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

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Abstract

Purpose: To evaluate long-term outcome 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 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 prior 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 three months and 6% and 17% at twelve 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 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 due to recanalization.

Keywords

punctal cauterization; punctal plugs; dry eye; ocular surface diseases; ocular graft-versus-host disease

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INTRODUCTION

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 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 cases of aqueous deficient dry eye since 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 six 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 evaluate the efficacy of punctal cauterization in the management of ocular surface diseases, and examine the punctal recanalization rate post-cauterization.

MATERIALS AND METHODS

This retrospective cohort study was conducted in accordance with 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 three-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 due to 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, 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 one

week. Corneal fluorescein staining was evaluated at baseline, three-, six- and twelve-month follow-up. As the method of quantifying corneal fluorescein staining varied by provider, we consolidated the corneal fluorescein staining data into none, mild, moderate and severe. National Eye Institute (NEI) grading (Scale 1–15) was divided in thirds: 1–5 was considered mild, 6–10 moderate, and 11–15 severe. When a 1–4 scale of punctal epithelial erosions or superficial punctate keratitis grading was used, grades 1–2 were considered mild, 3 moderate, and 4 severe. Recanalization of puncta was recorded on the basis of ocular exam findings, plug insertion into a previously cauterized punctum, or need for re-cauterization.

We used R-3.6.1 Software (R Core Team, 2019, Vienna, Austria) for statistical analysis of the recorded data. The data are presented as mean ± standard deviation. We used Kruskal Wallis test to compare the ocular surface parameters at baseline and follow ups. The plug retention rates were determined by Kaplan–Meier analysis with log-rank test. A two-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 male and 53 (66%) were female. The mean follow-up period was 27 months. The most common ocular surface disease was ocular graft-versus-host disease (GVHD) (n=36, 45%) followed by primary keratoconjunctivitis sicca (n=15, 19%). Stevens-Johnsons Syndrome (SJS), Sjogren's 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 eleven 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 two cases of canaliculitis. Seven patients (9%) had history of prior cauterization with spontaneous recanalization, and four patients (5%) had primary cauterization without a trial of plugs due to the severity of their ocular surface disease. The indication for punctal cauterization was not recorded in one patient and the results are summarized in Table 2.

At three months post-cauterization, 43 patients (54%) reported improvement in symptoms, while 26 (32%) had no symptomatic improvement compared to the baseline. Three patients (4%) reported a worsening of symptoms and 8 (10%) were unsure about changes in symptoms. Corneal fluorescein staining (CFS) of each eye was compared pre- and post-cauterization. The percentage of eyes with severe (21%) and moderate (25%) disease were significantly decreased to 8% and 19% respectively at three months and 6% and 17% respectively at twelve months (p=0.0006) (Figure 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. (Figure 2). A significantly higher recanalization rate (30%) was observed in eyes that had been treated with topical corticosteroids, compared to those that were not (15%, p = 0.0003).

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, as 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 dry eye disease.[10,12,14,15] Moreover, punctal plugs are painless, and can easily be reversed if patients experience epiphora. While punctal plugs are commonly used in many patients with moderate to severe dry eye disease, 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 prior 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 due to 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]

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] Amongst these procedures, thermal cautery is the treatment of choice at our institution due to 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 SJS are common causes of aqueous insufficiency that required punctal cauterization. Repeated plug loss and inability to fit the plug are primary reasons for punctal cauterization.

Our data demonstrate that over half of the treated patients reported symptomatic improvement after punctal cauterization, but there was a wide range of responses. This is likely due to the high proportion of patients with dry eye disease associated with severe chronic inflammatory disease that can progress over time. Despite the mixed subjective response in patients, corneal fluorescein staining, an objective measure of disease severity, improved significantly in the first three months, and this improvement persisted for twelve months after cauterization in 65% of patients. Recanalization rates (21%) in our study are comparable to those previously reported in the literature by Dohlman (25%) using diathermy.[10] 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. Due to the retrospective nature of our study, it is not clear if 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 corneal fluorescein staining and we arbitrarily consolidated these into four grades on the basis of severity. Varying follow-up duration also made it challenging to accurately assess the temporal relationship between the outcomes and unknown events other than the interventions that could potentially influence the outcomes.

