Comparison between three snip punctoplasty and silicone tube stent in patients with primary punctal stenosis

Shaimaa Salama, Eman El Hefney, Rasha El Zeini, Ayman Abd El Ghafar.

Ophthalmology Department, Ophthalmic Center, Mansoura University, Mansoura, Egypt.

Corresponding author*:* Ayman Abd El Ghafar, Mansoura Ophthalmic Center, Faculty of Medicine, Mansoura University. Elgomhoria street, Mansoura, Egypt, Postal code 35516. Mobile: 0201005876138, Fax: 002-050-2203043 Email: aiman_eg_123@yahoo.com.

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Short title*:* 3-snip punctoplasty versus silicon intubation

ABSTRACT

Purpose: This study compares the safety and effectiveness of bicanalicular silicone intubation in individuals with primary punctal stenosis versus 3 snip punctoplasty.

Patients and methods: This study included 40 eyes with primary punctal stenosis (lower punctum) who were classified into two groups according to the surgical correction technique; three snip punctoplasty (group 1) and Bicanalicular silicone Intubation (group 2). All included cases were subjected to ophthalmic history taking and full ophthalmological examination including evaluation of the lacrimal tear strip, fluorescein dye disappearance test (FDDT), syringing and degree of epiphora. Patients were assessed at one day, one week, one month, three months and six months postoperative for evaluation of silicone tube stability, patency of the punctum, lacrimal tear strip, FDDT and degree of epiphora.

Results: There was highly statistically significant improvement in FDDT and grading of Epiphora in between two groups starting from the first day postoperative in group B. The incidence of patient satisfaction was higher in the silicone intubation group, but it didn't reach a statistically significant value. Recurrence of Epiphora was reported in two cases in group 1 and in 1 case only in group 2.

Conclusion: Bicanalicular silicone intubation is superior than 3-snip punctoplasty for the treatment of primary punctal stenosis.

Keywords: punctal stenosis, punctoplasty, silicone intubation, epiphora.

INTRODUCTION

One of the most typical symptoms that ophthalmologists see is epiphora, which can have a wide range of underlying causes. Patients with epiphora frequently experience wet eyes, a burning sensation, and ocular discomfort. One of the etiological causes of epiphora is punctal stenosis[1].

Punctal stenosis causes a narrowing of the lacrimal canaliculus' exterior aperture[2]. Epiphora incidence rates have been found to range from 8 to 54.3 percent, depending on the context, the population, and interobserver variability[3].

Punctal stenosis can be primary or acquired, due to many causes include trauma, dry eye disease, blepharitis, lid border malposition, aging-related changes, and secondary to radiotherapy or topical eye drops like glaucoma drugs[4, 5].

Numerous therapy approaches have been proposed in the literature, with vastly varying results and success rates. This may be due to the broad heterogeneity in pathology and the lack of clinical guidelines[6].

Nowadays, surgeons frequently use punctoplasty (1, 2, or 3 snip punctoplasty) or a combination of punctal dilation and mitomycin C treatment to treat primary punctal stenosis.

Additionally, stenting techniques like bi-canalicular Silicone Intubation, Mini-Monoka Stents, and perforated punctal plugs are becoming more popular[7, 8].

The current study compared the security and efficiency of bicanalicular silicon intubation and three snip punctoplasty in individuals with primary punctal stenosis.

PATIENTS AND METHODS

A randomized comparative interventional study was carried out between February 2020 and January 2021 at the Mansoura Ophthalmic Center, Mansoura University, in Egypt.

The 40 eyes of the main punctal stenosis research participants were divided into two groups, group 1 (which included 20 patients who underwent 3 snip punctoplasty), and group 2 (20 individuals underwent bicanalicuar silicone intubation were included). Cases from both genders with primary punctal stenosis of the lower punctum > grade 0 were included. Patients with chronic inflammation, blepharitis, dry eye syndrome, lid malposition, local irradiation, congenital punctal stenosis and punctal stenosis grade 0 were excluded.

