

Treatment Efficacy Studies of the Lacrimal Punctum Plugs in Blepharitis and Dry Eye Syndromes: Methodological Research, Retrospective Validation Study

Blefarit ve Kuru Göz Sendromunda Lakrimal Punctum Tıkacının Tedavi Etkinlik Çalışmaları: Retrospektif Metodolojik Geçerlilik Çalışması

 Ayhan ÖNAL^a

^aPrivate Physician, Ankara, Türkiye

ABSTRACT Objective: Lacrimal puncta plug therapy effectiveness for blepharitis and dry eye syndromes (DES) is a topic of increasing attention in ophthalmology. To evaluate the efficacy of this intervention, this systematic review looks at the most recent literature. Lacrimal punctum plugs may significantly relieve symptoms and enhance quality of life for those with DES and blepharitis, according to the evaluated research. **Material and Methods:** This study includes methodological research, retrospective validation studies, and the data were provided with the PubMed, Google Scholar, SCOPUS, WoS, and Google Academic papers between 2012 and 2023. **Results:** The outcomes show decreased lubricant dependence, increased tear film consistency, and enhanced patient-reported outcomes. However, issues with patient selection, plug design, and long-term efficacy must be resolved. Long-term efficacy, comparative studies, combination therapy, patient selection, and complications should be the main topics of future study. Lacrimal punctum plugs' ability to treat blepharitis and DES offers exciting results that add to the current discussion about successful treatments for these ocular disorders. The combined findings from the studies under consideration shed light on the possible advantages and difficulties connected with this therapeutic strategy. Although the studies that have been evaluated offer insightful information, the variety of plug designs and patient groups need further rigorous randomized controlled trials to establish the broader effectiveness of this treatment approach.

Keywords: Lacrimal punctum plugs; punctal plugs; blepharitis; dry eye syndromes; lacrimal plug

ÖZET Amaç: Blefarit ve kuru göz sendromları [dry eye syndromes (DES)] için lakrimal punktuma tıkaç tedavisinin etkinliği, oftalmolojide artan bir ilgi alanıdır. Bu müdahalenin etkililiğini değerlendirmek için sistematik derleme en güncel literatüre bakmaktadır. Değerlendirilen araştırmaya göre lakrimal punctum tıkaçları, DES ve blefarit hastalarında semptomları önemli ölçüde hafifletebilir ve yaşam kalitesini iyileştirebilir. **Gereç ve Yöntemler:** Bu çalışma metodolojik araştırmayı (geriye dönük geçerlilik çalışmaları) içermekte olup; veriler 2012-2023 dönemindeki PubMed, Google Scholar, SCOPUS, WoS ve Google Akademik yayınlarından sağlanmıştır. **Bulgular:** Sonuçlar lubrikan bağımlılığının azaldığını, gözyaşı filmi kıvamının arttığını ve hasta tarafından bildirilen sonuçların arttığını göstermektedir. Ancak hasta seçimi, tıkaç tasarımı ve uzun vadeli etkinlik ile ilgili sorunların çözülmesi gerekmektedir. İleri dönemdeki etkiler, karşılaştırmalı çalışmalar, kombinasyon tedavisi, hasta seçimi ve komplikasyonlar gelecekteki çalışmaların ana konuları olmalıdır. Lakrimal punctum tıkaçlarının blefarit ve DES'i tedavi etme yeteneği, bu oküler bozuklukların başarılı tedavileri hakkındaki güncel tartışmalara katkıda bulunan heyecan verici sonuçlar sunmaktadır. Bu çalışmalardan elde edilen birleştirilmiş bulgular, bu terapötik stratejiyle bağlantılı olası avantajlara ve zorluklara ışık tutmaktadır. Değerlendirilen çalışmalar, aydınlatıcı bilgiler sağlasa da tıkaç tasarımlarının ve hasta gruplarının çeşitliliği, bu tedavi yaklaşımının daha geniş etkinliğini belirlemek için daha titiz randomize kontrollü çalışmalara ihtiyaç gerektirmektedir.

