The Use of Argon Laser Punctal Stenosis in Patients With Contact Lens-Induced Dry Eyes

Ali R. Djalilian, M.D., Joshua O. Mali, M.D., and Edward J. Holland, M.D.

Objective: To determine the efficacy of argon laser punctal stenosis in patients with contact lens-induced dry eyes.

Methods: A retrospective review of 25 eyes of 13 patients who underwent argon laser punctal stenosis to improve their contact lens intolerance was performed. The mean age was 31 (range, 21–52) years and 11 patients (85%) were women. The mean Schirmer I test was 15.2 (range, 3–35).

Results: All patients tolerated the procedure well. In 19 eyes, the treatment involved only the lower punctum, whereas in six eyes, it involved both the upper and lower puncta. Eight patients required more than one treatment session (range, 2–6). At follow-up after 6 months, 10 of the 13 (77%) patients reported a substantial improvement in their symptoms and contact lens wear time.

Conclusions: Argon laser punctal stenosis provides a useful and titratable treatment of contact lens intolerance due to dry eyes.

Key Words: Argon laser punctal—Contact lens—Dry eye.

A comprehensive definition of the dry eye state is provided by Pflugfelder in which he defines dry eye state as the dysfunction of the lacrimal functional unit consisting of the ocular surface, main and accessory lacrimal glands, meibomian glands, eyelids, and the interconnecting neuronal innervations. This dysfunction causes an unstable tear film which in turn promotes ocular surface inflammation, epithelial disease, and symptoms of discomfort. This unit functions as a continuum; the interconnectedness of these individual players allow for varied causes of dry eye disease (aqueous deficiency, directly disrupting tear film, and so forth.) to set off a cascade of events that affect all aspects of the lacrimal functional unit and thus tear film composition and stability. Therefore, treatment modalities can be directed at any one of these components of the lacrimal functional unit and provide relief to other aspects of the unit.

Contact lens wear is known to directly induce tear film instability and secondary dry eyes. Traditionally, treatments have been focused on enhancing volume of tears to overcome any aqueous deficiency and promote overall tear film stability. The use of artificial tears provides temporary relief for such patients. However, frequent application of drops can be both inconvenient and expensive. Punctal occlusion provides a mechanism to maintain the patient’s own tears for a longer period, thus decreasing the need for supplemental drops. However, there is a wide variability among patients, and therefore, total punctal occlusion (thermal cautery and punctal plugs) may not be appropriate for every patient, given that in many cases their symptoms are primarily present during contact lens wear. Previous studies on the use of punctal occlusion in contact lens wearers have found mixed results with some studies showing a benefit whereas others showing no significant beneficial effect. This may in part because of the heterogeneous patient populations, small sample sizes, and perhaps the all-or-none effect of total punctal occlusion. Therefore, we hypothesized that punctal stenosis, which is a more physiologic form of treatment that maintains an appropriate level of flow through the punctum, may provide relief to patients with contact lens induced dry eyes.

Argon laser punctal stenosis is a relatively new strategy in the treatment of dry eyes. Unlike its counterparts (thermal cautery and punctal plugs), argon laser punctal stenosis does not have to provide only total punctal occlusion, because it can be titrated to achieve the desired effect. To date, there have been no published studies regarding its efficacy in the treatment of contact lens-induced dry eye. Given the ability of argon laser to titrate the effect of punctal stenosis and the less invasive nature of the procedure relative to other surgical methods of punctal occlusion, we hypothesized that argon laser punctal stenosis will provide an effective
and desirable treatment in patients with contact lens intolerance due to dry eyes.

