Three-snip punctoplasy with everting interrupted sutures versus three-snip punctoplasty with mini-Monoka stent for management of punctal stenosis (prospective comparative study)

Yomna E. Radi, Essam S. Elmatbouly, Ahmed Daifalla, Ahmed Sherin M. Bayoumy

Department of Ophthalmology, Benha University, Benha, Egypt

Correspondence to Yomna E. Radi, 251H, Hadayek Elahram, Giza, Egypt.
Tel: +20 101 657 0336;
e-mail: yomnaophthalmology@gmail.com

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Purpose
To compare the results of three-snip punctoplasty with the placement of three everting interrupted sutures versus three-snip punctoplasty with mini-Monoka stent in managing punctual stenosis.
Patients and methods
Fifty adult patients underwent three-snip punctoplasty with three everting interrupted sutures in one eye (right eye) (group A), and the other eye (left eye) (group B) underwent three-snip punctopasty with mini-Monoka stent. The sutures and stent were removed 6 weeks after the surgery. Epiphora, punctal opening, tear height meniscus, fluorescein and disappearance test results were analyzed and compared to preoperative information.
Results
Hundred eyes of 50 patients with a median age of 59 years, and females accounted for 56% of the sample. Anatomical and functional success in the right eye (group A) was 87.8 and 85.7%, respectively. On the other hand, the left eye (group B) anatomical and functional success were 89.7 and 87.7%, respectively. Regarding epiphora, there was a statistically significant difference between presurgical and postsurgical follow-up examinations in both right and left groups regarding Munk score. TMH decreased all through the follow-up visits between the two groups, almost to half, with no significant difference between both groups.
Conclusion
Both three-snip punctoplasty with everting sutures and three-snip punctoplasty with mini-Monoka stent are successful techniques in the management of punctal stenosis.

Keywords:
epiphora, mini-Monoka stent, punctal stenosis, three-snip punctoplasty

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Epiphora due to acquired external punctal stenosis is quite a common and challenging condition [1]. Chronic blepharitis, dry eye, and certain eye drops, including antiglucomatous medications and topical steroids, have been associated with a high incidence of punctal stenosis [2]. Establishing a sufficient opening, keeping the punctal position against the lacrimal lake to improve tear access from the lacrimal lake, and maintaining the lacrimal pump's functionality are fundamental concepts in treating of punctal stenosis [3].

Since 1853, Bowman introduction of single-snip punctoplasty [4]. Several punctoplasty procedures have been introduced, including two snips, three snips, four snip, and even the Kelly punch [5]. All punctoplasty procedures depend on cutting through the punctum to reach the ampulla with an adequate opening that is difficult to fibrose [6]. The punctoplasty cutting could be single vertical, double vertical, three vertical cuts with two vertical cuts connected at the base, two vertical cuts, and one horizontal, or even four cuts, two vertical and two horizontal cuts to achieve a rectangular opening [7]. This could also be achieved through horizontal dilatation with three-snip punctoplasty [8].

However, restenosis related to the healing of apposed cut edges and disruption of canaliculus anatomy is a disadvantage of the punctoplasty procedure, leading to variable success rates [9]. The application of mitomycin-C and the use of silicon stents in the form of unicanilicular or bicanalicular stents, including the famous mini-Monoka stents and punctal plug insertions, have improved the success rates of punctoplasty procedures [10]. Associated

canalicular stenosis and internal punctal stenosis are quoted to be more than 45% in some series [11].

In this study, we intended to compare the results of the surgical technique of placement of three interrupted sutures in the posterior wall of the ampulla to maintain punctal opening and prevent re-approximation of the cut ends after rectangular three-snip punctoplasty in the right eye (group A) versus modified rectangular three-snip punctoplasty with a mini-Monoka stent in the left eye (group B).

Study design

A comparative prospective interventional randomized study.

Patients and methods

(1) The patients were selected from the outpatient ophthalmology clinic of Benha University Hospital, from January 2020 until April 2021. An informed consent was obtained from all cases which participated in the study. The study was approved by Benha University Institutional Review Board (MD 1-3-2020).
(2) Fifty adult patients (100 eyes) are divided into two groups: group A (right eye) underwent three-snip punctoplasty with three everting interrupted sutures, and group B (left eye) underwent three-snip punctoplasty with mini-Monoka stent.

