Management of acquired punctal stenosis in trachomatous patients using single versus double silicone tube insertion (a pilot study)

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Objective
This study compares the effect of double versus single bicanalicular silicone tube in reducing tear meniscus and degree of tolerance to their presence in patients with punctal stenosis.
Materials and methods
The interventional case series included 30 eyes of 15 patients with acquired epiphora with bilateral visible stenotic puncti defined by inability to insert a 26-G cannula into the punctum without dilation. Under general anaesthesia, punctal dilation and bicanalicular silicone intubation were performed: one on the right side and two on the left side. Tear meniscus height was evaluated using a slit-lamp scoring system (Z–IV) at 1 week, 1 month, 6 months (when tubes were removed) and 12 months. Patients' satisfaction was evaluated by another scoring system (from 1 to 5) in addition to punctal shape and complications.
Results
All patients had trachoma associated with punctal stenosis. Tear meniscus was reduced compared with the preoperative status at every follow-up in both groups, especially at 1 and 6 months in favour of the double intubation group ($P < 0.05$). No difference was found following tube removal. High patient satisfaction and tolerance were reported while tubes were in place in both groups, with minimal complications.
Conclusion
Double bicanalicular silicone intubation is as well tolerated as single tubes and could be considered in the management of acquired punctal stenosis, especially in patients with trachoma, mostly because of punctum overstretch with more potential space for tear drainage. Further studies are required to evaluate retaining of the stent to prevent recurrence following tube removal.

Keywords:
bicanalicular, double, intubation, punctum, stenosis, trachoma

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Introduction

Punctal stenosis is narrowing of the external opening of the lacrimal canaliculus. It is also defined as a visible punctum yet smaller than 0.3 mm that requires probing with a punctal finder, followed by a standard punctal dilator to insert a 00 Bowman probe [1].

Punctal stenosis is a substantial etiological factor that should be considered in the assessment and treatment of patients with epiphora [2–4]. Incidence is still unknown and yet, reported rates range from 8 to 54.3%, depending on the setting, demographics and interobserver variability [1]. Chronic blepharitis and old age have been found to be risk factors. Female sex is still a controversial risk factor [1,4–8].

Acquired punctal stenosis may result from lid trauma [4,9], medial ectropion [10], infections (trachoma and herpes simplex virus) [11,12], cicatrizing conjunctivitis, for example, ocular cicatricial pemphigoid, chronic blepharitis (infectious ulcerative, seborrhoeic or rosacea) [9], tumours and toxic effects of some topical medications, for example, antiglaucoma, antiviral and topical steroids [13]. Systemic causes include chemotherapeutic agents, for example, docetaxel [14,15], autoimmune diseases such as Stevens–Johnson syndrome and graft-versus-host reactions [4,16], and fibrosis secondary to punctal plug insertion [9,17].

There are no uniform clinical guidelines for treatment [5]. Hence, many procedures have been suggested; for example, repeated punctal dilatation, punctal snip procedures [6,9], perforated plugs [4,18] and wedge punctoplasty [9]. Insertion of stents with or without snip procedures has been advocated especially

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in cases associated with canalicular stenosis. Different stents could be used such as self-retaining stents [19], mini-Monoka [20], or a regular bicanalicular silicone tube [14] that could also be retained for a long period. The use of mitomycin-C was also suggested as an adjunctive treatment in cases of punctal stenosis [21].

There are few reports on the use of silicone bicanalicular intubation in the management of acquired punctal stenosis associated with trachoma. This study aims to compare the outcome of double bicanalicular silicone stent insertion versus single bicanalicular tubes in the management of symptomatic cases of epiphora because of this cause.

Materials and methods

This is a controlled prospective interventional case series that was carried out in Kasr Al-Ainy and El Nour Hospitals and included 30 eyes of 15 patients from December 2010 till March 2013. All patients included in this study presented with epiphora of 12 months or more in duration. All the patients included had visible stenotic upper and lower puncti. Congenital cases, cases with lid trauma, malpositions, or laxity as well as lacrimal sac mucocele or previous lacrimal system surgery were excluded.

