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Original Article

Bicanalicular intubation procedure for acquired punctual stenosis

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Abstract: Purpose: The goal of this study was to assess the effectiveness of a bicanalicular intubation procedure for the treatment of acquired punctual stenosis (APS). Methods: A prospective study was performed on consecutive patients who accepted bicanalicular intubation to treat their APS. The intubation lasted for three to six months. Follow up time was for more than one year after removal of the Crawford tube. At follow-up, patients' signs and symptoms were carefully evaluated as well as the condition of their lacrimal punctum. Results: In total, 48 patients (67 eyes) met the criteria for acquired punctual stenosis. There were 39 females and nine males. The mean age was 48 ± 15 years (range, 13-73 years). The initial complaint for all patients was watery eyes. Both the upper and lower punctum were closed up in 61 eyes and a single punctum was missing in six eyes. The mean duration of symptoms was 14.9 ± 5.8 months (range 6-48 months). The mean follow up time was 12.5 ± 3.8 months after pulling out the Crawford tube. At the final follow-up, the treatment was anatomically successful for all 67 eyes. Of the total number of eyes, 63 (94%) showed a significant improvement in symptoms. Two eyes were relieved of indoor epiphora, and two eyes had minimal epiphora outdoors but only with wind or cold. One patient had lacrimal punctum granulation and subsequently underwent granulation excision, one patient had punctum dehiscence. Conclusions: Bicanalicular intubation is an effective, safe, simple, and relatively non-invasive treatment strategy for the management of epiphora secondary to APS.

Keywords: Lacrimal punctum, punctual stenosis, lacrimal intubation, Crawford tube

Introduction

Excessive tearing of the eye ("epiphora") is a common problem in everyday ophthalmological practice. Tear fluid is produced by the lacrimal gland, the accessory lacrimal glands, and the action of the lids forms the tear film, whose quantity and composition are subject to regulatory control by the efferent lacrimal pathway system. Epiphora due to lacrimal duct obstruction is a common ophthalmologic problem accounting for 3% of ophthalmologic clinic visits in some [1]. Obstruction of the lacrimal drainage system can be caused by congenital abnormalities, or it can be acquired in the course of life. Acquired obstruction of the lacrimal drainage system develops later in life and may be caused by a secondary process related to a recognizable causative factor or by a primary idiopathic process. Anatomical obstruction or stenosis may occur at any point along the lacrimal outflow pathway. Lacrimal punctum are the beginning of the lacrimal drainage system and the location of the outflow of tears. Acquired punctual stenosis (APS) is one of the most important reasons for acquired obstruction of the lacrimal drainage system. A survey in China indicated that lacrimal punctum closure was diagnosed in 20.6% of lacrimal duct obstruction patients [2].

Several different procedures have been described to treat APS. These include one-snip punctoplasty, two-snip punctoplasty, three-snip punctoplasty, simple punctal dilation, snip procedure with perforated punctal plug insertion, and punctal period. Preliminary clinical observations indicate that insertion of a Crawford tube punching, the use of intraoperative mitomycin C, and even total punctal excision with

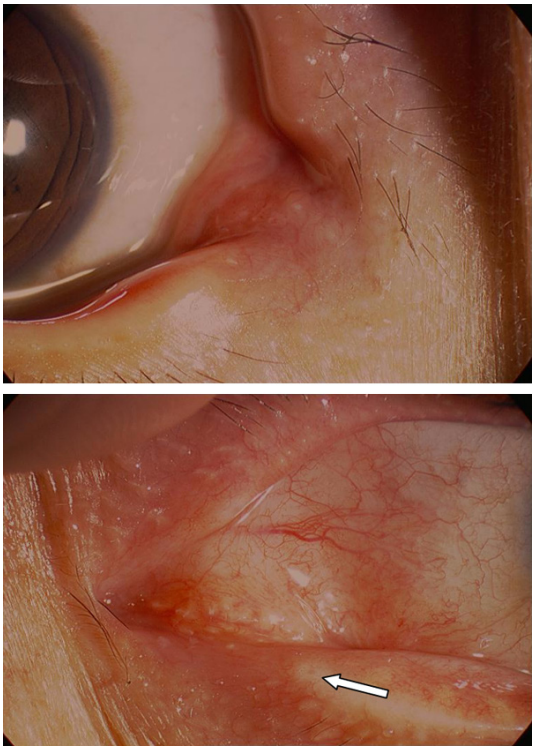

Figure 1. Symptomatic epiphora patients with missing punctum on both the upper and the lower puncta (white arrow).

