani, Bharat, and Kirandeep Kaur. "Current Approach in Surgical Management of Dry Eyes–Dry Eye Review II." TNOA Journal of Ophthalmic Science and Research 59, no. 3 (2021): 241-249.
16. Peck, J.J. and Wax, M.K., 2014. Medical Management of Facial Paralysis. Facial Paralysis: A Comprehensive Rehabilitative Approach, p.41.
17. Elder MJ, Dart JK. 9Tears and the Dry Eye. InNervous Control of the Eye 2000 Jan 10 (pp. 321-362). CRC Press.
18. Grixti, A. and Malhotra, R., 2018. Oral mucosa grafting in periorbital reconstruction. Orbit, 37(6), pp.411-428.
19. Suhr, M.A., Günther, M. and Springer, I.N., 2004. Ptosis relief after botox injection using dermabond. Plastic and reconstructive surgery, 114(1), pp.262-263.
20. Petit, J.Y., Clough, K., Sarfati, I., Lohsiriwat, V., De Lorenzi, F. and Rietjens, M., 2010. Lipofilling in breast cancer patients: from surgical technique to oncologic point of view. Plastic and reconstructive surgery, 126(5), pp.262e-263e.


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