After being given the approval by the Mansoura Faculty of Medicine's institutional review board (code number: MS.20.01.1005) and obtaining an informed written consent from the participants, full history was obtained for all cases. Full ophthalmic examination was done for all cases including assessment of the visual acuity (VA) using Landolt's broken rings chart. The anterior segment was evaluated using slit lamp biomicroscopy (Haag Streit BP 900, Koeniz, Switzerland), while the posterior segemnt was evaluated using an indirect ophthalmoscope.

Diagnosis of punctal occlusion

1. **Fluorescein Dye Disappearance Test:**
   - For FDDT a single drop of sodium fluorescein at a concentration of 2 percent was instilled into the lower fornix.
   - The tear meniscus's fluorescence along lower margin of the lid was observed using the cobalt-blue slit lamp filter.
   - As regard the scale developed by Ozgur et al., FDDT was classified into three categories: Grades one (3minutes), two (3-5 minutes), and three (> 5 minutes) all have time limits[9].

2. **Syringing**

Syringing was performed in this study to exclude proximal or distal obstruction combined with the primary punctal stenosis. Because syringing uses a higher hydrostatic pressure than the average tear outflow, it is not a physiological test. The test's results must be interpreted in relation to FDDT and clinical evaluation.

Technique

The punctum was dilated by means of a Nettleship dilator, followed by the application of a Bowmann probe while stretching the outer canthus, and finally, irrigation of the lacrimal system using a fluid-filled syring with a healon tip. Avoiding forceful irrigation is crucial for protecting the canaliculi and obtaining a more precise result. The syringing was repeated through the upper punctum if the inferior punctum was not present or if there was a canalicular occlusion. The patient was instructed to look down and laterally during the upper punctum irrigation as the canaliculus was stretched laterally and somewhat everted.

Interpretation

A blockage in the common canaliculus or nasolacrimal duct is indicated by regurgitation (reflux) through the opposing punctum. If fluid is re-injected through the same punctum without any delay, there is a canalicular obstruction, and another canaliculus must be used for the subsequent syringing. The nasolacrimal duct is said to be blocked when the lacrimal sac is enlarged. Irrigation into the nose is a sign of anatomical patent but not necessarily a working system. A partial obstruction is indicated by some reflux and partial irrigation into the nose.

Operative techniques

A. 3 snip punctoplasty:

- First, 0.4 percent topical benoxinate hydrochloride was used. Next, 2 percent lidocaine was injected under the lower punctum, and the punctum was then dilated with a Nettleship dilator.

- After the posterior wall of the punctum was stabilized with a pair of fine-toothed forceps, vertical 2-mm incisions were made into the posterior wall of the punctum and the vertical canaliculus using Vannas scissors.
- The horizontal incision that connected the ends of the two vertical incisions was used to cut off the posterior wall of the punctum and vertical canaliculus.
- Compression with a cotton tip for one minute was used to achieve hemostasis.

B. Bicanalicular silicone intubation:

- General anaesthesia was used in all patients.
- Dilatation of the upper and lower punctum using a Nettleship dilator then passing Bowman probe vertically then, horizontally while stretching the outer canthus till entering the sac (hard stop).
- Using a bicanalicular intubation set (2 probe bicanaliculus intubation set, FCI, France) one of the probes is passed through the upper punctum and then retrieved through the nasal cavity using an artery forceps.
- Utilizing the lower punctum to insert the second probe and retrieving it through the nasal cavity.
- After correcting traction on the punctal side of the tube, the 2 ends were knotted together in the nose with 8 or 10 knots.
- By being kept in situ for six months, the silicone tube was extracted from the nose after cutting the loupe on the conjunctival side.

Postoperative treatment and follow up examinations

Fluorometholone 0.1 percent eye drops and topical moxifloxacin 0.5 percent eye drops were applied four times per day for one week.

Clinical Protocol of follow up:

Patients underwent slit lamp examinations one day, one week, one month, three months, and six months following surgery to evaluate**:**

a) Stability of the silicone tube in the punctum.
b) Patency of the punctum.
c) Lacrimal tear strip (Meniscus).
d) FDDT
e) Degree of epiphora according to Munk et al., scale[22].

Data analysis using statistics

An IBM/SPSS. program SPSS 27.0, in (Chicago, Illinois), was used to analyze the data. Frequencies and percentages (%) were used to describe categorical data. Means and standard deviations (SD) were utilized to express quantitative data (Normal distributed data).