**MATERIALS AND METHODS**

A retrospective review of 13 consecutive patients who underwent argon laser punctal stenosis for contact lens intolerance due to dry eyes was performed. Twelve wore soft contact lenses and one patient wore rigid gas permeable lenses. All patients reported dryness and foreign body sensation with contact lens wear that was relieved with artificial tears. Three patients had previously tried collagen plugs. Two patients had an underlying diagnosis of lupus and one had a positive Fluorescent Antinuclear Antibody, a sensitive screening test used to detect autoimmune diseases such as lupus. All patients were generally asymptomatic when not wearing contact lenses and only occasionally required the use of artificial tears. The slitlamp examination and the fluorescein staining pattern of the ocular surface were likewise unremarkable in all cases in the absence of contact lenses. Patients were carefully examined for evaporation of tear film in contact lens wearers compared with the absence of contact lenses.6,22–25 and contact lens wear time (Table 2). Two patients had no improvement and one patient had only minimal improvement. None of the patients developed epiphora.

**RESULTS**

A total of 77 argon laser procedures were performed in 25 eyes. The mean age of the patients was 31 (range, 21–53) years, and 11 (85%) of them were women. All patients tolerated the procedure well and reported minimal to no discomfort. In 19 eyes, the treatment involved only the lower punctum, whereas in six eyes, it involved both the upper and lower puncta. Eight patients required more than one treatment session (range, 2–6). Overall, 12 puncta were treated only once, 8 puncta were treated twice, and 13 puncta were treated three or more times to achieve the desired degree of stenosis. At follow-up after 6 months, 10 of the 13 patients reported a substantial improvement (score ≥ 2) in their symptoms and contact lens wear time (Table 2). Two patients had no improvement and one patient had only minimal improvement.

**DISCUSSION**

Although the exact mechanism is still unclear, there have been many proposed mechanisms in regards to contact lens-induced dry eye. Theories have centered on two critical aspects: quantity of tears and quality of tear film.19 In patients with mild aqueous tear deficiency, the quantity of tears is of primary concern to address patients’ symptoms. However, contact lens wear has been shown to induce tear film instability by causing abnormalities of the lipid, aqueous, mucin, tear base, and surface.11,12 This induced dry eye state is further evident by the increased tear osmolarity and evaporation of tear film in contact lens wearers compared with age- and sex-matched controls.5,20,21 Other proposed factors include possible inflammatory effects of contact lenses6,22–25 and dewetting related to lack of biocompatibility of the lens surface.6,22,26,27 Thus, the combination of reduced quantity of tears and tear film stability provide a challenge to physicians in treating patients with contact lens-induced dry eye.

Patients typically complain of irritation and foreign body sensation while wearing their contact lenses.7 It is likely that many of these patients actually have an underlying mild or moderate aqueous tear deficiency that is exacerbated by contact lens wear. Therefore, the treatment of contact lens-induced dry eyes has been primarily focused on replacing the aqueous component. However, dry eye is a complex condition, and it is critical to address other underlying issues contributing to dry eye such as meibomian gland dysfunction, blepharitis, or papillary conjunctivitis, which can contribute to the dry eye state or to the patient’s symptoms.28 Likewise, the lens type, lens fit, and the schedule of lens wear are important factors to take into consideration when treating contact lens-induced dry eyes.6,29 In general, silicone hydrogel soft lenses30,31 with a low water content and high oxygen permeability (Dk)22,31–34 and rigid gas permeable lenses with low wetting angle allowing for better wettability35 are recommended for patients with dry eye symptoms. There are treatment options that have been shown to be beneficial in both contact lens-induced dry eye and non-contact lens dryness. Of course, artificial tears are the most direct method of improving eye
dryness in patients. As mentioned previously, however, it becomes tedious and inconvenient to continually apply expensive artificial tears for symptom relief. More recently in the medication realm, cyclosporine 0.05% ophthalmic emulsion has emerged as a potential treatment. One recent study evaluating contact lens-intolerant patients and the use of cyclosporine 0.05% showed significant improvement in dry eye symptoms, decreased use of rewetting drops, increased wearing time, and improvements in temporal bulbar conjunctival fluorescein staining as compared with patients using rewetting drops only. Another more recent study showed no statistically significant difference in objective findings and subjective reporting of symptoms between contact lens wearers, there was no significant difference in improvement of symptoms between the group of patients receiving punctal plugs and the sham procedure significantly improved dry eye symptoms between the group of patients receiving punctal plugs and the sham procedure group. Furthermore, although reversible, a number of patients cannot tolerate punctal plugs and over time, a significant number of the plugs fall out and need to be replaced. Nonetheless, punctal plugs are a reasonable choice for patients with contact lens-induced dry eyes.