microscopic externalization of the vertical canaliculus [3-9]. The limitation of any procedure that involves cutting the annular ring of the punctum is re-stenosis from fibrotic scarring. Here we studied the results of managing lacrimal punctum stenosis with bicanalicular intubation of Crawford tubes.

Patients and methods

This was a prospective study of patients with APS at our hospital, from March 2013 to March 2015. This study was approved by the Ethics Committee of Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University. The study complied with the tenets of the Declaration of Helsinki. Informed consents were obtained from all patients. The patients' puncta was dilated and irrigated through the nasolacrimal systems. Patients whose nasolacrimal systems were freely patent to irrigation with no reflux from the opposite canaliculus or punctum were included in this study. Patients with punctal agenesis combined with the absence of underlying canalicular tissue were excluded. All patients in this study had accepted puncta dilation at least three times before agreeing to Crawford tube insertion.

Symptomatic patients with missing puncta (**Figure 1**) underwent examination under anesthesia. All surgical procedures were performed by a single, experienced specialist lacrimal surgeon. A management plan was devised for eyes with lacrimal intubation of Crawford tube (**Figure 2A**). Lacrimal intubation of the Crawford tube was performed under topical anesthesia with 0.4% Oxybuprocaine Hydrochloride (Santen Pharmaceutical Co, Ltd). The inferior nasal meatus was treated with a pledget soaked in 0.4% Oxybuprocaine Hydrochloride (Santen Pharmaceutical Co, Ltd) and 1% Ephedrine Hydrochloride solution. First, a dilator was used to dilate the lacrimal puncta. After dilation of the puncta, irrigation through both the upper and the lower puncta with saline was attempted. A silicone Crawford tube was passed from both the lower and upper punctum to the nasolacrimal duct and out of the nose. The two ends were tied beside the nose and the tube was left in the nose for 3 to 6 months (**Figure 2B-E**). The follow up time was more than one year after pulling out the Crawford tube.

At follow-up and after Crawford tube removal, one of the authors carefully evaluated the degree of watering, patients' satisfaction, and symptomatic improvement to ascertain functional results. Patients were asked to quantify their symptoms as follows: (a) no resolution, severe epiphora the same as or worse than before the procedure; (b) partial resolution, substantial subjective improvement of epiphora; or (c) full resolution, complete absence of tearing or minimal epiphora, both indoors and outdoors.

Results

A total of 48 patients (67 eyes) with APS were studied. There were 39 females and nine males. The mean age was 48.4 ± 15.2 years (range, 13-73 years). The initial complaint for all patients was watering of the eyes. Both the upper and lower punctum were closed up in 61 eyes and a single punctum was missing in six eyes. The mean duration of symptoms was 14.9 ± 5.8 months (range 6-48 months). Patient data, including disease course and history of previous treatment, are shown in **Table**