Chi-Square test (or Fisher's exact test) was used to compare two groups with categorical variables, whereas Student's t-test was used to compare two groups with parametric quantitative variables. Qualitative data between two dependent groups was compared using McNamar's test or marginal homogeneity test was used. For all tests, P values <0.05 are considered significant.

RESULTS

40 eyes with primary punctal stenosis of the lower punctum were in this study, and they were divided into 2 groups based on the surgical technique used to repair them (figure 1). Group 1(20 eyes) underwent correction using three snip punctoplasty (figure2) and Group 2 (20 eyes) underwent correction using bicanalicular silicone intubation (figure3). There was no statistically significant difference in the mean age of the cases between groups 1 and 2 (p=0.705); it was 42.80 ± 8.15 years for group 1 and 41.70 ± 10.01 years for group 2. In between 2 groups, there was no statistically significant relation, despite the fact that group 1 contained 8 men (40%) and 12 women (60%) and group 2 had 6 men (30%) and 14 women (p=0.507) (70%) (Table 1).

Table (1): Age and sex distribution in the two studied groups

Items	**Group 1 (Three snip punctoplasty) (n=20)**	**Group 2 (Silicone Intubation) (n=20)**	P value
Age (years)	42.80 ± 8.15	41.70 ± 10.01	0.705
Sex			
Males	**8 (40%)**	**6 (30%)**	0.507
Females	**12 (60%)**	**14 (70%)**	