Inclusion criteria

(1) Both sexes are included.
(2) Age from 25 to 70 years.
(3) Bilateral punctal stenosis grade 1 and grade 2, according to kashkouli and colleagues (Table 1), with epiphora grade 4 and grade 5 according to Munk score (Table 2).
(4) The normal position of the lower eyelid margin.

Table 1 Punctal stenosis scale by Kashkouli *et al.* [12]

Grades	Clinical signs
0	No papilla and punctum (punctal atresia). Surgery is needed to create a papilla
1	A membrane covers papilla; exudative or true membrane or fibrosis difficult to recognize with a standard punctum dilator, a 25-G needle, followed by a punctal finder
2	Less than normal size, but recognizable A punctal finder, followed by a standardized punctum dilator required
3	Normal regular punctum dilator is required
4	Small slit (≤2 mm). No intervention required
5	Large slit (≤2 mm). No intervention required

Table 2 Munk scale for epiphora [2]

Grades	Munk scale
0	No epiphora
1	Epiphora requiring dabbing less than twice a day
2	Epiphora requiring dabbing 2–4 times a day
3	Epiphora requiring dabbing 5–10 times a day
4	Epiphora requiring dabbing more than 10 times a day
5	Constant epiphora

Exclusion criteria

(1) Patients with canalicular or nasolacrimal duct occlusion.
(2) Patients with additional epiphora-causing conditions, such as dry eye syndrome and ocular surface disorders.
(3) Patients with abnormal eyelid position, such as lid laxity, entropion, and ectropion, were disqualified.
(4) Systemic diseases that cause dry eye, such as rheumatoid.
(5) Patients on topical medications as antiglucoma drops.

History

Detailed history including onset, frequency, and severity of epiphora. Previous topical medications, such as antiglucoma drops, antihistaminics, and lubricant drops were asked for.

Examination

(1) External examination: thorough examination to rule out causes of watering other than punctal stenosis. We looked for facial nerve palsy, lower lid laxity, lagophthalmos, blepharospasm, and abnormal blinking.
(2) Slit lamp examination: we looked at the punctal pathology and size. Conditions as conjunctivochalasis, punctal ectropion, blepharitis, and centurion syndrome were ruled out.
    (a) TMH using a slit lamp, changes in tear film volume and fluorescein and disappearance test were done for all cases before surgery.

Diagnostic tests

The fluorescein dye disappearance test was done before surgery.

Treatment technique

(1) Surface anesthesia with benoxinate 0.4% eye drops (E.I.P.I. CO., 10th of Ramadan, Egypt) for the ocular surface in both eyes and local infiltration anesthesia with 0.5% lidocaine solution (Xylocaine 0.5%; AstraZeneca,

Ontario, Canada) with epinephrine in a 1 : 100 000 weight ratio.

(2) The lower punctum was dilated using puctal dilator, and then successive Bowman's lacrimal probes up to 1.2 mm were inserted. A pair of small Westcott spring scissors were inserted closed into the punctum down to the ampulla and opened to dilate the lower punctum to about 2 mm [8].

(3) A rectangular flap was removed by making two parallel vertical cuts and a connecting cut at the base. Three interrupted sutures (9-0 nylon) were placed at the edges and the base of the wound in such a way also slightly evert the edges of the cut in the right eye.

(4) The same technique was used in the left eye three-snip punctoplasty with the insertion of a mini-Monoka stent (FCI Ophthalmics, Issy-les-Moulineaux, Cedex, France) and fixed with 9-0 nylon suture.

(5) The sutures and stent were removed 6 weeks after the surgery.

(6) TMH using a slit lamp, changes in tear film volume, and fluorescein and disappearance test were done for all cases before surgery.

(7) TMH was measured soon after the last blink with a medium-intensity horizontal slit beam and ×40 magnification. Without fluorescein, TMH was defined as the distance between the reflections of the upper and lower margins of the tear meniscus. The lower border of the slit beam was focused on the lower edge of the tear meniscus, and the slit was enlarged to get to the upper edge of the meniscus by dialing the aperture diaphragm lever.

(8) Patients' subjective symptoms were rated as improved or not improved. We also took note of all recurrences.

(9) Functional success was defined as a patient with no tearing, or only tearing less than twice a day, or tearing two to four times a day (epiphora grades 0, 1, and 2).

