Long-term outcomes of punctal cauterization in the management of ocular surface diseases

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Long-term Outcomes of Punctal Cauterization in the Management of Ocular Surface Diseases

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Purpose: To evaluate the long-term outcomes of surgical occlusion of lacrimal puncta using thermal cautery in the management of ocular surface diseases.

Methods: We reviewed medical records of 80 consecutive patients from a single academic center who underwent punctal cauterization. Patient demographics, ocular history, symptoms, and signs of ocular surface diseases pre- and post-cauterization were recorded.

Results: A total of 80 patients (171 puncta) were included, with an average age of 59 years and a follow-up duration of 27 months. The most common ocular morbidity was ocular graft-versus-host disease (n = 36), followed by primary keratoconjunctivitis sicca (n = 15). Indications for punctal cauterization included plug loss (n = 51), difficulty in plug fitting (n = 11), plug-related complications (n = 6), recanalization of previous cauterization (n = 7), and severe ocular surface disease requiring permanent punctal closure (n = 4). After punctal cauterization, the percentage of eyes with severe (21%) and moderate (25%) dry eye decreased significantly (8% and 19% at 3 months and 6% and 17% at 12 months, $P = 0.0006$). Fifty-four percent of patients reported improvement in their symptoms. The rate of recanalization was 21% during the follow-up period. The use of topical corticosteroids was associated with higher recanalization rate. Associated complications were limited to temporary pain and swelling.

Conclusions: Punctal cauterization is an effective modality in treating severe ocular surface diseases in patients who repeatedly lose punctal plugs, and it can be easily performed in a clinic setting without major complications. However, cauterization may need to be repeated in up to a quarter of cases because of recanalization.

Key Words: punctal cauterization, punctal plugs, dry eye, ocular surface diseases, ocular graft-versus-host disease

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Dry eye disease (DED) is an extremely common multifactorial disorder affecting the ocular surface and manifests as sensations vacillating from mild discomfort to severe pain, with or without visual acuity loss but significantly affecting patient's overall quality of life.[1–4] Aqueous tear deficiency is also a major contributor to the pathogenesis of severe ocular surface diseases associated with graft-versus-host disease (GVHD) and Stevens–Johnson syndrome.[5–7] The application of surface lubricants, such as artificial tears, gels, and ointments, provide symptomatic relief but are often not efficacious for the management of severe aqueous insufficiency.[8] Punctal occlusion is primarily indicated in the cases of aqueous deficient dry eye because the plugs aid in the preservation of natural or artificial tears and improve the quantity of the tear film.[9–11] Silicone plugs are a common and widely accessible method of punctal occlusion. However, these plugs are often prone to spontaneous extrusion. In a previous study, we recorded plug loss in 27% of patients within 6 months, and this rate increased significantly to 63% in patients who underwent repeated plug placements.[12]

Surgical occlusion of the lacrimal puncta by cauterization is a viable alternative in patients with recurrent plug extrusion or plug-related complications. Punctal cauterization using diathermy was first described by Dohlman in 1978.[10] The technique has since been used for management of a wide range of ocular surface pathologies.[13] In this study, we evaluated the efficacy of punctal cauterization in the management of ocular surface diseases and examined the punctal recanalization rate postcauterization.

MATERIALS AND METHODS

This retrospective cohort study was conducted in accordance with the tenets of the Declaration of Helsinki and was approved by the Massachusetts Eye and Ear Institutional Review Board. We reviewed the electronic case records of consecutive patients who underwent punctal cauterization by multiple providers at a single institution during a 3-year period, from January 2014 to December 2016. The procedure was performed with local (subcutaneous and topical) anesthesia and a handheld thermal cautery device. Details of the procedure were according to the treating physician's preference.

The records of 90 consecutive patients in the study period were reviewed and 10 cases were excluded because of inadequate documentation and/or follow-up, resulting in a total of 80 patients. Demographics, ocular history, history of punctal plug use, procedure site, and reported symptoms pre- and post-cauterization were recorded. For the procedure,

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topical anesthetic (proparacaine eye drop or lidocaine gel) was applied to the eye. The periocular area was sterilized, and lidocaine was injected subcutaneously near the punctal area. Gentle pressure was applied to the anesthetized area for several minutes. Punctal cauterization was performed using a fine tip, sterile disposable cautery device (AA00, Bovie Medical Corp, Clearwater, FL). The metal tip of the handheld cautery was inserted into the punctum and vertical portion of the canaliculus, and the device was then turned on (heated to a temperature of 1300°F). As the tissue surrounding the tip was cauterized and turned white, the metal tip was gradually retracted out of the punctum and the punctal opening was cauterized. Patients were instructed to apply ophthalmic erythromycin ointment over the punctal area for 1 week. Corneal fluorescein staining (CFS) was evaluated at baseline, 3-, 6-, and 12-month follow-up. Because the method of quantifying CFS varied by provider, we consolidated the CFS data into none, mild, moderate, and severe. National Eye Institute grading (scale 1–15) was divided in thirds as follows: 1 to 5 was considered mild, 6 to 10 moderate, and 11 to 15 severe. When a 1 to 4 scale of punctal epithelial erosions or superficial punctate keratitis grading was used, grades 1 to 2 were considered mild, 3 moderate, and 4 severe. Recanalization of puncta was recorded on the basis of ocular examination findings, plug insertion into a previously cauterized punctum, or need for recauterization.