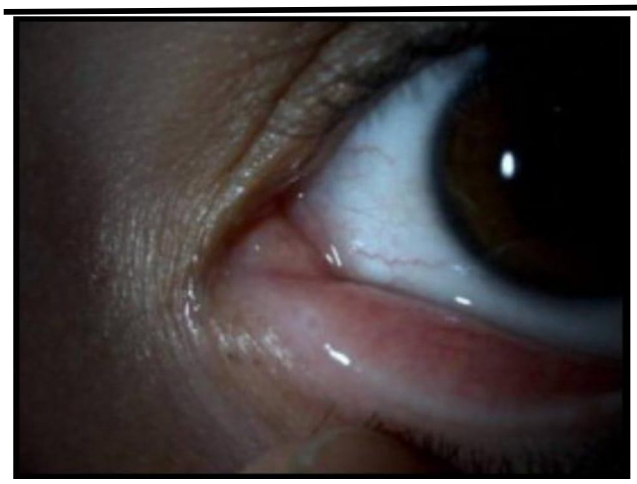

Figure (1): primary punctal stenosis of the lower punctum

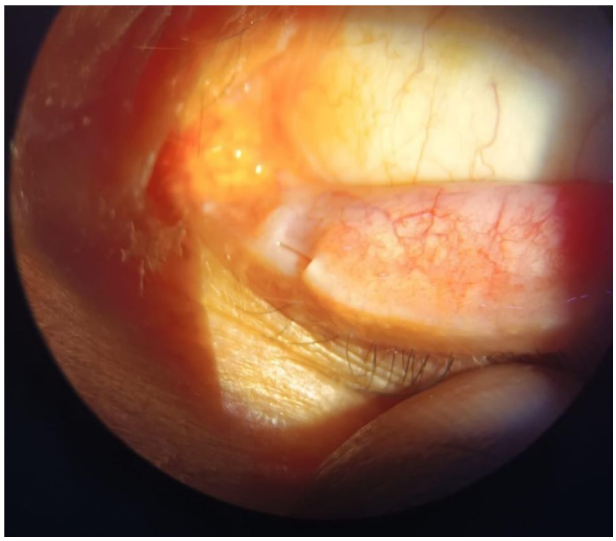

Figure (2): 3- snip punctoplasty

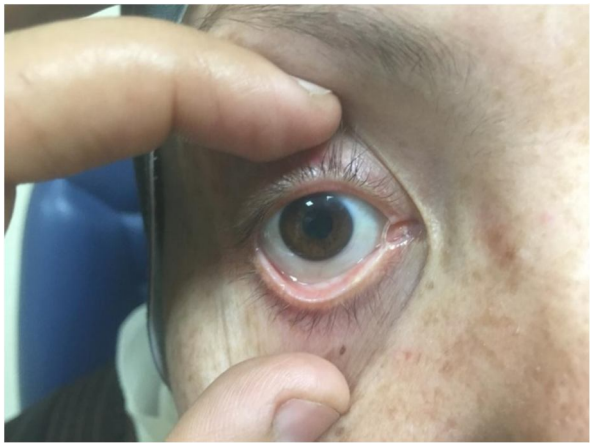

Figure (3): bicanalicular silicon intubation

In the preoperative stage, there were 12 cases (60%) with grade 2 epiphora and 8 cases (40%) with grade 3 epiphora while in group 2 there were 2 cases (10%) with grade 2 epiphora and 18 cases (90%) with grade 3 epiphora with statistically significant difference between the two groups (p = 0.001).

There was no statistically significant difference between the two groups (p = 0.197) at 1 day postoperatively between the 10 cases (50 percent) in group 1 and the 6 cases (30 percent) in group 2 with grade 1 epiphora.

There was no statistically significant difference between the two groups after 1 week postoperatively (p = 0.465), although there were 6 cases (30%) of grade 1 epiphora in group 1 and 4 cases (20%) in group 2.

At 1 month postoperative, there were 6 cases (30%) with grade 1 epiphora in the two studied groups. At 3 months postoperative, there were 8 cases (40%) with grade 1 epiphora in group 1 while in group 2 there were 4 cases (20%) with grade 1 epiphora without a difference between the two groups that was statistically significant (p = 0.168).

At 6 months postoperative, there were 8 cases (40%) with grade 1 epiphora in group 1 while in group 2 there were 2 cases (10%) with grade 1 epiphora (the difference between the two groups being statistically significant (p = 0.028)).

The grading of epiphora was higher within group 2 preoperative while at 6 months postoperative, this was reversed as the grading of epiphora was statistically significantly higher in group 1. The grade of epiphora in the two study groups significantly improved beginning on the first postoperative day compared to preoperative (table 2).

Table (2): Analysis of grading of epiphora along the duration of follow up in the two studied groups

Items	Group 1 (Three snip punctoplasty) (n=20)	Group 2 (Silicone Intubation) (n=20)	P value
Preoperative			
Grade 2	**12 (60%)**	**2 (10%)**	0.001*
Grade 3	**8 (40%)**	**18 (90%)**	
1 day postoperative			
No epiphora	**10 (50%)**	**14 (70%)**	0.197
Grade 1	**10 (50%)**	**6 (30%)**	
P1	**< 0.001***	**< 0.001***	
1 week postoperative			
No epiphora	**14 (70%)**	**16 (80%)**	0.465
Grade 1	**6 (30%)**	**4 (20%)**	
P1	**< 0.001***	**< 0.001***	
1 month postoperative			
No epiphora	**14 (70%)**	**14 (70%)**	1
Grade 1	**6 (30%)**	**6 (30%)**	
P1	**< 0.001***	**< 0.001***	
3 months postoperative			
No epiphora	**12 (60%)**	**16 (80%)**	0.168
Grade 1	**8 (40%)**	**4 (20%)**	
P1	**< 0.001***	**< 0.001***	
6 months postoperative			
No epiphora	**12 (60%)**	**18 (90%)**	0.028*
Grade 1	**8 (40%)**	**2 (10%)**	
P1	**< 0.001***	**< 0.001***	

P1: for comparison with preoperative data in each group

In the preoperative stage, all the cases in group 1 showed grade 3 according to fluorescein dye disappearance (FDDT) while grade 1, grade 2, and grade 3 cases, respectively, made up 2 cases (10%), 4 cases (20%), and 14 cases (70%) in group 2 according to FDDT test with statistically significant difference between the two groups (p = 0.029).

At 1 day postoperative, all the cases in group 1 showed grade 1 according to FDDT while in group 2 there were 18 cases (90%) and 2 cases (10%) with grade 1 and grade 2 respectively according to FDDT with no statistically significant difference between the 2 groups (p = 0.147).

At 1 week postoperative, in group 1, there were 16 cases (80%) and 4 case (20%) with grade 1 and grade 2 respectively according to FDDT while in group 2 there were 18 cases (90%) and 2 cases (10%) with grade 1 and grade 2 respectively according to FDDT with the difference between the two groups is not statistically significant (p = 0.376).