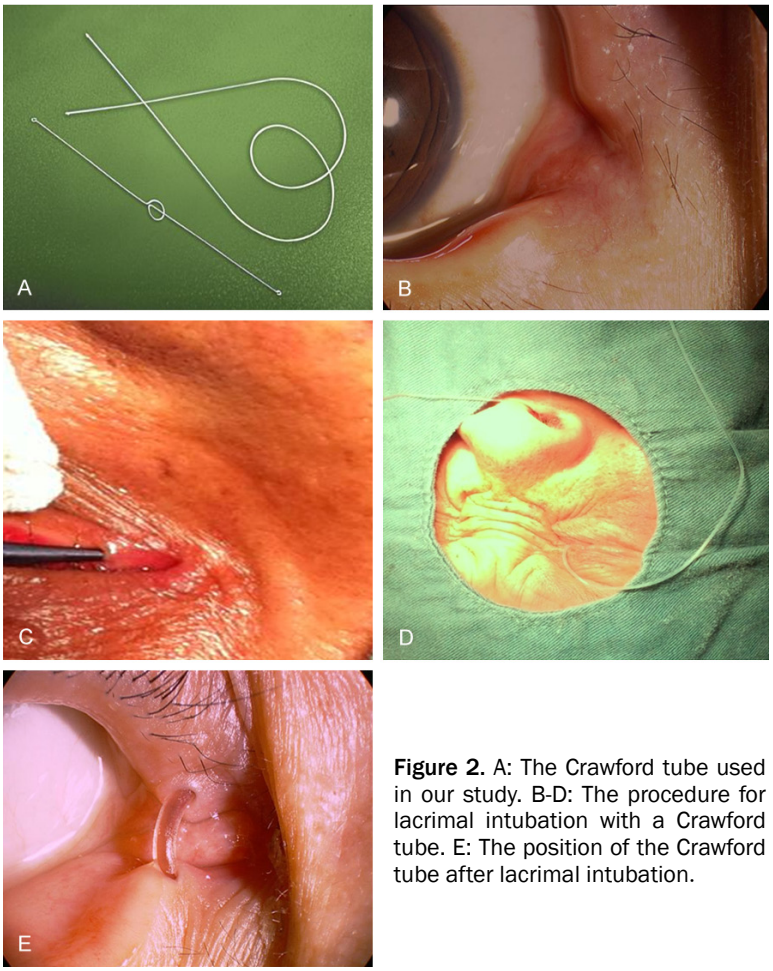

Figure 2. A: The Crawford tube used in our study. B-D: The procedure for lacrimal intubation with a Crawford tube. E: The position of the Crawford tube after lacrimal intubation.

Table 1. Baseline characteristics

Variables	All data
Patients (eyes)	48 (67)
Age (mean ± SD, years)	48.4 ± 15.2
Gender (M/F)	9/39
Duration of symptoms	14.9 ± 5.8 (months)
Bicanalicular intubation (OD/OS)	31/36
Cause of acquired external punctal atresia (eyes)	
Chronic blepharitis	25
Trachoma Cicatricial scarring	12
Chemical burn	11
Herpes simplex infection	5
Stevens-Johnson syndrome	4
Prolonged topical medication	5
Idiopathic or primarily age-related	5
Time to tube removal (months)	5.5 ± 0.8
Duration of follow-up (mean ± SD, months)	12.5 ± 3.8

1. Two patients also suffered with canalicular stenosis. Incomplete punctal canalization was observed in four cases with missing punctum and canalicular agenesis.

The possible causes of APS include: chronic blepharitis (25 eyes), Trachoma Cicatricial scarring (12 eyes), Chemical burn (11 eyes), Herpes simplex infection (five eyes), Stevens-Johnson syndrome (four eyes), and idiopathic, primarily age-related, or related to prolonged use of topical medication (10 eyes).

The Crawford tube was placed 3-6 months after the operation (mean: 5.5, SD: 0.8). The mean follow up time was 12.5 ± 3.8 months after pulling out the Crawford tube. At the final follow-up, we found anatomical success (with open punctum) in all 67 eyes (**Figure 3**). Of these, 63 eyes (91%) showed full resolution, which meant complete absence of tearing both indoors and outdoors. Two eyes were relieved of indoor epiphora, two eyes had minimal epiphora outdoors but only with wind or cold. One patient had lacrimal punctum granulation (**Figure 4**) and subsequently underwent granulation excision, one patient had punctum dehiscence.