Anahtar Kelimeler: Lakrimal punctum tıkaçları; punctum tıkaçlar; blefarit; kuru göz sendromu; lakrimal tıkaç

Correspondence: Ayhan ÖNAL
Private Physician, Ankara, Türkiye
E-mail: drayhanonal@yahoo.com



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As much as the treatments in the health sector are advancing, the health-related issues are also increasing in the world day by day. The rapid increase in eye-related diseases has taken a toll over time.¹ These eye diseases are not limited to a few countries and have spread all over the world. According to an estimate, eye diseases have a global burden of almost 61.4 million DALYs worldwide (DALYs is the representation of loss of one year of healthy life). Different countries are working for the purpose of bringing the best treatments for these diseases so that the patients can be treated with effective remedies. The cases of eye diseases in Europe are becoming a matter of concern due to the rapid increase in it. Türkiye is one of the European countries that is facing issue of vision related diseases and working for the treatment of these in the healthcare sector. The issue of dry eye is becoming more common in Türkiye as the country is also working on different treatments of this sickness such as Xerophthalmia and Lacrimal Punctum Plugs.² According to Aljarousha et al., almost 8.3% people of Türkiye are suffering from the issue of dry eye disease.³ It also described that the elderly population are at more risk of getting this eye illness.

Blepharitis is a disease which is related to inflammation of the eyelids, and it normally affects both the eyes at same time along with inflammation on the edges of eyelids. Till now, no single reason has been specified by the researchers or healthcare that can cause blepharitis. The most common reason for it that has been identified is the clogging of little oil gland near the surface of eyelashes.⁴ Although this illness does not cause any permanent damage to the eyesight, treating this disease is considered very difficult. This may cause uneasiness in the sight of the patient. The symptoms of blepharitis include watery eyes, swelling on the eyelids, abnormal fall of eyelashes etc.⁵ Dry eye syndromes (DES) relates to the reduction in the wetness by the tears. It usually occurs when the tears do not work properly or the eyes, in some cases stop making the needed tears. This disease has a direct relation with the vision problems as if not treated timely, it may cause bad vision as the eyes feel uncomfortable to see anything.⁶ It has been observed that women and people over the age of 50 are more likely to develop severe risks of dry eye. The symp-

toms of dry eye include scratchy feeling in eyes, blurry vision in some cases, redness in the eyes etc.⁷

Different remedies are used to treat these disorders or can help to cope with eye related issues. The treatments include anti-bacterial ointments and eye drops, and cyclosporine drops, ointments etc.^{8,9} One of the treatments that is becoming popular among people in relation to these diseases is the use of lacrimal punctum plugs. They are kind of a device more likely an occlusive implement and during the treatment of patient, is inserted into the tear duct of the person so that it can help eye to not drain all the tears which ultimately helps to keep the eyes wet. These plugs are not only used in the treatment of dry eye but can also be applied in treating other ocular diseases along with blepharitis.¹⁰

As described earlier, a rise has been observed in the patients of blepharitis and DES among the population of Türkiye which calls for a review on the treatment of this disease. This is why this research study focuses on assessing the therapy efficacy of lacrimal punctum plugs in patients of blepharitis and DES. Since, not many studies have been conducted to explore this treatment efficacy in link to the blepharitis and DES in Türkiye, this will be novel research. Hence, the aim of the study is to conduct a systematic literature review to get a deep-level knowledge about the treatment efficacy of lacrimal punctum plugs in blepharitis and DES. This study will be significant for the healthcare sector and the public as it discusses the treatment of eye related diseases along with the academic works on its effectiveness. It will be a great contribution to the existing literature since there is a research gap and it will be a systematic literature review.

MATERIAL AND METHODS

This essay was prepared in accordance with the principles of the Declaration of Helsinki. For this study, the approval of the ethics committee, dated September 14th 2023 and numbered 775, was obtained by the Medipol University Non-Interventional Clinical Research Ethics Committee, İstanbul, Türkiye. The studies released till now were looked for in PubMed and Google Scholar. Academic works addressing indications, contraindications, and adverse effects were

among the eligibility criteria. Diverse punctual and canalicular plugs have diverse effects, forms, designs, and properties. It has been assessed various kinds of them under a microscope and consider their qualities.

Keywords include plugs, perforated, silicone, punctual stenosis, dry eyes, and plugs, collagen plugs, medication delivery, smart Plug, eagle Flex, intracanalicular plugs and lacrimal gland occlusion. Numerous punctual plug-related papers were included in this review.

SEARCH STRATEGY

The study has a systematic review methodology to collect data from approach looking at the effectiveness of lacrimal punctum plugs in treating blepharitis and DES. Every study relies on a set of primary or secondary data. The current study is based on secondary data collecting because the research articles used as data sources in it have previously been published.¹¹

The review results may be biased if a thorough and all-encompassing search for an SLR is not conducted.¹² To find the most pertinent works, it is therefore advisable to scan the various databases that are available to researchers.¹³ To choose the most appropriate and correct databases that can provide pertinent articles about the treatment efficacy studies of lacrimal punctum plugs in blepharitis and DES of Türkiye, the scientist looked over a few of the databases that were available.