In this study, argon laser was used to achieve punctal stenosis in 13 consecutive patients with contact lens intolerance due to dry eyes. Overall, 77% of the patients reported a substantial improvement in their symptoms and their contact lens tolerance. In most of these patients, the goal was not complete and permanent occlusion of the puncta, but rather partial occlusion (stenosis) to relieve their symptoms. This allows for the retention of tears that are more physiologic to the ocular surface when compared with artificial tears. For many patients, the goal may be to simply reduce their need for frequent artificial tears that can be prohibitive to their lifestyle or professional activities. This can be more appealing to patients not only in regards to convenience (quick surgical procedure vs. constant application of artificial tears) but also in addressing the issue of cost effectiveness.

Clinically, after one laser treatment, recanalization occurs within several weeks. However, there is residual stenosis at the puncta or the proximal canaliculus. Repeated treatments seem to have an additive effect, thus achieving greater and greater degrees of benefit.

### Table 2: Results of Argon Laser Punctal Occlusion for Contact Lens-Induced Dry Eye

| Age/Sex | Eye | Schirmer I | Lids treated | Powera/shotsb | Improvementc | Comments |
|---------|-----|------------|--------------|---------------|--------------|----------|
| 21/F    | OD  | 30         | Lx3, Ux3     | 150–300/98    | 3            |          |
|         | OS  | 30         | Lx3, Lx3     |               |              |          |
| 27/F    | OD  | 15         | Lx2          | 200–300/101   | 3            |          |
|         | OS  | 19         | Lx2          |               |              |          |
| 40/F    | OD  | 15         | Lx6          | 200–300/97    | 2            |          |
|         | OS  | 14         | Lx6          |               |              |          |
| 25/F    | OD  | 7          | Lx1          | 300/75        | 0            |          |
|         | OS  | 5          | Lx1          |               |              |          |
| 28/F    | OD  | 14         | Lx1          | 300/80        | 0            | Lupus    |
|         | OS  | 16         | Lx1          |               |              |          |
| 31/F    | OD  | 21         | Lx3, Ux1     | 300/87        | 2            |          |
|         | OS  | 24         | Lx2, Ux1     |               |              |          |
| 28/M    | OD  | 3          | Lx3          | 150–250/101   | 2            | Thermal cautery L OU |
|         | OS  | 8          | Lx3          |               |              |          |
| 41/F    | OD  | 7          | Lx5, Ux2     | 250–300/96    | 3            |          |
|         | OS  | 6          | Lx5, Ux2     |               |              |          |
| 53/F    | OD  | 35         | Lx2          | 300/96        | 2            |          |
|         | OS  | 25         | Lx2          |               |              |          |
| 24/M    | OD  | 25         | Lx2          | 300/75        | 1            | Lupus    |
|         | OS  | 23         | Lx2          |               |              |          |
| 24/F    | OD  | 9          | Lx1, Ux1     | 300/88        | 2            | + FANA   |
|         | OS  | 10         | Lx1, Ux1     |               |              |          |
| 36/F    | OD  | 13         | Lx1          | 250–300/99    | 2            |          |
|         | OS  | 14         | Lx1          |               |              |          |
| 25/F    | OD  | 10         | Lx3          | 250/97        | 3            |          |

aPower in milliwatts.
bMean number of shots per treatment.
cSelf-reported improvement in contact lens wear tolerance: 0 = none, 1 = minimal (<25%), 2 = moderate (25%–50% improvement), 3 = significant (50%–75%), 4 = symptoms nearly resolved (75%–100%).