Discussion

The basic principles of treatment of APS include creating an adequate opening, maintaining the punctal position against the lacrimal lake, enhancing tear access from the lacrimal lake to the punctal opening, and preserving the function of the lacrimal pump. Some authors have recommended performing a one-snip procedure to alleviate the punctal stenosis, followed by insertion of perforated punctal

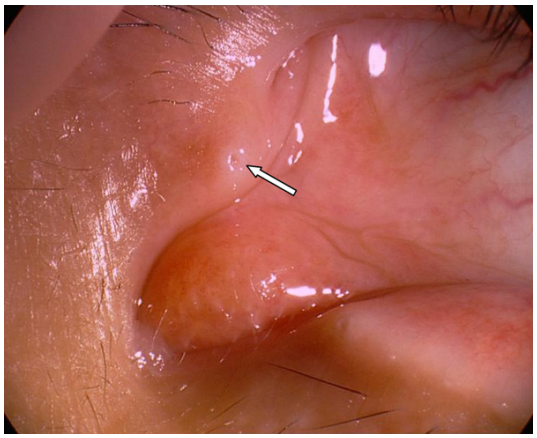

Figure 3. The puncta were open 12 months after pulling out the Crawford tube (white arrow).

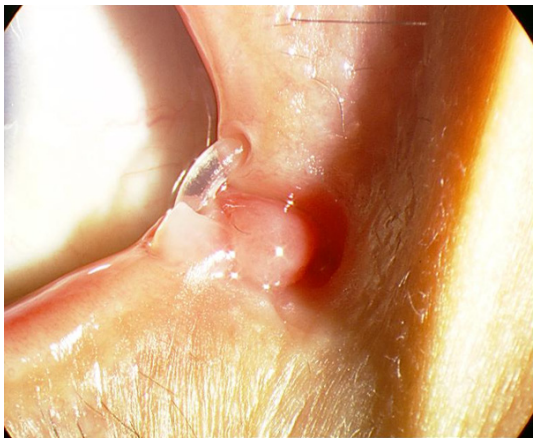

Figure 4. The patient suffered both lacrimal punctum granulation and punctum dehiscence.

plugs to reduce the risk of re-stenosis [5]. Kashkouli [10] described the use of mini-monoka in combination with a one-snip punctoplasty for acquired punctal stenosis with an 85% functional success rate. However, the drawback of devices inserted into the punctum is that they can migrate and cause blockages distally. The use of simple silicone tubing as a monocanalicular stent without a one-snip procedure has been described previously for the treatment of punctal stenosis [6]. The disadvantage of this technique, however, is that the stent requires a suture to ensure fixation. The reasons for these two complications may relate to the stimulation and tear of the silicone tube to the punctum. A bicanalicular intubation was performed with Crawford tube insertion to prevent re-stenosis during the healing phase and tried to address associated internal punctal and canalicular stenosis simultaneously. The rate of anatomical success of this study was 100% among 67 eyes with APS. A high functional success rate was also achieved, whereby over 94% of participants demonstrated a functional improvement in symptoms after we inserted a Crawford tube to treat their APS. This suggests that the Crawford tube helped to provide long term success in the treatment of APS with and without associated internal punctal and canalicular stenosis.

In our cases, chronic inflammation was the most common cause of punctal atresia. These data are in agreement with a previous finding in patients with APS [11]. APS and nasolacrimal duct obstruction (NLDO) can appear together or separately. Our results show a high functional success rate of Crawford tube insertion for the treatment of APS (64/67) demonstrating a functional improvement in symptoms. The insertion of a Crawford tube is quick, relatively painless, non-invasive, and generally without significant risk to the patient. The rationale for placing a Crawford tube is to widen the punctum and canaliculus, and the silicone tube remains in situ to prevent subsequent narrowing, similar to angioplasty. The procedure is completed under topical anesthesia, which eliminates any need for general anesthesia. There was one patient who suffered punctum granulation and another patient suffered punctum dehiscence. The reasons for these two complications may relate to stimulation and tear of the silicone tube to the punctum. In our study, there were no other serious complications, such as persistent corneal erosion, bacterial keratitis, or lid infection.

In conclusion, bicanalicular intubation of a Crawford tube can address two problems in patients with APS. The first is to prevent reunion and scarring of the punctum during the healing phase and the second is to address associated internal punctal and canalicular stenosis.

Acknowledgements

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formed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University.

Disclosure of conflict of interest

None.

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