Despite these limitations, our study demonstrates 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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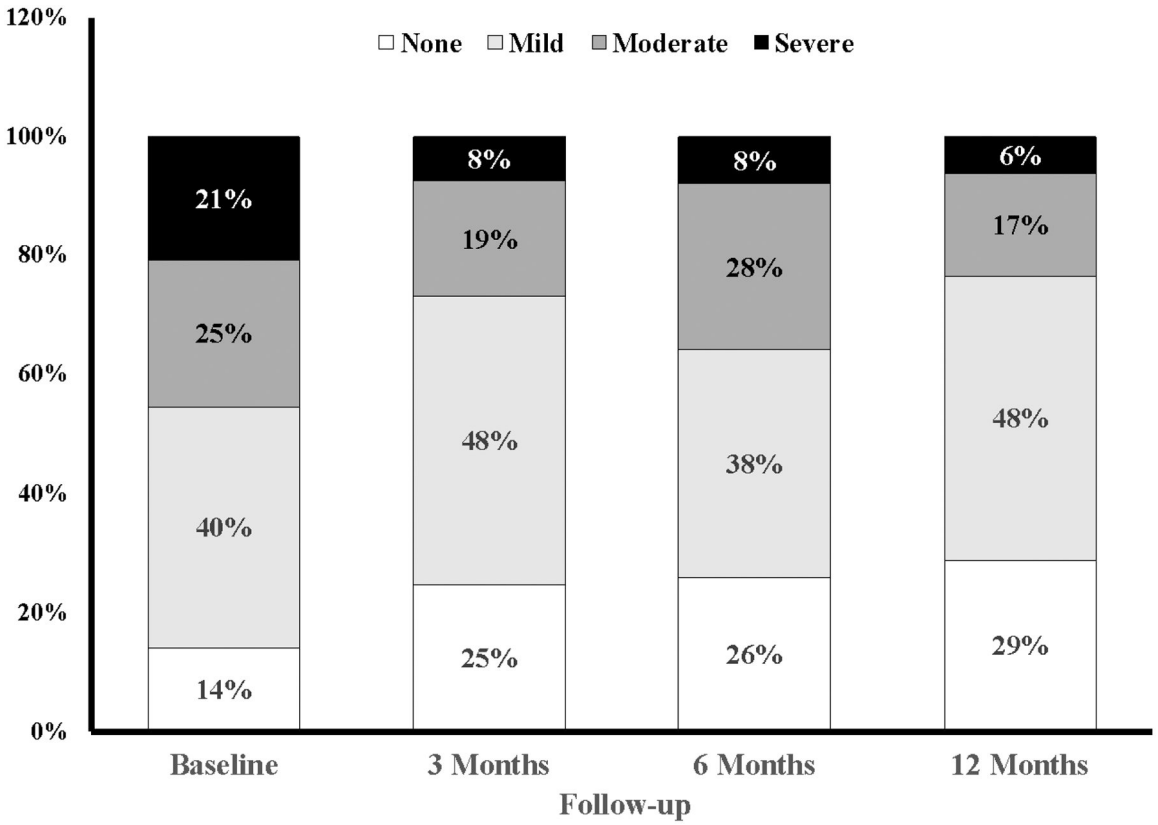

FIGURE 1. Efficacy of punctal cauterization in reducing disease severity.

Bar graphs representing the disease severity in patients at baseline, three-, six- and twelve-month follow-ups. A significant reduction in disease severity was observed during three-, six- and twelve- month follow-ups compared to the baseline (p=0.0006).

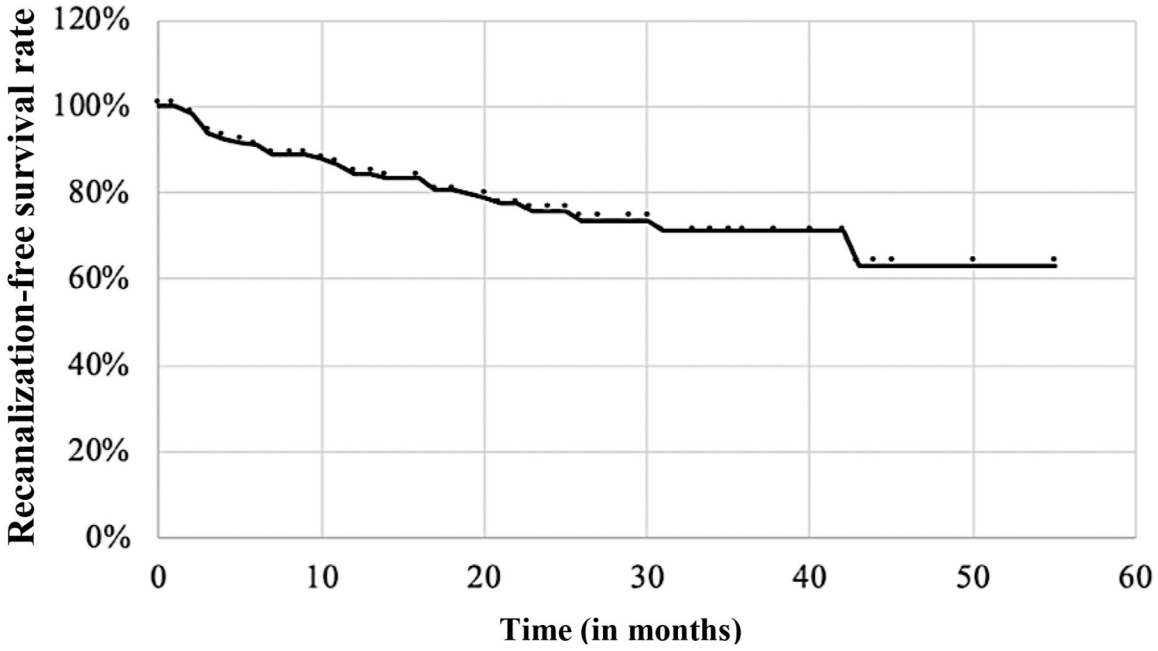

FIGURE 2. Recanalization of cauterized puncta.

36 out of 171 (21%) cauterized puncta recanalized during the study period and the median time from cauterization to recanalization was 12 months.

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%)
Sjogren's 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**

TABLE 2.

Indication for punctal cauterization

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