Long-term outcomes of punch punctoplasty with Kelly punch and review of literature

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Abstract

Purpose   To report long-term outcomes of punch punctoplasty utilizing the Kelly punch and to compare the results with other described methods of punctoplasty in literature.

Patients and methods   A retrospective, non-comparative interventional case series of patients who underwent punch punctoplasty at the Hong Kong Eye Hospital over an 8-year period. A standard Kelly Descemet's membrane punch was utilized for punctal enlargement in all cases. Patient records and their operative records were reviewed. Anatomical success was defined by well-patent puncta on follow-up. Functional success was considered complete if tearing resolved completely postop and partial if residual tearing remained despite patent puncta and nasolacrimal drainage system. An OVID MEDLINE review was performed to compare success rates of various punctoplasty surgeries in literature.

Results   In all, 101 punch punctoplasties from 50 patients were performed between January 2008 to January 2016. At a mean follow-up of 34 months (range: 6–86 months), the anatomical success rate was 94% (95 out of 101 puncta), whereas functional success was 92% (54 out of 59 eyes). Two cases experienced postop dry eyes; otherwise no major complication was observed.

Conclusion   Punch punctoplasty via the readily available Kelly punch is a simple, minimally invasive procedure that demonstrates high anatomical and functional success as a sole primary treatment for simple punctal stenosis.

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Introduction

Acquired external punctal stenosis is a common and readily treatable cause of epiphora.

The incidence of punctal stenosis is still unknown, with reported rates ranging from 8 to 54.3%.[1] Many factors have been implicated in its pathogenesis—most commonly it is involutional or idiopathic, but it can also be secondary to chronic inflammation such as chronic blepharitis and dry eyes, eyelid malpositioning, trauma, eyelid neoplasms, and so on. Longstanding treatment with topical antiglaucomatous agents or chemotherapeutic agents such as mitomycin C have also been associated.[2]

The basic principles in the treatment of punctal stenosis include creating an adequate opening, maintaining the punctal position against the lacrimal lake, enhancing tear access from lacrimal lake to punctal opening, and preserving the function of the lacrimal pump.[3] However, there has been no consensus on the most efficacious way to perform the procedure.

The snip procedure beginning with bowman's one snip punctoplasty was first described in 1853[4] and has now been modified and developed into one of the most commonly practiced punctoplasty procedures. Variations ranging from 1 to 4 snips described in literature exist.[5] However, restenosis related to healing of apposed cut edges and disruption of canaliculus anatomy is a disadvantage of this procedure leading to variable success rates.

This has led to suggestions of adjunctive approaches such as application of mitomycin C[6,7] and punctal plug insertion.[8] Some authors propose adding on self-retaining bicanalicular stents,[9] or mini-monoka tubes[10] on top of snip punctoplasty procedures as associated canalicular stenosis and internal punctal stenosis is quoted to be more than 45% in some series.[3] However, these more complex procedures are also not routinely used in uncomplicated cases. Chalvatzis *et al*[3] reported 25% of patients requiring reintroduction of displaced silicon stents,[9] and there are also problems of chronic irritation with the mini-monoka stents.

As an alternative to the snip procedure, Hughs and Maris[11] in 1967 first described the use of a punch to perform posterior ampullectomy, revisited in 1991 by Edelstein and Reiss[12] with a specially designed reiss punctal punch. Although this technique was not popularized, Carrim *et al*[13] later followed up by reporting punctoplasty with the readily available Kelly Descemet's membrane punch.

For the past 10 years we have offered punch punctoplasty with Kelly punch to the majority of our patients presenting with symptomatic punctal stenosis. The purpose of this study is to examine the effectiveness of this simple procedure in achieving successful outcomes as a primary first-line therapy for epiphora associated with punctal stenosis.

Materials and methods

Retrospective chart review of all patients who underwent punch punctoplasty at the Hong Kong Eye Hospital from January 2008 to January 2016 was reviewed. Data retrieved included patient demographics, presenting symptoms and duration, grades of punctal stenosis, associated ocular findings, procedures performed, intraoperative findings, and finally outcome in terms of functional and anatomical success.

In literature, the methods provided on the assessment of punctal size[12,13] are usually based on an observational assessment or the use of either 26-G needle or 00 bowman probe alone. In our series, we categorized punctal grades as defined by Kashkouli *et al*:[14]

- Grade 0: punctal atresia where no punctum opening is identifiable.
- Grade 1: barely recognizable punctum in which the opening may or may not be covered by a membrane or fibrosis.
- Grade 2: punctum less than normal size, but recognizable.
- Grade 3: normal-sized punctum able to be entered by a 00 bowman probe.
- Grade 4 (<2 mm) and Grade 5 (>2 mm) are larger than normal punctum.