At 3 months postoperative, in both groups, there were 18 cases (90%) and 2 cases (10%) with grade 1 and grade 2 respectively according to FDDT.

At 6 months postoperative, in group 1, there were 16 cases (80%) and 4 cases (20%) with grade 1 and grade 2 respectively according to FDDT while in group 2 there were 18 cases (90%) and 2 case (10%) with grade 1 and grade 2 respectively according to FDDT with no statistically significant difference between the two groups (p = 0.376).

There was highly statistically significant improvement in FDDT in the two studied groups starting from the first day postoperative (Table 3).

Table (3): Analysis of grading of fluorescein dye disappearance test (FDDT) along the duration of follow up in the two studied groups

Items	Group 1 (Three snip punctoplasty) (n=20)	Group 2 (Silicone Intubation) (n=20)	Test of significance
Preoperative			
Grade 1	**0 (0%)**	**2 (10%)**	0.029*
Grade 2	**0 (0%)**	**4 (20%)**	
Grade 3	**20 (100%)**	**14 (70%)**	
P1	**< 0.001***	**< 0.001***	
1 day postoperative			
Grade 1	**20 (100%)**	**18 (90%)**	0.147
Grade 2	**0 (0%)**	**2 (10%)**	
P1	**< 0.001***	**< 0.001***	
1 week postoperative			
Grade 1	**16 (80%)**	**18 (90%)**	0.376
Grade 2	**4 (20%)**	**2 (10%)**	
P1	**< 0.001***	**< 0.001***	
1 month postoperative			
Grade 1	**16 (80%)**	**20 (100%)**	0.035*
Grade 2	**4 (20%)**	**0 (0%)**	
P1	**< 0.001***	**< 0.001***	
3 months postoperative			
Grade 1	**18 (90%)**	**18 (90%)**	1
Grade 2	**2 (10%)**	**2 (10%)**	
P1	**< 0.001***	**< 0.001***	
6 months postoperative			
Grade 1	**16 (80%)**	**18 (90%)**	0.376
Grade 2	**4 (20%)**	**2 (10%)**	
P1	**< 0.001***	**< 0.001***	

P1: for comparison with preoperative data in each group

In group 1, 80% of the cases were satisfied with the surgical results while in group 2 this percentage was higher (90%), but it didn't reach a statistically significant value (p= 0.376) (Table 4).

Table (4): Analysis of patients' satisfaction in the two studied groups

Items	Group 1 (Three snip punctoplasty) (n=20)	Group 2 (Silicone Intubation) (n=20)	P value
Satisfaction			
Not satisfied	**4 (20%)**	**2 (10%)**	0.376
Satisfied	**16 (80%)**	**18 (90%)**	

In group 1, two cases suffered from recurrence of epiphora (10%) due to restenosis of the punctum after 3 months of punctoplasty while only one case (5%) suffered from recurrence of epiphora in group 2 due to restenosis of the punctum after 5 months of silicone intubation with no statistically significant difference between the two groups (p=0.548). Only two cases in group 2 suffered from tube extrusion after 3 months of surgery (Table 5)

Table (5): Analysis of complications in the two studied groups

Items	Group 1 (Three snip punctoplasty) (n=20)	Group 2 (Silicone Intubation) (n=20)	Test of significance
Complications			
Recurrence of epiphora	**2 (10%)**	**1 (5%)**	0.548
Tube extrusion	**0 (0%)**	**2 (10%)**	0.147

DISCUSSION

40 eyes with primary punctal stenosis were included in the study, and they were divided into two groups based on the surgical strategy employed to treat them. The cases in group 1 underwent correction using three snip punctoplasty and the case in group 2 underwent correction using Silicone Intubation.

The mean age of the cases in groups 1 and 2 in the current study was 42.80 ± 8.15 years and 41.70 ± 10.01 years, respectively; there was no statistically significant difference

between the two groups (p=0.705). Group 1 contained 8 men (40%) and 12 women (60%) while group 2 contained 6 men (30%) and 14 women (70%) with no statistically significant difference between the two groups (p=0.507).