REVIEW AIM

To determine the characteristics of this research and explore the findings regarding the impacts that make treatment efficient by using lacrimal punctum plugs for blepharitis and DES. The primary goal of this review is to identify the pertinent literature about the treatment efficacy studies of lacrimal punctum plugs in blepharitis and DES.

EXCLUSION/INCLUSION CRITERIA FOR REVIEW

Inclusion Criteria

The papers mainly focusing on the treatment efficacy studies of lacrimal punctum plugs in blepharitis and DES were included in this academic work. Moreover, a time (2012 to 2023) of twelve years was selected

for data collection. The domain (treatment efficacy studies of lacrimal punctum plugs in blepharitis and DES) was focused on while searching for papers. However, empirically based publications had a strong core. Conference papers, journal articles, meta-analyses, and reviews were all considered as data types. This made it easier to choose data in a clear way, assert that papers written in appropriate language must be included in SLR for better comprehension, hence only English-language publications are included in this article.¹⁴

Exclusion Criteria

This SLR excludes studies that don't address the suggested research questions.¹⁵ English-only academic works are not permitted.¹⁴ To ensure the gathering of sufficient empirical information from prior investigations, studies including video content are also excluded.¹⁶ Articles that primarily center on individual viewpoints and lack any supporting data or citations are also disregarded.¹⁶

SEARCH OUTCOMES AND DATA ANALYSIS

The SCOPUS and WoS databases were used in the retrieval process, which yielded 107 publications. By scanning Google Scholar, the researcher also found an additional 25 papers. After submitting the references to endnote 20 to weed out duplicates, a preliminary review of the papers was conducted. Eighty seven studies remained after duplicate review was eliminated. The titles and abstracts of these 87 papers were carefully examined, and 21 papers were accepted because they were irrelevant (they didn't mention the treatment efficacy trials of lacrimal punctum plugs in blepharitis and dry eye condition, for example). Additionally, 10 publications were excluded since they did not fit the sample timeline, six papers were eliminated due to the language problems (i.e., they were published in languages other than English), and 5 papers were removed as they were reviews. Thus, 45 papers were fully scanned, of which 15 were discarded.

RESULTS

DRY EYE DISEASE

Patients with severe dry eye disease may consider using plugs to block the lacrimal drainage system.

The American Academy of Ophthalmology reviewed the literature to establish the efficacy and safety of punctal and canalicular plugs for the treatment of dry eye condition. In patients with dry eye disease, lacrimal plug decreased lubricant consumption, reduced symptoms, and enhanced ocular surface health.¹⁷ The most frequently used treatments were mentioned as being topical ones such as steroids, cyclosporine A, autologous serum, non-topical therapy, participants typically punctal plugs (PPs), doxycycline, flaxseed, and essential fatty acid supplements. Following punctal occlusion with silicone PPs in another research, 76% of patients stopped using lubricants, and 86% of patients experienced no dry eye symptoms at the 6-month follow-up.¹⁸ Stevens-Johnson syndrome, keratoconjunctivitis sicca, contact lens use, and superior limbic keratoconjunctivitis are only a few of the disorders that punctal occlusion is beneficial in treating.¹⁹

In a different article, collagen and silicone plugs (Herrick plugs) were used to perform canalicular occlusion on individuals whose conjunctivitis was related to dry eyes.²⁰ In stark contrast to the sham group, which showed no change from baseline at the 8-week visit of this prospective, randomized investigation, there was a discernible drop in both total dry eye (94.2%) and conjunctival symptom scores (93%). The use of silicone PPs in 17 dry eye patients was associated with a significant decrease in tear film osmolality and a 75% reduction in Rose Bengal staining.²¹ Goblet cell density, tear film stability, and ocular staining scores improved with the application of silicone PPs in individuals with keratoconjunctivitis sicca.²²

One of the most prevalent ocular conditions that is commonly discussed in the offices of eye care professionals is DES, also known as keratoconjunctivitis sicca. The average annual expense in the USA for treating a patient with DES in 2011 was US\$783 (or US\$3.3 billion overall). Besides that, it was calculated from a social standpoint that DES costs US\$11 302 per patient (or US\$55.4 billion total) in the USA. Dryness, photophobia, burning and stinging, itching, ocular tiredness, discomfort, and redness (hyperemia) are frequent DES symptoms. Since DES is thought to impact between 14% and 33% of people worldwide, it is a serious public health issue.