The indication for punctoplasty in our series is a patient with epiphora, with clinically stenosed punctum grade 2 or smaller, with lacrimal syringing being performed or attempted preoperatively, and with no other evident cause of epiphora. Cases with combined procedures, for example, lid position correction on top of punctoplasty, were excluded to avoid confounding factors. We also only included cases with postoperative follow-up longer than 6 months.

To compare outcomes of different types of punctoplasty surgeries described in literature, an OVID MEDLINE search was conducted with the following keywords: 'punctoplasty' and 'punctal stenosis'. Isolated case reports and non-English language literature were excluded.

Surgical method

Punctoplasty was performed in all cases under local anesthesia with 2% lignocaine with 1:200 000 adrenaline as shown in Figure 1. The punctum sites were identified
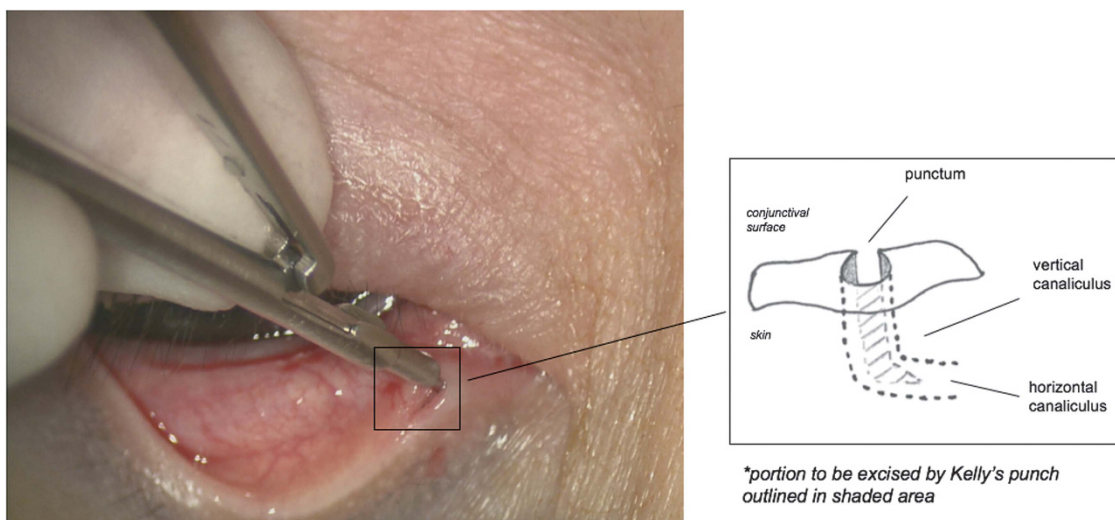

Figure 1 Intraoperative photograph and schematic diagram of a right lower lid punctoplasty with the Kelly Descemet's membrane punch. Wedge excision of tissue from the posterior wall and posterior ampullectomy is performed. Extending the removal of punctal tissue 2–3 mm beyond the vertical component of the canaliculus can prevent re-approximation of the raw cut ends of the ampulla causing failure.

and marked. Membranes covering the punctum site were perforated with a 25/27-G needle as required. The punctal opening was enlarged circumferentially using a punctal dilator. A Kelly Descemet's membrane punch with a 1.0 mm diameter head and a 0.75 mm-deep bite was then inserted into the ampulla to perform posterior ampullectomy and achieve enlargement of the punctal opening. In our experience, we usually remove punctal tissue up to 2–3 mm beyond the vertical component of the canaliculus. Cautery is avoided throughout the procedure to limit inflammation and subsequent scarring. Hemostasis was achieved in most cases with compression and cold saline alone; the use of cotton tip applicator soaked with 2.5% phenylephrine eyedrops could further reduce bleeding. Syringing and probing were performed at the conclusion of surgery to confirm the patency of the lacrimal drainage system and to check for any associated common canaliculus or nasolacrimal duct obstruction. Postoperatively, all cases received combined steroid and antibiotics eyedrops (Gutt Decadron C, mixture of Gutt Dexamethasone and Gutt 0.5% chloramphenicol) for 2 weeks. No adjuvant therapy such as mitomyin C was used in our series.

At each follow-up visit, a patient's symptoms were recorded, and slit lamp examination of puncta and syringing and probing were performed. Anatomical success was defined as a visible well-patent puncta (grade 3–5) on physical examination, and functional success was defined as a complete resolution of epiphora upon follow-up. Partial success was defined as patent puncta on physical examination with improved but residual symptoms of epiphora.

Institutional review board approval was obtained from the Research Ethics Committee of the Kowloon Central/Kowloon East Cluster, and the study adhered to the principles outlined in the Declaration of Helsinki.