Rashdan et al. included 50 eyes from 30 individuals who had been given a punctal stenosis or occlusion diagnosis in agreement with our findings. They were divided into two equal groups of 25 eyes each. Group A receiving lacrimal stenting and group B receiving 3-snip punctoplasty. The distribution of sex and age between these groups was comparable. In Group A, 7 patients (41% of the total) were male, and 10 patients (59%) were female; in Group B, 7 patients (54%) were male and 6 patients (46%) were female (P = 0.46). In Groups A and B, the mean age and standard deviation were 34.32 9.11 and 40.54 7.66 years, respectively (P = 0.08).[10].

Moreover, Ammar et al. performed a study that was conducted on 65 eyes of 39 patients with acquired lower punctal stenosis grade 1 or grade 2 who were divided into two groups: group A (34 eyes of 20 patients operated on by intubation) and group B (31 eyes of 19 patients operated on by rectangular 3-snip punctoplasty). There were no statistically significant differences between the two groups regarding age (mean age in group A was 54.75 ± 6.84 years and in group B was 55.26 ± 7.01 years, with *P* = 0.818) or sex (*P* = 0.267) [11].

Starting on the first postoperative day in the current investigation, there was a highly statistically significant improvement in the grade of epiphora in the two analysed groups. The only time there was a statistically significant difference between the two groups was at 6 months of follow-up. At 6 months postoperative, there were 8 cases (40%) with grade 1 epiphora in group 1 while in group 2 there were 2 cases (10%) with grade 1 epiphora with a statistically significant difference between the two groups (p = 0.028).

Epiphora scoring revealed statistically significant differences between the two groups in Rashdan et alstudy .'s at each follow-up visit (P = 0.007, P = 0.001, P = 0.005, and P = 0.002, respectively, at 1-week, 1-month, 3-months, and 6-months). In 88 percent of instances with lacrimal stenting and 84 percent of cases with three snip punctoplasty, the punctum was still open at the one-week follow up. In instances with lacrimal stenting, Puncture was visible after one month in seventy six percent of cases and in cases with three-snip punctoplasty, in 56% of cases. In instances with lacrimal stenting, the punctum was open at 6 months in 65% of cases, and in cases with three-snip punctoplasty, it was open in 48% of cases. Their findings suggest that three-snip punctoplasty is not as effective in terms of anatomical outcome as lacrimal stenting methods, such as closed intubation or the insertion of perforated punctal plugs [10].

Comparing rectangular 3-snip punctoplasty (group B) to punctoplasty with silicone intubation (group A), Cao and his colleagues showed that group A provides better outcomes. Functional success was greater in group A compared to group B (65.1 % vs 46.7 %, P=0.047) [10].) In the study by Mandour et al., 24 people with total lower punctal obstruction were included. Each patient got a full ophthalmological examination, which included a dye disappearance test and a slit-lamp examination, because they had all been complaining of epiphora. Using a pigtail probe from the patent upper punctum, the scalpel-opened lower stenosed punctum was located. A silicone, self-retaining bicanalicular stent was inserted after the lower lacrimal channels were syringed to confirm their patency. One year following surgery, epiphora was nonexistent (grade 0) in 16 eyes (66.7%) and scarcely evident (grade 1) in 4 eyes (16.7 percent). A statistically significant difference compared to the preoperative epiphora was detected[12].

At six weeks, 82 percent of the 77 eyes in patients who underwent punctal dilation with Mini Monoka tube insertion rather than snip operations displayed improvement in epiphora, according to Hussain et al. But during the 6-week followup, they observed stent migration in one patient and early stent loss in three patients[13].

Following up on 87 eyes, Ali et al. discovered that while 82 percent of cases showed complete postoperative symptom relief, 10.3 percent of the eyes experienced epiphora and 5.3 percent had restenosis following punctoplasty[14]. Additionally, punctal stenosis was later treated with perforated punctal plugs,

the majority of which had an average success rate of up to 85%[15,16] .

In the current study, there was highly statistically significant improvement in the fluorescein dye disappearance test in the two studied groups starting from the first day postoperative. Nevertheless, during the course of the follow-up period, there was no statistically significant difference between the two groups.

According to a study by Mandour et al. (2019), grade 1 fluorescein dye disappearance time was observed one year after surgery in 20 instances (83.3%) and grade 2 fluorescein dye disappearance time was observed in 4 cases (3-5 minutes) (16.7 %)[12].