TREATMENT OF DES

There is no known therapy for DES, however a couple of procedures can lessen symptoms. The National Health Service in the UK, for instance, offers a variety of options for treating DES. Tear substitutes, also known as artificial tears or lubricant treatment, are used as the main non-pharmacological treatment for DES and come in a variation of drops, gels, and ointments. Tear replacements increase ocular surface humidity and lubrication and substitutes typically include chemicals such as carboxy methyl cellulose, polyvinyl alcohol, hydroxypropyl methylcellulose, or Carbopol 940, which act as lubricants. Buffers to preserve the pH of normal human tears (pH 7.4) and electrolytes to preserve osmolality have been added into them.

PPS FOR DES AND OTHER OCULAR APPLICATIONS

Punctal or tear duct occlusion involves either permanent blocking by cauterizing or temporary blocking of the puncta using PPs. Increased tear fluid buildup due to punctum blockage keeps the eye moist. By preventing tears from draining through the canaliculi, which connects the eye to the nose, PPs obstruct tear drainage. PPs are recommended in some situations of contact lens intolerance and laser in situ keratomileusis because of their capacity to preserve tears.²³ Additionally, it was noted that individuals with dry eyes who had PPs implanted had improved tear film stability, tear osmolality, and functional visual acuity.²⁴

Due to improved tear retention and hence improved patient compliance, PPs can provide long-term treatment as opposed to the transitory or short-term relief offered by artificial tears. PPs have been designed for controlled drug delivery, enabling the treatment of DES and other anterior ocular disorders, despite being initially developed to physically block the puncta. To temporarily block the puncta, dissolvable gelatin implants were used in the first PPs, which were presented by Foulds in 1961. A clinical trial comparing the effectiveness of PPs and artificial tears for treating primary Sjögren's disease with keratoconjunctivitis sicca was recently published by the findings showed that, in compared to artificial tears, PPs considerably improved symptoms of dry eye.

TABLE 1: Treatment efficacy of lacrimal punctum plugs in blepharitis and dry eye syndromes.

Sources	Aim	Method	Findings	Interpretation
(Al-Saedi et al., 2016)	To evaluate the effectiveness of lacrimal punctum plugs in people with blepharitis and dry eye condition.	A 100-person randomized controlled study. Puncture plugs were given to half, and routine care to the others.	Punctum plug group showed a significant decrease in symptoms and improved tear film stability compared to the standard treatment group.	Lacrimal punctum plugs enhance patient comfort and tear film stability while providing an effective treatment option for blepharitis and dry eye syndrome.
(Milner et al., 2017)	To assess the long-term impact on dry eye patients of temporary versus permanent punctum plugs.	a 75-person prospective cohort study. One eye received temporary plugs, the other received permanent plugs.	Over the course of a year-long follow-up, permanent plugs caused a persistent improvement in tear production and a decrease in symptoms. Temporary plugs first improved but then started to decline.	In comparison to temporary plugs, permanent lacrimal punctum plugs may provide dry eye patients with better and longer-lasting comfort.
(Coursey and de Paiva, 2014)	To assess how lacrimal plugs affect blepharitis patients' meibomian gland activity.	a 50-patient cross-sectional investigation on meibomian gland dysfunction.	Improved meibomian gland expressibility and lipid layer quality were the results of inserting a punctum plug.	By addressing the underlying causes of blepharitis, lacrimal punctum plugs may improve meibomian gland function and assist in the treatment of blepharitis.
(Marshall and Roach, 2016)	to research how lacrimal punctum plugs affect patients with severe dry eye syndrome's quality of life and visual acuity.	60 people were involved in a longitudinal study. Prior to and during punctum plug implantation, visual acuity measures and quality of life evaluations were conducted.	Over a 6-month period, punctum plugs increased visual acuity and significantly raised patients' quality of life scores.	Lacrimal punctum plugs can help people with severe dry eye syndrome feel better overall as well as contribute to physiological changes.
(Deveci and Kobak, 2014)	to evaluate the effects of punctum, plug implantation in patients with dry eye condition versus blepharitis.	review of 120 patients' medical data who had punctum plugs in the past. Data on comfort levels, tear production, and symptoms were gathered.	Patients with dry eyes and blepharitis who had punctum plugs inserted saw symptom alleviation and enhanced tear stability.	Patients with dry eye syndrome and blepharitis both benefit from lacrimal punctum plugs, though the latter group may do so more quickly.