Results

Altogether, 101 puncta from 50 patients were studied. There was a female predisposition with 36 women and 14 men in the study. The mean age at presentation was 59 years (range 3–86 years). Bilateral stenosis was noted in 30% (15/50) of the patients. All patients presented with

tearing. In terms of identifiable etiologies, eight cases were documented to have chronic blepharitis, three cases were on chronic antiglaucomatous eyedrops, and two cases had recurrent canaliculitis. There were three cases of iatrogenic punctal stenosis following punctal cauterization, which was used as a treatment for dry eye.

The majority of cases in our series (69%; 70/101) had grade 1 stenosed puncta, followed by 27% (27/101) of grade 2 size and 4% (4/101) with grade 0 punctal atresia. The mean punctal grading is 1.14 ± 0.5. Table 1 presents an overview of recruited patient demographics and clinical profile.

Following punctoplasty, syringing and probing revealed canalicular or nasolacrimal duct obstructions in 9% (6/65) eyes. Excluding these cases with post-puncta occlusion, at a mean follow-up of 34 months (range: 6–86 months), complete resolution of symptoms was achieved in 92% (54/59) of eyes. Subgroup analysis of the five eyes with functional epiphora despite patent puncta and lacrimal system revealed two cases with underlying chronic blepharitis and one case of lacrimal pump failure secondary to horizontal lid laxity. In two cases, a cause for the functional epiphora could not be found.

Anatomical success was maintained in 94% (95/101) at 6-month follow-up. The three eyes with punctal restenosis showed evidence of restenosis by 1 month postop. Thirty-five cases available for long-term follow-up of more than 1 year (range 12 to 86 months), showed well patent puncta at 1 month up to latest follow up. No cases required reoperation or secondary procedures in our series. Two patients complained of postoperative dry eye; otherwise there were no major complications observed after punch punctoplasty in our series. The clinical outcomes of punctoplasty surgery is summarized in Table 2.

Discussion

Our series demonstrates high efficacy of punch punctoplasty as a primary procedure, with an anatomical success rate of 94% and a functional success rate of 92%. The results echo those of Edelstein and Reiss's series on wedge punctoplasty with reiss punctal punch, which achieved 95% anatomical success and 92% functional

Table 1 Patient demographics

Patients/eyes/puncta (no.)	50/65/101
Sex (M/F; no.)	14/36
Mean age at surgery (years; range)	59 ± 18.5 (3–86)
Grade of punctal stenosis (0/1/2; no.)	4/70/27
Mean punctal grading	1.14 ± 0.5
Laterality R/L/B (no.)	16/19/15

Table 2 Clinical outcome of punctoplasty surgery

Anatomical success no. (%)	95/101 (94)
Functional success no. (%) excluding cases with post-puncta occlusion	54/59 (92)
Restenosis (%)	6/101 (6)
Common canalicular or nasolacrimal duct obstruction no. (%)	6/65 (9)

Table 3 Literature review of current evidence on punctoplasty

Authors	Period	Place of study	No. of cases	Type of surgery	Success rate	Study type
Offwutt *et al*[22]	1993	USA	32 Eyes 23 patients	Excision of stenotic puncta and microscopic externalization of the vertical canaliculus	Anatomical: 100% Functional: 96%	Prospective FU 6 months to 4 years
Eldstein and Reiss[12]	1993	USA	38 Eyes 21 patients	Punch punctoplasty ± lid tightening	Anatomical: 95% Functional: 92%	Retrospective FU ~ 12 months
Kashkouli *et al*[3]	June 1999 to May 2002	UK	53 Eyes 45 patients	Horizontal one snip + mini-monoka stent	Anatomical: 96.2% Functional: 84.9%	Prospective FU mean 18.5 months
Chak *et al*[19]	January 2003 to January 2005	UK	108 Eyes 75 patients	Three-snip procedure	Functional: 89.8%	Retrospective FU mean 0.68 years
Shahid *et al*[18]	April 2002 to June 2006	UK	205 Puncta, 135 patients	2/3-Snip procedure	Anatomical: 91.1% Functional: 64%	Retrospective FU mean 23 weeks
Konuk *et al*[8]	May 2002 to September 2006	Turkey	44 Eyes 26 patients	Perforated punctal plugs	Functional: 84.1%	Retrospective FU mean 19 ± 13.4 months
Caesar *et al*[16]	2005	UK	53 Patients	Three-snip procedure	Functional: 92%	Retrospective FU duration not defined
Murdock *et al*[17]	January 2006 to January 2010	USA	50 Eyes 32 patients	Three-snip procedure	Functional: 86%	Retrospective FU 6–17 months
Hussain *et al*[10]	January 2008 to December 2009	UK	123 Eyes 77 patients	Mini-monoka stent after punctocanaliculoplasty	Functional: 88%	Retrospective FU at least 6 weeks
Kim *et al*[20]	February to September 2010	Korea	45 Eyes 26 patients	Rectangular four snip procedure	Anatomical: 88.9% Functional: 93.3%	Retrospective FU 6 months
Chalvatizis *et al*[9]	February 2011	Greece	32 Eyes 16 patients 32 Eye 16 patients	Three-snip procedure Modified three-snip procedure + bicanalicular self-retaining stent	Anatomical: 31.2% Functional: 18.7% Anatomical: 81.2% Functional: 62.5%	Prospective FU 6 months
Ali *et al*[15]	2011–2013	UK	87 Eyes 56 patients	Rectangular three-snip procedure	Anatomical: 84.3% Functional: 74.7%	Retrospective FU 6 months