(10) Anatomical and surgical success was defined as patients having a patent punctum larger than 0.2 mm (grade 3, 4, and 5).

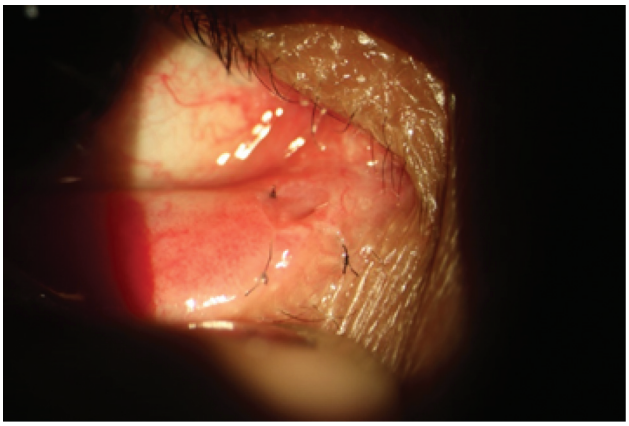
Follow up

TMH using a slit lamp, changes in tear film volume and fluorescein and disappearance test were assessed after surgery at 1 week, 1, 3, 6, 9, and 12 months (Fig. 1).

Statistical methods

Data was gathered, edited, coded, and entered using IBM SPSS, version 27 of the Statistical Package for Social Science. When parametric data were obtained, they were displayed as means, SDs, and ranges; when nonparametric data were discovered, they were displayed as medians, minimums, maximums, and interquartile ranges. Additionally, qualitative characteristics were displayed as percentages and numbers. Tests were used for comparison between categorical or nonparametric data, including: the Wilcoxon signed ranks test, exact McNemar test, Sign test, and Friedman test. Parametric and nonparametric tests of significance were validated via Kolmogorov–Seminrov test.

Figure 1



Right eye shows the position of the three interrupted sutures (nylon 9-0).

Results

The median age of the studied patients was 59 years. There was a female predominance in 28 (56%) out of 50 patients, while males were 22 (44%) out of 50 (Table 3). No surgical complications were reported.

We achieved a high anatomical success rate in both groups without any statistical difference. The anatomical success was 87.8% in group A and 89.7%

Table 3 Demographic data distribution across the studied group

Parameters	Descriptives [*n* (%)]
Age (years)	
Median	59
Minimum	22
Maximum	80
Range	58
Interquartile range	11
Sex	
Male	22/50 (44)
Female	28/50 (56)
Total	50

in group B at 12 months. There was a change in the anatomical success throughout the follow-up, with a slight decrease, especially after stitch and stent removal. Anatomical success in group A ranged from 98% in the first month to 87.8% in 12 months, while in group B ranged from 100% in the first month to 89.7% in 12 months. Although this decrease was not of statistical significance, we observed restenosis in seven cases in group A and six cases in group B over 12 months follow-up. We also reported relatively early restenosis in one case in group A, even before suture removal (Table 4), showed detailed follow-up of anatomical success (Fig. 2).

It depicts that the number of successful cases within the left group was greater than those in the right group.

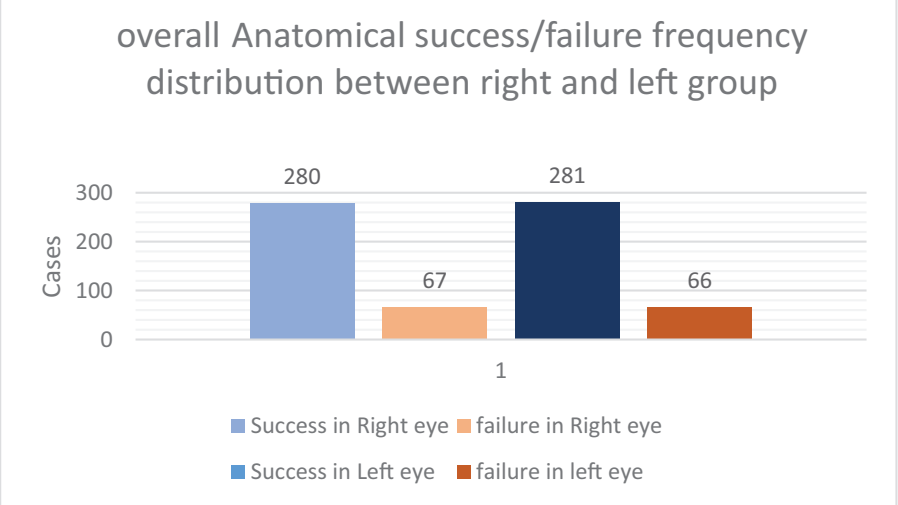
The functional success rate at 12 months was 85.7% in group A and 87.7% in group B, which is not statistically significant. Although we achieved a high functional success rate at the end of the follow-up, the early follow-up of functional success results, especially before suture removal, was affected by irritation from the procedure and sutures, from which the patient complained and was treated with topical steroids and lubricant in group A. While in group B, there was less irritation with one fixation suture which was more tolerable by most patients. Although there was no statistically significant difference between both groups in each follow-up visit. The addition of all follow-up data together resulted in an overall functional success proportion difference ($P<0.004$) in favor of group B (Table 5) showing a detailed follow-up of functional success.