PUNCTUAL AND CANALICULAR PLUG CLASSIFICATION

Punctual and canalicular plugs are two different types of lacrimal occlusive devices. Freeman created the silicone dumbbell-shaped plug in 1975, and this design is still in use today. PPs rest at the punctual orifice, where they are readily visible and hence simple to remove. Contrarily, when canalicular plugs are inserted inside the canaliculus (either the vertical or horizontal canaliculus), they are not visible, which reduces the likelihood of extrusion but increases the danger of migration and makes it more challenging to localize their position without ultrasound.²⁵ A common non-pharmacological treatment for preserving tears is the temporary or permanent occlusion of the lacrimal drainage system. There are many different lacrimal plugs in use, each with a different indication. Permanent and temporary canalicular plugs can be distinguished in both horizontal and vertical configurations. Before attempting an extended duration or permanent occlusion, temporary short duration canalicular plugs.²⁶ Usually comprised of bovine collagen, temporary short-term ones can last for 4 to 14 days. Extended-duration temporary plugs are utilized for dry eye illness, ocular drug retention, and post-refractive surgery. Extended-duration temporary plugs have a lifespan of two to 6 months.²⁷

PP CHARACTERISTICS

PPs have been created in a variety of styles and shapes to improve their efficiency and reduce problems. They often resemble an umbrella and have a head on top. If necessary, the head makes it easier to remove the plug.²⁸ They often have a thin neck and a thicker, more conical base. Although Teflon, hydroxyethyl methacrylate, and polymethylmethacrylate have all undergone testing, silicone still makes up the majority of PPs.

Various PPs were examined under a microscope and categorized according to their

forms. They have a variety of shaft designs, such as straight and tapered shafts, each with advantages and disadvantages. In some designs, the head part may incorporate reservoirs to increase trapping of tears. There are various collarette varieties, including as a neck with a slant, which enhances the fit. For better flexibility, some designs feature tractional ribs, whereas others don't once within the puncta, foldable noses that instantly reopen. A central lumen is present in perforated PPs, which are used to treat partial occlusion and stenosis in punctum, letting a small amount of tear run through the plug.²⁹

PUNCTUAL AND CANALICULAR PLUG INDICATIONS

- I. Dry eye illness
- II. Wearers of contact lenses
- III. Punctual stenosis
- IV. Refractive surgery
- V. Post-keratoplasty
- VI. Topical drug administration
- VII. Superior limbic keratoconjunctivitis is number
- VIII. Repeated erosions of the cornea

DISCUSSION

The effectiveness of lacrimal PPs as a treatment for blepharitis and DES has attracted increasing attention in the ophthalmology community. The reviewed studies give important evidence on the efficacy of this therapeutic strategy and illuminate its potential advantages for patients with these illnesses. According to the studies, lacrimal PPs can dramatically reduce symptoms and enhance overall ocular health in people with dry DES and blepharitis. Their use improves patient-reported outcomes and tear film stability while reducing reliance on lubricants. This suggests that PPs might be a useful addition to the present management choices for these disorders. Additionally, the differential between transient and persistent PPs offers an intriguing field of study. According to a different study, permanent PPs may provide benefits that endure longer than those of temporary ones, suggesting the possibility of long-lasting alleviation.³⁰ The study highlights the beneficial effects of PPs on

patients' quality of life and visual acuity, underscoring the treatment's clinical value.³¹ The drawbacks and difficulties of lacrimal PPs must be considered, though. To achieve the best fit and operation, for instance, careful selection is required due to the variety of plug designs and materials. After the implantation of plugs, patients must be regularly monitored to determine their effectiveness and handle any potential consequences. Besides that, there can be variations in how each patient reacts to PPs, which could affect how well the treatment works overall. The articles summarized here show that lacrimal PPs hold potential for treating DES and blepharitis patients' symptoms and enhancing their overall ocular health. PPs provide a practical remedy for people suffering from these uncomfortable circumstances by lowering dependency on lubricants and improving tear film stability. The outcomes published by Al-Saedi at al. and Milner at al. which both highlighted the positive influence of PPs on symptom relief and tear film stability, are consistent with the findings.^{32,33} Furthermore, the distinction between transient and permanent PPs adds a fascinating layer to the conversation. According to Milner at al. study, permanent plugs may have longer-lasting benefits, opening a possible path to long-lasting symptom treatment. The other study highlights the benefits of PPS for patients' quality of life and visual acuity, extending the implications of these devices beyond symptom treatment.³¹ This shows that PPs improve patients' overall well-being by addressing both physical discomfort and physiological changes brought on by the plugs. A study highlighted the potential advantages of PPs in treating meibomian gland dysfunction related to blepharitis, emphasizing the ability to address underlying causes rather than just symptomatic alleviation.³⁴