Detailed general and ocular histories were obtained including topical and systemic medications, followed by slit-lamp examination for associated conjunctival diseases. Tear film breakup time and corneal fluorescein staining were also performed to exclude dry eye. Cases with breakup time less than 10 s with or without corneal staining were excluded.

Tear meniscus height was measured using slit-lamp biomicroscopy after inserting a fluorescein strip wetted by artificial tears into the inferior fornix of the anaesthetized eye. The tear meniscus height was measured 5 min later with cobalt blue light and a scoring system (Z–IV) was used for comparison and correlation (Table 1).

Punctal stenosis was defined by inability to insert a 26-G cannula (outer diameter 0.47 mm) into the punctum without dilation, meaning that punctum would be less than 0.3 mm. Cases of punctal occlusion defined by inability to insert a 32-G cannula and/or absence of an opening that may show a vascularized membrane were excluded.

Table 1 Tear film scoring system

IV	Overflowing/lid eczema
III	High lake >2 mm
II	Normal (2 mm)
I	Low (1–2 mm)
Z	Very low/hardly detectable

Dilatation of the punctum was attempted to perform probing and irrigation test to ensure patency of the rest of the drainage system. Cases with canalicular or common canalicular as well as nasolacrimal duct obstruction were excluded and managed accordingly, whereas patients who fulfilled the inclusion criteria were scheduled for surgery within a period not more than 2 weeks from attempted irrigation.

The study was approved by the hospital's medical and ethical committee and an informed consent was obtained from all patients. The study and data collection conformed to all local laws and complied with the principles of the Declaration of Helsinki.

Procedure

Under general hypotensive anaesthesia and using a surgical microscope, bilateral punctal dilation using a Nettleship punctal dilator was performed. A bicanalicular silicone tube with a double metallic loader and outer diameter 0.7 mm (Eagle Labs, Rancho Cucamonga, California, USA) was inserted through the upper and lower puncti of each eye into the nasolacrimal duct to be retrieved from the nose using a grooved dilator at the area below the inferior turbinate. The tube was tied using a square knot, allowing a relaxed loop between the puncti, and ensuring that it was not pulling on them. A second silicone bicanalicular tube was further inserted into the left eyes of all the operated patients and secured in the same manner.

Topical antibiotic eye drops as well as nasal decongestants were prescribed for a week. Patients were followed up at 1 week, 1 month and 6 months for tear meniscus height using the same preoperative scoring system. Local punctal complications were checked. The degree of patients' satisfaction (in terms of tolerance to the presence of the tube as well as persistence of symptoms) was evaluated using a scoring system (ranging from 1 to 5, where 1 is very unsatisfied, 2 unsatisfied, 3 indifferent, 4 satisfied and 5 very satisfied). The side with a single tube was labelled group A, whereas the side with two tubes was labelled group B.

The tubes in both eyes were removed at 6 months and then patients were re-evaluated for punctal opening using Bowman's probes, tear meniscus height as well as subjective evaluation 6 months later.

Statistical analysis

The ordinal variables (tear film and patient satisfaction levels) were coded from 1 to 5 for statistical analysis. Statistical analysis was carried out using IBM SPSS v20.0 statistical software (IBM Corporation, Armonk, NY, USA). Descriptive statistics were calculated and the numerical data were summarized as mean ± SD, whereas categorical data were summarized in tables and percentages. Correlation between ordinal variables was assessed using Spearman's rank correlation coefficient. Intergroup comparisons were performed using the Mann–Whitney *U*-test, whereas those between preoperative data and postoperative data in the same group were performed using related-samples Wilcoxon signed rank test. A *P*-value of 0.05 or less was considered statistically significant.

Results

This study included 30 eyes of 15 patients: nine women (60%) and six men (40%), average age 42.92 ± 17.04 years. All included eyes had trachomatous palpebral subconjunctival fibrosis, and nine of the patients included (18 eyes) had additional post-trachomatous degenerations showing variable degrees of trachoma. In addition, eight patients (16 eyes) had a history of chronic topical medication use (12 eyes had chronic allergic conjunctivitis and four eyes had been subjected to antiglaucoma treatment), three patients (six eyes) had a history of bilateral cataract surgery and one patient (two eyes) had Stevens–Johnson syndrome.