We used R-3.6.1 Software (R Core Team, 2019, Vienna, Austria) for the statistical analysis of the recorded data. The data are presented as mean ± standard deviation. We used the Kruskal–Wallis test to compare the ocular surface parameters at baseline and follow-ups. The plug retention rates were determined by the Kaplan–Meier analysis with logrank tests. A 2-sided P value less than 0.05 was considered statistically significant.

RESULTS

A total of 171 puncta of 80 patients were included in the study. The average age of patients at baseline was 59.3 years (range 28–91). Twenty-seven (34%) patients were men and 53 (66%) were women. The mean follow-up period was 27 months. The most common ocular surface disease was ocular GVHD (n = 36, 45%), followed by primary keratoconjunctivitis sicca (n = 15, 19%). Stevens–Johnsons syndrome, Sjögren disease, neurotropic cornea secondary to herpetic disease, anterior basement membrane dystrophy, exposure keratopathy, filamentary keratitis, limbal stem cell deficiency, bacterial keratitis, and radiation keratitis were other ocular surface morbidities. Demographics and clinical characteristics of patients included in the study are summarized in Table 1.

Repeated loss of punctal plugs was the most common cause for punctal cauterization reported in 51 patients (64%). The providers could not successfully fit plugs in 11 patients (14%) either because the puncta were too large or too small. Six patients (8%) had plug-related complications, including pain, irritation, foreign body sensation, and 2 cases of canaliculitis. Seven patients (9%) had history of previous cauterization with spontaneous recanalization, and 4 patients (5%) had primary cauterization without a trial of plugs because of the severity of their ocular surface disease. The indication for punctal cauterization was not recorded in 1 patient, and the results are summarized in Table 2.

TABLE 1. Demographics and Clinical Characteristics of 171 Puncta of 80 Patients Who Underwent Punctal Cauterization

Male	27
Female	53
Age (mean ± SD)	59.3 ± 14.5

Etiology of Ocular Surface Disease (n, %)	Patients	Puncta
Graft-versus-host disease	36 (45%)	84 (49%)
Primary dry eye/tear deficiency	15 (19%)	30 (18%)
Stevens–Johnson syndrome	6 (8%)	16 (9%)
Sjögren syndrome	5 (6%)	10 (6%)
Recurrent abrasions	5 (6%)	9 (5%)
Herpes keratitis	5 (6%)	7 (4%)
Exposure keratitis	3 (4%)	5 (3%)
Filamentary keratitis	2 (3%)	5 (3%)
Limbal stem cell deficiency	1 (1%)	1 (1%)
Corneal ulcer	1 (1%)	2 (1%)
Radiation keratitis	1 (1%)	2 (1%)
Total	80	171

At 3 months postcauterization, 43 patients (54%) reported improvement in symptoms, whereas 26 (32%) had no symptomatic improvement compared with the baseline. Three patients (4%) reported a worsening of symptoms and 8 (10%) were unsure about the changes in symptoms. CFS of each eye was compared pre- and post-cauterization. The percentages of eyes with severe (21%) and moderate (25%) diseases were significantly decreased to 8% and 19%, respectively, at 3 months and 6% and 17%, respectively, at 12 months (P = 0.0006) (Fig. 1). Complications of punctal cauterization were limited to temporary pain and swelling reported by 3 patients.

Thirty-six of 171 (21%) of the cauterized puncta recanalized during the 27-month follow-up period, and the median time from cauterization to recanalization in these patients was 12 months (Fig. 2). A significantly higher recanalization rate (30%) was observed in eyes that had been treated with topical corticosteroids, compared with those that were not (15%, P = 0.0003).

TABLE 2. Indication for Punctal Cauterization

Indication	N (%)
Repeated plug loss	51 (64%)
Unable to fit plugs	11 (14%)
Previous complications with plugs	6 (8%)
Recanalization of previous cauterization	7 (9%)
Severe ocular surface disease	4 (5%)
Not documented	1 (1%)

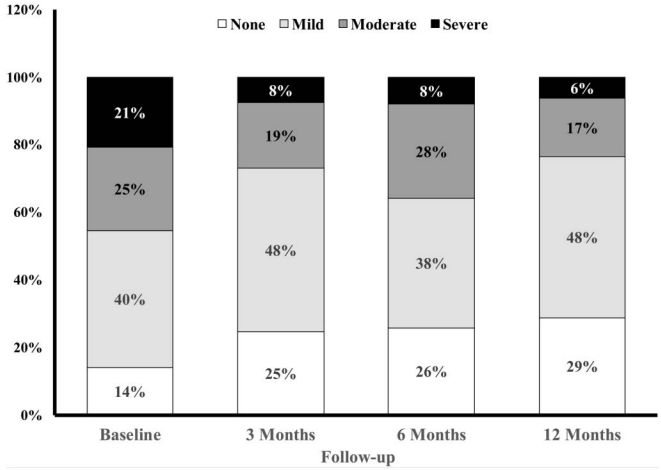

FIGURE 1. Efficacy of punctal cauterization in reducing disease severity. Bar graphs representing the disease severity in patients at baseline, 3-, 6-, and 12-month follow-ups. A significant reduction in disease severity was observed during the 3-, 6-, and 12-month follow-ups compared with the baseline ($P = 0.0006$).