L indicates lower punctum; U, upper punctum; OD, right eye; OS, left eye; OU, both eyes; FANA, fluorescent antinuclear antibody test; x #, no. treatment sessions per punctum.
of stenosis. Based on our clinical observations, there is a cumulative clinical response that correlates with progressive scarring and stenosis of the puncta after each treatment. This provides the primary advantages of the argon laser; that is, treatment can be titrated according to the patient’s clinical response. Both cautery and plugs, typically provide an all-or-none effect; however recently, punctal plugs have been designed to allow partial flow through the center of the plug.

A previous study using the argon laser reported that 86% of the treated puncta remained open after 1 year and seemed to use a slightly different technique, because the authors did not describe using a marking pen to provide additional pigmentation in the punctal area to improve the laser uptake. Thus, to achieve the necessary uptake, they used significantly higher powers (2.0–2.4 W) compared with our study (0.3–0.5 W). In addition, they treated each puncta only once. The patient’s clinical response to treatment was not reported in that study and complete occlusion of the puncta was the only reported outcome.

One of the limitations of our study was the absence of controls. Because the condition is typically bilateral, it may be possible in the future to use one eye as the control.

Another limitation of the study was the subjective nature of our self-reported grading schematic. There are several validated questionnaires that can be used to evaluate patients with dry eye. Traditionally, the McMonnies Index and Ocular Surface Disease Index have been proven to be valid and reliable instruments for measuring the severity of dry eye disease in both patient care and clinical trials. Even more appropriate for our study, the contact lens dry eye questionnaire (CLDEQ) focuses solely on contact lens wearers and is designed to assess the prevalence, frequency, diurnal severity, and intrusiveness of dry eye ocular surface symptoms. More recently, the CLDEQ has been shown to be a more accurate and efficient screening questionnaire when compared with the McMonnies Index with regards to evaluating patients with contact lens-induced dry eye. Therefore, future prospective studies can use screening tools such as the CLDEQ to measure patients’ responses more accurately and reliably.

Previous studies involving other known treatments for contact lens-induced dry eye have also used several objective measures to aid in the evaluation of patients’ response to various treatments. Tear break up time has been used widely as a reliable test to assess tear film stability in both the clinical setting and many research trials. In patients with contact lens-induced dry eye, the tear break up time on the contact lens surface is about half of the same measure on the corneal surface. Rose bengal or lissamine green staining has also been particularly useful in detecting early or mild dry eyes by analyzing the conjunctiva. Tear interferometry can be used to evaluate pre-lens tear film thickness, contact lens center thickness, and post-lens tear film thickness. Reduced tear film thickness has been shown to be a significant factor in the presence of contact lens-induced dry eye. Additionally, pre-lens tear film thinning time, which is rapid in patients with dry eye, can be a significant factor associated with dry eye status. Further research analysis through measuring tear volume (meniscus height and phenol red thread) and tear osmolality can prove to be helpful as well in evaluating patients with dry eye. As mentioned previously, it is important to note the exact type of lens and lens care system used by patients. In our study, we did not record the exact soft lens type or lens care system, which should be included in further studies. In future studies, we hope to implement these additional objective parameters to supplement our results. However, it is important to note a balanced combination of objective criteria and subjective patient reporting of symptoms that are vital in assessing the overall effect of any treatment on a patient’s condition.

Overall, it has been demonstrated that argon laser punctal stenosis is a safe and potentially useful treatment of contact lens-induced dry eyes. It can be performed readily under topical anesthesia with no significant discomfort. More importantly, it provides the ability to titrate the level of treatment. Future studies may be beneficial to evaluate its role in non-contact lens wearers with mild-to-moderate aqueous tear deficiency.

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