Tear meniscus level was significantly reduced in both groups at every follow-up compared with the preoperative condition (Wilcoxon signed rank test) as can be seen in Table 2. However, the mean tear meniscus ranks showed a statistically significant reduction in value at 1 and 6 months in favour of the double intubation group ($P < 0.05$). However, no difference was detected between both groups at 1 week and 12 months, that is, after tube removal (Mann–Whitney *U*-test) (Table 3).

Patients were significantly satisfied throughout the follow-up period ($P < 0.05$). Their overall satisfaction was inversely proportional to tear meniscus height. It was low in the first postoperative week and yet it became significantly higher at 1 month and remained till the time of tube removal by 6 months. It was also found that patients' satisfaction decreased at the 12-month follow-up, that is, after tube removal (Fig. 1). Patients' satisfaction in both groups showed no statistically significant difference throughout the follow-up period ($P > 0.05$), with good tolerance to tube presence whether single or double (Table 4).

Punctum shape was observed and minimal deroofing of the canaliculus forming slit-shaped upper and lower puncti occurred in five eyes (16.7%), three in group A and two eyes in group B, and yet no stent migration was detected in either groups. Upper punctal granuloma was observed by 6 months in two eyes in group A (6.7%), whereas restenosis of upper and lower puncti occurred in 11 eyes (36.7%): six in group A and five in group B. Three eyes showed only lower punctum restenosis (10%): two eyes in group A and one eye in group B.

Discussion

In the current study, bicanalicular silicone intubation was used to treat punctal stenosis in symptomatic trachomatous patients. Whether single or double, symptoms were relieved and tear meniscus height was reduced as long as the tubes were retained in place, especially in the double intubation group; however, it started to increase with decreased satisfaction in both groups following tube removal.

There was no statistically significant difference in the tear meniscus level in both groups during the first week of the follow-up compared with the preoperative level ($P = 0.503$). This could be explained by the postoperative oedema that affected the punctum and upper system, leading to less space around the

Table 2 Wilcoxon signed rank test: tear meniscus level in both groups compared with the preoperative level

Intubation	*P*-value tear film			
	1 week preoperative	1 month preoperative	6 months preoperative	12 months preoperative
Single	0.001	0.001	0.001	0.004
Double	0.001	0.001	0.000	0.002

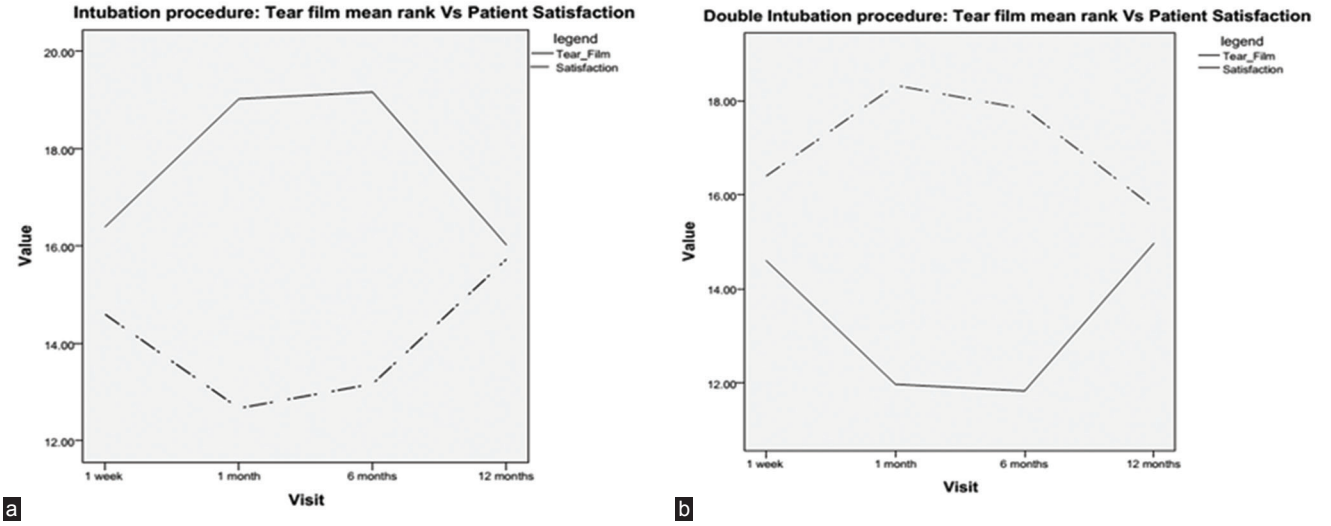
it shows a significant reduction of tear meniscus in both groups at every follow up as compared to the preoperative level.