DISCUSSION

Management of severe ocular surface disease due to aqueous tear deficiency is a frequent challenge to eye care providers. Punctal occlusion using silicone plugs is often the treatment of choice because it is well-tolerated by patients with rare adverse events and promotes retention of tear volume on the ocular surface, reducing signs and symptoms of DED.[10,12,14,15] Moreover, punctal plugs are painless and can easily be reversed if patients experience epiphora. Although punctal plugs are commonly used in many patients with moderate to severe DED, previous studies suggest that a high proportion of plugs are spontaneously lost or can migrate to the nasolacrimal duct or sac, potentially causing severe complications such as canaliculitis and dacryoadenitis in rare instances.[11,16]

In a previous retrospective study of 100 eyes of 50 patients, we found that 53% of punctal plugs were lost within a 6-month follow-up period.[12] We reported that plug retention was particularly low in patients with dry eye associated with ocular GVHD because of the fibrotic changes in the punctal anatomy caused by chronic conjunctival inflammation. Other complications associated with punctal plugs include pruritus, discomfort, lesions of the conjunctiva and cornea, epiphora, canaliculitis, and pyogenic granuloma.[17]

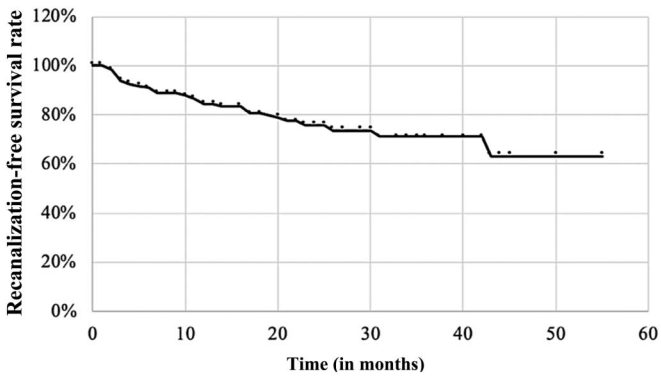

FIGURE 2. Recanalization of cauterized puncta. Thirty-six of 171 (21%) cauterized puncta recanalized during the study period, and the median time from cauterization to recanalization was 12 months.

Application of topical medications are often inadequate in treating severe ocular surface diseases. Therefore, additional procedures may be needed to effect the permanent occlusion of the puncta, including thermal cautery, diathermy, argon, and diode laser.[17–22] Among these procedures, thermal cautery is the treatment of choice at our institution because of its ready accessibility and ease of use of a handheld thermal cautery device. In our current cohort, in addition to primary keratoconjunctivitis sicca, several ocular surface inflammatory diseases such as ocular GVHD and Stevens–Johnsons syndrome are the common causes of aqueous insufficiency that required punctal cauterization. Repeated plug loss and inability to fit the plug are the primary reasons for punctal cauterization.

Our data demonstrated that over half of the treated patients reported symptomatic improvement after punctal cauterization, but there was a wide range of responses. This is likely because of the high proportion of patients with DED associated with severe chronic inflammatory diseases that can progress over time. Despite the mixed subjective response in patients, CFS, an objective measure of disease severity, improved significantly in the first 3 months, and this improvement persisted for 12 months after cauterization in 65% of patients. Recanalization rates (21%) in our study are comparable with those previously reported in the literature by Dohlman[10] (25%) using diathermy. A lower rate of recanalization has been previously reported in patients with chronic inflammatory and potentially cicatrizing diseases such as chronic GVHD.[23] Complications associated with punctal cauterization are rare and mild. It is worth noting that we found an association between the use of topical corticosteroid and recanalization. Owing to the retrospective nature of our study, it is not clear whether there is a causal relationship. Further studies are warranted to elucidate the role of corticosteroids in punctal recanalization.

Our study is limited by its retrospective nature, and the data collection and analysis exclusively rely on the accuracy of the reviewed data. Providers who performed cauterization in our study used different scoring systems in grading the CFS, and we arbitrarily consolidated these into 4 grades on the basis of severity. Varying follow-up duration also made it challenging to accurately assess the temporal relationship between outcomes and unknown events other than the interventions that could potentially influence the outcomes.

Despite these limitations, our study demonstrated that punctal cauterization is an efficacious modality in treating aqueous tear insufficiency in patients with ocular surface diseases. The procedure is well tolerated with rare mild complications. Recanalization occurs in up to a quarter of patients and repeat cauterization may be needed.

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