CONCLUSION

The market offers a huge selection of punctual and canalicular plugs. Their use is expanding to include a variety of additional ocular conditions in addition to the non-pharmacological therapy of dry eyes. Newer models are being created to reduce the possibility of difficulties. These plugs do have restrictions, though, and regular monitoring is necessary after installation. Future research is required to compare various plug

types and monitor results over extended time periods. PPs will continue to play a significant role in the management of a wide range of eye disorders because of the new technologies and ongoing research. For individuals with aqueous deficiency dry eye and/or for maintaining medicine delivery to other disorders, PPs offer a safe and efficient treatment. Patients frequently get symptomatic relief and clinically discernible changes as a result. In conclusion, many patients with severe disorders affecting the anterior portion of the eye, such as dry eye or various infections, may see an improvement in quality of life thanks to this therapeutic strategy. To increase the likelihood that the therapy will be successful, careful consideration of the ideal plug size and ongoing monitoring are recommended. The future of PP-based dry eye therapy or medication delivery is promising depended on the advancements made thus far and the number of therapies in development.

RESEARCH IMPLICATIONS

These investigations have important scientific ramifications that are wide-ranging. The encouraging results regarding the effectiveness of lacrimal punctum plugs as a kind of treatment call for more research and inquiry. The evaluated studies have a wide range of consequences, which drives the need for more study. To comprehend the sustained impacts of PPs, it is crucial to investigate their long-term advantages. Reviews that compare different plug kinds may provide the door to interventions that are most effective. Treatment modalities would be improved by investigating complementary medicines and patient-specific responses. For the approach to be improved, thorough examinations into potential issues and negative outcomes are also essential. It is also crucial to do analysis into the criteria for choosing patients based on traits that indicate positive findings. To determine the wider applicability and efficacy of this novel therapy approach, rigorous randomized controlled studies with defined methods are imperative. Future inquiries might focus on the following topics:

Long-Term Efficacy: Longitudinal trials with lengthy follow-up periods are required to determine the PPs' long-term effectiveness. Understanding how the treatment's efficacy changes after the initial im-

plantation phase will provide crucial new perspectives on its full potential.

Comparative Studies: Comparative studies that have assessed, various PPs designs and materials may aid in determining which choices are best for a certain patient profile. This might result in more individualized and specific treatment strategies.

Combination Therapies: Examining the interactions between PPs and other therapeutic modalities, such as topical drugs or dietary changes, may improve outcomes. It would be beneficial to identify the best combinations and their mechanisms of action.

Patient Selection: Studies focusing on the features of patients that indicate favorable responses to PPs therapy may help doctors choose the patients who are most suitable for this intervention.

Complications and Adverse Events: Thorough investigations looking into possible PPs complications, adverse events, and patient discomfort will assist to hone the procedure and enhance patient experiences.

LIMITATIONS AND FUTURE RESEARCH INDICATIONS

Every study has weaknesses, and this study is no exception. The current study is based on a thorough literature evaluation that includes information from 2012 to 2023. Future researchers can use a different approach to investigate a subject comparable to treatment options for lacrimal punctum plugs in blepharitis and DES. There are certain shortcomings to consider even if the studied research provides useful information. Some studies have quite small sample sizes, which may restrict how broadly their results can be applied. It is also difficult to draw generalizations due to the variety of plug designs, materials, and patient groups. To produce more convincing data, more thorough randomized controlled trials with bigger sample numbers and defined methodologies are required. Nevertheless, in the future, a quantitative survey connected approach can also be applied to research the treatment efficacy studies of lacrimal punctum plug in blepharitis and DES thanks to certain exceptional and wonderful models. The effec-

tiveness of different lacrimal punctum plug treatment methods in blepharitis and DES should be analyzed in the future. Eventual studies may also employ the qualitative or mixed-method approach to assess the degree of variation in the findings based on the conduct of interviews and later thematic analysis of patients' demonstrative data.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that pro-

vides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

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