Table 3 Mann–Whitney *U*-test: comparison of the mean sum of ranks over the follow-up period between both groups

Time	Intubation	Mean sum of rank	*Z* score	*P*-value
1 week	Single	16.40	–0.670	0.503
	Double	14.60		
1 month	Single	19.03	–2.340	0.019*
	Double	11.97		
6 months	Single	19.17	–2.406	0.016*
	Double	11.83		
12 months	Single	16.03	–0.344	0.731
	Double	14.97		

Lower tear meniscus was detected in the double intubation group compared with single intubation at 1 and 6 months of follow-up, with no difference 6 months following tube removal; *Significant.

Figure 1



Patients' satisfaction was inversely proportional to tear meniscus in both groups, whether single (b) or double (a), with a decrease in satisfaction following tube removal in both groups.

inserted tube to allow tear outflow. However, the tear meniscus in each group reduced more over the 1-month to 6-month follow-up period compared with the preoperative level ($P < 0.05$), which could be attributed to the potential space created between the stretched punctum and the stent placed.

It was also noted that the difference between the mean tear meniscus height in both groups became significant over the first month until the sixth month in favour of the double intubation group ($P = 0.019$ and 0.016, respectively). The relatively lower tear meniscus in the this group is suggested to be caused by the overstretch of the punctum that became dilated by the presence of two tubes that also formed a figure of 8, thus creating a small triangular space on each side and providing a wider available space for draining the tears compared with the close coaptation of the punctum on the single tube, allowing only a narrow tear outflow.

Insertion of stents varied from perforated punctal plugs to silicone tubes such as mini-Monoka (FCI Ophthalmics, Issy-Les-Moulineaux, France) with 82–84% functional improvement [1,20]. Silicone stents are suggested in punctal stenosis, especially if combined with canalicular stenosis with or without one snip punctoplasty [6,7].

In the current study, all patients had various degrees of trachoma, which is still endemic in Egypt and usually associated with severe progressive fibrosis; hence, more extensive interventions were required. All included patients had upper and lower punctal stenosis that led to symptoms that are less likely to be relieved using the monocanalicular tube. On the basis of this as well as stent availability, bicanalicular intubation was performed, with effective reduction of the tear film in both groups throughout the period of follow-up.

Table 4 Patients' satisfaction correlated to the mean tear meniscus and the presence of a single or double tubes using spearman ρ

Follow up time	1 week	1 month	6 months	12 months
1 week				
Correlation coefficient	1.000	0.499	0.417	0.300
Significance (two-tailed)	—	0.005*	0.022*	0.108
1 month				
Correlation coefficient	0.499	1.000	0.861	0.394
Significance (two-tailed)	0.005*	—	0.000*	0.031
6 months				
Correlation coefficient	0.417	0.861	1.000	0.579
Significance (two-tailed)	0.022*	0.000*	—	0.001*
12 months				
Correlation coefficient	0.300	0.394	0.579	1.000
Significance (two-tailed)	0.106	0.031	0.001*	—

Over the follow up period, patient satisfaction was inversely proportional to the tear meniscus height however there no statistically significant difference between both studied groups. Presence of two tubes was as well tolerated as the presence of one tube; *Significant.