This high functional success in both groups was confirmed by a statistically significant improvement of epiphora when comparing preoperative to

Table 4 Comparison of anatomical success achievement among the right against left group through all presurgical and postsurgical examinations

	Anatomical success					
	Right group		Left group			
	Success	No success	Success	No success	Test	
Examination time	*n* (valid %)	*n* (valid %)	*n* (valid %)	*n* (valid %)	Test of significance	*P* value
1 week	50 (100.0)	0	50 (100.0)	0		0.500
1 month	49 (98.0)	1 (2.0)	50 (100.0)	0		0.500
3 months	47 (94.0)	3 (6)	48 (96)	2 (4)		*P*=1
6 months	45 (91.8)	4 (8.2)	47 (95.9)	2 (4.1)		0.500
9 months	44 (89.8)	5 (10.2)	45 (91.8)	4 (8.2)		1.000
12 months	43 (87.8)	7 (12.2)	44 (89.7)	6 (10.3)		1.000
Overall	280 (81)	67 (19)	281 (81)	66 (18)	Cochran's *Q*	*P*=0.133

Figure 2



Bar chart compares the overall distribution of anatomical success/failure in both right and left groups.

Table 5 Comparison of functionally successful cases between right and left eye groups through presurgical and postsurgical examination

	Functional success				
	Groups [*n* (valid %)]				
	Right		Left		
Examination time	Success	No success	Success	No success	Test of significance
1 week	32 (64.0)	18 (36.0)	36 (72.0)	14 (28.0)	*P*=0.063
1 month	34 (68.0)	16 (32.0)	35 (70.0)	15 (30.0)	*P*=0.5
3 months	45 (90)	5 (10)	45 (90)	5 (10)	*P*=1
6 months	44 (89.8)	5 (10.2)	45 (91.8)	4 (8.2)	*P*=0.5
9 months	43 (87.8)	6 (8.2)	44 (89.7)	5 (10.2)	*P*=0.5
12 months	42 (85.7)	7 (10.2)	43 (87.7)	6 (12.2)	*P*=0.5
Overall	240 (69.16)	107 (30.84)	248 (71.47)	99 (28.5)	Exact McNemar *P*=0.004*

postoperative data throughout all follow-up visits ($P<0.001$). Table 6 shows a detailed comparison of epiphora preoperative to each follow-up visit (Fig. 3).

It depicts that the number of successful cases within the left group was greater than those in the right group, which means the number of failures in the right group was greater than in the left group (Fig. 4).

It is noticed that most cases fall in grades 4 and 5 (blue dots) presurgical. Then, almost all cases fell between 0 and 1 grades (orange dots) after 12 months from both maneuvers (Fig. 5).

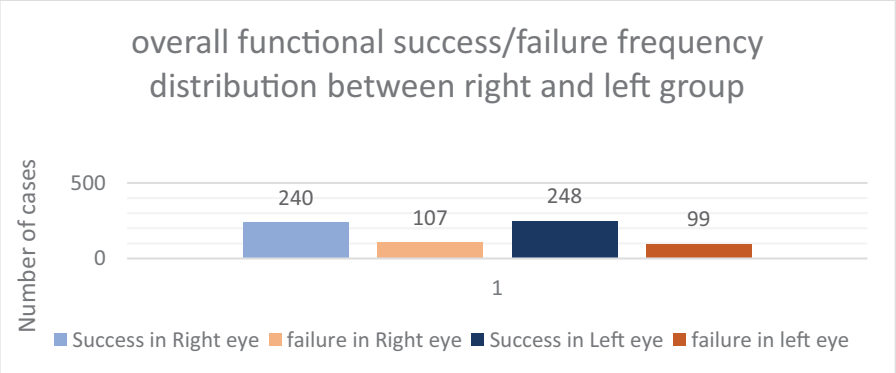
Objectively, TMH confirmed the high success rate and was decreased all through follow-up visits between the two groups almost to half, with no significant