In the study by Ammar et al., functional success was attained in 32 (94.1%) eyes in group A and 22 (71.0%) eyes in group B (the stent group), with a statistically significant difference (P = 0.013), whereas anatomical success was attained in 31 (91.2%) eyes in group A and 26 (83.9%) eyes in group B[11].

Three-snip punctoplasty, silicone intubation, and predetermined tube retention were used in a distinct series of patients with trachomatous bi-punctal stenosis. An average of 29.6 months were spent keeping the tube in place, and success rate was 85%[17].

Al-Sulaiman and Al-Suhaibani claim that silicone intubation can treat punctal stenosis in individuals with allergic conjunctivitis, including both puncta, without the requirement for incisional punctoplasty. In general, the tubes were removed at 18.7 weeks, with functional and anatomical success rates of 87.8% and 91.8 percent, respectively[18].

In a prospective study, Using self-retaining bicanalicular stents, 3-snip punctoplasty was compared to punctoplasty alone by Chalvatzis et al. The former procedure performed better in terms of anatomical success (81 vs. 31 percent) and functional success (62 vs. 18 percent)[19].

In a study by Farag et al., the use of an autostable bicanaliculus intubation stent was found to be effective in treating acquired punctal stenosis in 20 (95%) of the eyes and anatomically successful in 19 (90%) of the eyes. Five (24%) of the eyes experienced premature spontaneous stent loss between the first week and the 2-month follow-up. One patient (5%) had persistent epiphora[20].

According to Al-study, Taher's 33 (82.5%) of 40 eyes had self-retaining bicanaliculus intubation set for the treatment of acquired punctal stenosis, and five (12.5%) of those 40 eyes experienced premature stent loss.

One of the main issues is the prolapse or loss of the lacrimal stent, which may require replacement. Long-term intubation can cause further problems, such as secondary bacterial or fungal infections, punctal or ostium granulomas, excessive bicanalicular stent loop tightening or inferior strain, punctal or ostium cheese wire, and, in rare cases, corneal erosions and infections[21].

In the current study, in group 1, two cases suffered from recurrence of epiphora due to re- stenosis of the punctum (10%) after 3 months of punctoplasty while only one case (5%) suffered from recurrence of epiphora in group 2 due to re-stenosis after 5months of silicone intubation without a difference between the two groups that was statistically significant (p=0.548). Only two cases in group 2 suffered from tube extrusion after 3 months of surgery.

According to Rashdan et al., stenosis was discovered in forty eight percent of the eyes in Group B by six months after surgery, compared to 36 percent of the eyes in Group A, who had postoperative problems. In group B, Only one eye's punctum was occluded[10].

Only one eye in Elbakary's research from 2022 displayed restenosis. This eye belonged to the category of severe stenosis (grade 1 punctum). Epiphora persisted in three eyes. One of them was caused by restenosis, and although having patent puncta, two of the patient's eyes exhibited epiphora[19].

Anatomical recurrence rate following standard rectangular three-snip punctoplasty was 5.7%, according to Ali et al.[14]

According to Chak and Irvine, the anatomical recurrence rate following conventional rectangle three-snip punctoplasty was around 6% (3/49 eyes) and conventional triangular three-snip punctoplasty was about 3% (2/50 eyes)[16].

CONCLUSION

Punctal stenosis is a major cause of epiphora being responsible for high incidence of ophthalmology clinic visits. The current results showed the superiority of silicone intubation technique over the three-snip punctoplasty technique in correction of primary punctal stenosis.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY

All data are included in this article.

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None

Conflict of Interest

Authors declare no conflicts of interest.

Corresponding author

Correspondence to: Ayman Abd El Ghafar

Email: aiman_eg_123@yahoo.com

Affiliations

Ayman Abd El Ghafar. Mansoura Ophthalmic Center, Faculty of Medicine, Mansoura University, Mansoura, Egypt.

Ethics declarations

Conflict of interest

Shaimaa Salama, Eman El Hefney, Rasha El Zeini, Ayman Abd El Ghafar. all authors have no conflicts of interest that are directly relevant to the content of this review.

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