Few reports are available to evaluate the role of bicanalicular stents in acquired punctal stenosis. However, it was recommended for the treatment of punctal stenosis associated with docetaxel, a chemotherapeutic agent, with or without canalicular obstruction. Recommendation of long-term intubation throughout the treatment period was also suggested [14].

The concept of double bicanalicular silicone intubation was suggested in cases of Dacryocystorhinostomy (DCR) with canalicular stenosis. Caversaccio and Hausler [22] reported 63% symptom-free patients who received two tubes after endoscopic DCR, whereas Hwang *et al*. [23] reported higher anatomical success rates (96.5%) in the double intubation group following DCR versus single tube group; yet, both showed the same functional outcome. Double intubation was also suggested for the management of nasolacrimal duct stenosis and resulted in complete resolution of symptoms in 79% of patients [24].

In this study, all punctal stenosis cases associated with canalicular stenosis were excluded to minimize the studied variables affecting the outcome, but it is believed that the absence of such an association augmented the tear drainage space while the stents are in place.

Following the removal of the tubes, the tear meniscus started to increase in some cases with detected punctal restenosis on examination (a total of eight eyes in the single intubation group and six eyes in the double intubation group). Stenosis started to reappear 3–5 months following tube removal (average = 3.6 months). Similar results were reported after removal of mini-Monoka [1] as well as spontaneous loss of punctal plugs because of accumulation of debris and induced inflammatory reactions [25]. The endemic nature of trachoma, which was found in all included patients, with its tendency to fibrosis in addition to other exciting factors, could play a role in recurrent stenosis a few months following tube removal [11]. It can cause conjunctival epithelial overgrowth and keratinization around the walls of the punctum as well as gradual fibrotic changes in the ostium with progressive occlusion [1].

In this study, patients were equally satisfied while the tube was retained and this satisfaction was inversely correlated to tear meniscus level. This subjective assessment through the questionnaire included tolerance to tube presence as well as symptoms' relief. The presence of two tubes was as equally tolerated as the presence of one tube. However, patient satisfaction decreased following tube removal because of the recurrence of stenosis and symptoms. Chronic irritation and reflex lacrimation because of allergic conjunctivitis, presence of trachoma and the use of topical antiglaucoma could be contributing factors.

Fayet *et al*. [26] found that the success rate did not seem to correlate with the duration of intubation after 1 month, but the complication rate did. Frueh [27] reported that most complications from silicone tubing occurred in the interval of 2–4 months after placement of the tubing and suggested a shorter time of intubation. Yet, both were referring to intubation in cases of congenital nasolacrimal duct obstruction.

No complications of significance were reported in either group although the stent was retained for 6 months. Two cases were associated with granuloma at the punctum by the end of the 6-month period in the single intubation group, suggesting that the occurrence of this complication was not related to the number of tubes inserted, but rather the forceful surgical opening of severely stenotic, hardly identified punctum. This minor injury might have flared up because of associated conjunctival pathology and possibly chronic mechanical irritation induced by the presence of the stent.

In this study, neither of the groups showed stent migration, a complication that can be easily avoided while using a bicanalicular silicone tube by allowing a loose loop between the upper and lower lids while tying both limbs. However, the shape of the punctum had changed into a slit in five eyes and this could have been because of minor tightening of the tube. In such cases, close follow-up was performed for any further tube migration so that they warranted early tube removal, and yet, none of the included cases required this.

Conclusion

Bicanalicular silicone intubation used for the treatment of isolated punctal stenosis is associated with lower tear meniscus that is more pronounced with double tube insertion. Double tubes were well tolerated compared with a single tube, and yet, patient satisfaction with the results was equal in both groups. Thus, changing the configuration of the inserted tube is a point that is worthy of further evaluation as it can provide an extra potential space for tear drainage while the stent is in place in cases of upper lacrimal system obstruction.

A larger sample would allow further consolidation of the current study as well as comparison of the effect of different stents, especially with different forms of punctal obstruction. Finally, assessment of recurrence of symptoms following tube removal requires further studies to evaluate the possibility of retaining the silicone tube in patients who are most likely to have restenosis.

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Conflicts of interest

There are no conflicts of interest.

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