Table 6 Comparison of epiphora Munk score between presurgical against all postsurgical examinations in both right and left eye group

Parameters	Group			
	Right		Left	
Epiphora Munk score	Test statistic	*P* value	Test statistic	*P* value
Presurgical				
1 week postsurgical	−5.905[b]	<0.001	−5.983[b]	<0.001*
1 month postsurgical	−6.043[b]	<0.001	−6.031[b]	<0.001*
3 month postsurgical	−6.218[b]	<0.001	−6.098[b]	<0.001*
6 month postsurgical	−6.158[b]	<0.001	−6.180[b]	<0.001*
9 month postsurgical	−6.162[b]	<0.001	−6.179[b]	<0.001*
12 month postsurgical	−3.462[b]	<0.001	−6.197[b]	<0.001*

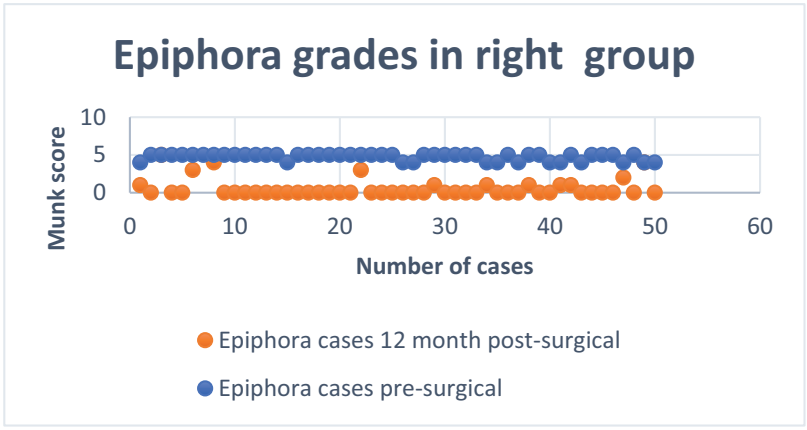
[b]Wilcoxon signed rank test. *Statistically significant *P* value at 0.05 alpha level.

Figure 3



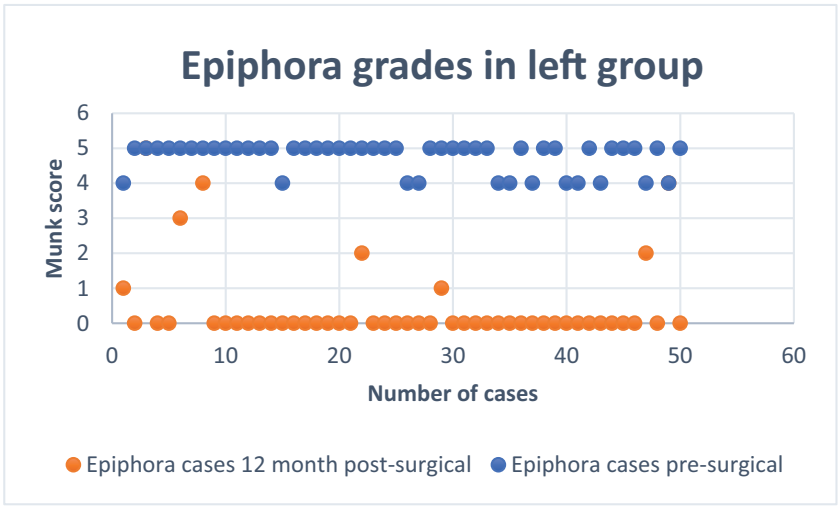
Bar chart compares the overall distribution of functional success/failure in both right and left groups.

Figure 4



Two scatter plots that depict the number of cases as classified by Munk score in both presurgical and 12-month postsurgical in the right and left eye groups.