success at a mean follow-up time of 12 months.[12] However, in their series, only three eyelids of three patients received reiss punctoplasty alone, whereas 35 eyelids received horizontal lower lid tightening in conjunction with punctoplasty.

Literature review shows a competitive edge of punch punctoplasty compared with other punctoplasty techniques as displayed in Table 3. Compared with the variable rates of success with the snip procedure, quoted to range from 31.2 to 92%,[15–20] the success rate with punch punctoplasty seems to be superior. It is also comparable to the success rates of combined procedures with bicanalicular stents or mini-monoka stent,[3,9] suggesting that a more complicated combined procedure for punctoplasty may not confer extra advantage. In turn, it may increase operating time, patient discomfort, and infection rates, and may impose possibility of other complications such as stent displacement.[9]

Punctal size varies widely in normal asymptomatic individuals, ranging from 0.1 to 0.8 mm^2, with a mean of 0.321 mm$^{2(ref. 21)}$ and the optimal punctal aperture for maximal tear outflow has not been established. Punch punctoplasty with a standardized Kelly punch allows for a controlled enlargement of the punctum and possibly less bleeding, which in turn lowers the risk of cicatricial punctal restenosis from scar formation and apposition of the raw cut ends. With the more selective and targeted de-roofing of the canaliculis, the punctum and proximal canaliciulus are allowed to marsupialize, creating a funnel-shaped opening that may facilitate existing lacrimal pump function. This technique offers advantage over the traditional three and four snip punctoplasties, as there is considerable difficulty in making controlled and uniform cuts along the vertical canaliculus especially in severe punctal stenosis. Inadvertent cutting outside the canaliculus creates a larger wound, increased bleeding, and subsequent healing with fibrosis. In our practice, we extend the ampullectomy to 2–3 mm beyond the vertical component of the canaliculus, as we believe that scarring and contraction during the healing process will eventually cause the punctal opening to become smaller. Therefore, we aim to create a larger opening during the surgery. The extent of tissue trauma is still much less compared with the conventional three-snip procedure, taking a balance between adequate tissue removal to prevent re-approximation of the raw cut ends of the ampulla causing failure while limiting the destruction of the capillary action of the canaliculus to the punched-out segment only.

In our study, functional and anatomical success rates are comparable, but literature reviews show anatomical success commonly exceeding functional success.[2,9,12,15,18,22] The importance of appropriate preoperative workup is emphasized to improve a patient's symptoms. As multiple factors may contribute to epiphora, it is important to determine the major causative factor in symptomatic epiphora. In our series, five eyes had functional epiphora despite patent puncta and lacrimal system. In two cases, symptoms improved after addressing underlying chronic blepharitis and in one case horizontal lid laxity likely contributed to functioning tearing; however, the patient was not keen for lid surgery. A definite cause for the functional epiphora could not be found in the other two cases. In these cases, non-surgical factors such as blepharitis could be addressed first and punctoplasty be considered later if the patient is still symptomatic.

To our knowledge, we present the largest series to date studying the long-term results of punch punctoplasty alone as a primary treatment for punctal stenosis. We are also able to demonstrate promising long-term results with this simple non-invasive procedure with a long mean follow-up time of 34 months. However, our study is limited by its retrospective nature and the lack of a standardized objective method to assess epiphora symptoms quantitatively.

Conclusion

We believe that punch punctoplasty is a good surgical method for the primary treatment of isolated punctal stenosis. It is a simple and less invasive procedure with minimal damage to the canaliculus and the lacrimal pump system.

Summary

What was known before
- Acquired external punctal stenosis is a common and readily treatable cause of epiphora.
- Multiple methods of punctoplasty have been described, but there has been no consensus on the most efficacious way to perform the procedure.
- Snip procedure is a simple and widely practised method. However, restenosis related to healing of apposed cut edges and disruption of canaliculus anatomy is a disadvantage of this procedure, leading to variable success rates.

What this study adds
- Punch punctoplasty is a simple and less invasive procedure with consistently high long-term functional and anatomical success rates as a sole primary treatment for punctal stenosis.
- More complicated combined procedures for punctoplasty may not confer extra benefit but may instead introduce potential complications.

Conflict of interest

The authors declare no conflict of interest.

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