Figure 5



Two scatter plots that depict the number of cases as classified by Munk score in both presurgical and 12-month postsurgical in right and left eye groups.

difference between both groups. There was a significant difference across each group independently when comparing preoperative to postoperative (Table 7).

Discussion

The problem of punctal occlusion and the achievement of good anatomical and functional success have been challenging for oculoplastic surgeons. The overall anatomical and functional success of different punctoplasty procedures, either alone or with stents, ranged from 89 to 96% and 85 to 93%, respectively [4]. Most studies showed that functional success is more than anatomical success, which had been explained by disruption of the anatomy of the ampulla by some punctoplasty procedures and, in some cases, by pump failure. Rectangular three-snip punctoplasty showed the highest anatomical and functional success and has been advocated by most surgeons, and they implied rectangular three-snip punctoplasty causes the least disruption of the anatomy. Chalvatzis *et al* [10] compared the three-snip punctoplasty with self-linking bicanalicular stents to punctoplasty alone in a prospective study, finding morphological success of 81 versus 31% and functional success of 62 versus 18%. In a study by Shahid *et al.* [13] on the outcomes of punctoplasty, the functional and anatomical success rates for punctoplasty surgery were 64 and 91%, respectively. There was no significant difference in anatomical success between a two-snip versus a three-snip punctoplasty technique (P=0.7).

Table 7 Depicts and compares the descriptive statistics of TMH across both right and left groups with the overall statistical difference across each group independently

Parameters	Group									
	Right				Left				Test	
Tear height meniscus	Median	Minimum	Maximum	Range	Median	Minimum	Maximum	Range	Test of significance	*P* value
Presurgery	0.600	0.4	0.8	0.4	0.500	0.4	0.8	0.4	Sign test	0.839
1 week	0.400	0.2	0.6	0.4	0.400	0.2	0.6	0.4		1
1 month	0.400	0.1	0.6	0.5	0.400	0.1	0.6	0.5		1
3 months	0.200	0.1	0.5	0.4	0.200	0.1	0.5	0.4		0.508
6 months	0.200	0.1	0.5	0.4	0.200	0.1	0.5	0.4		0.687
9 months	0.200	0.1	0.4	0.3	0.200	0.1	0.4	0.3		1
12 months	0.200	0.1	0.5	0.4	0.200	0.1	0.4	0.3		0.063
Overall	Friedman Test $P<0.0001$				Friedman Test $P<0.0001$					

Types of different stents, either unicanalicular (mini-Monoka) or bicanalicular stents, have been used to augment and increase both anatomical and surgical success in conjunction with three-snip punctoplasty, especially mini-Monoka, as they maintain punctal opening for longer duration and address any element of canalicular obstruction. According to Jeganathan *et al.* [14], the mini-Monoka stent had an 84% success rate in treating secondary canalicular obstruction. At 6 weeks, Hussain *et al.* [15] showed that 82% of 77 patients who underwent punctal dilation with mini-Monoka tube insertion without snip operations had improved epiphora. At the 6-week checkup, they did, however, find premature stent loss in three patients and stent migration in one patient. After performing a three-snip punctoplasty, Park *et al.* [16] introduced three interrupted sutures to preserve the punctal expansion and reported a 98% anatomical success rate.

In our study, group A functional and anatomical success was 85.7 and 87.8%, respectively. On other hand group B functional and anatomical success was 87.7 and 89.7%, respectively. There was a higher anatomical and surgical in group B than group A, although not statistically significant. Our observations attributed this difference to the fact that the mini-Monoka stent in group B addressed both punctal and canalicular occlusion and caused less irritation than the placement of three sutures technique.

We also observed a higher functional success rate in group B than group A due to the suture irritation throughout all follow-ups. Although there was no statistically significant change between group A and group B through each, follow-up visit, the combined data of all follow-up visits showed that the overall functional success was less than anatomical success, which can only be explained by pump failure, and that although the punctum is open, in some instances tear was not drained. We reported no stent loss or complication.

Conclusion

Both three-snip punctoplasty with everting sutures and three-snip punctoplasty with a mini-Monoka stent showed both anatomical and functional success. Although there was no statistically significant difference, there was superiority in three-snip punctoplasty with mini-Monoka through all follow-up months. Both three-snip punctoplasty with everting sutures and three-snip punctoplasty with a mini-Monoka stent are successful techniques in the management of punctal stenosis.

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Nil.

Conflicts of interest

There are no conflcits of interest.

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