Endoscopic laser recanalisation of presaccal canalicular obstruction

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Abstract
Aim—To document the results of erbium (Er)-YAG laser treatment in presaccal canalicular obstruction in combination with the use of a flexible endoscope.

Methods—For the first time an Er-YAG laser (Schwind, Sklerostom) was attached to a flexible endoscope (Schwind, Endognost) and used to recanalise a stenosis of the upper, lower, or common canaliculus. In 17 patients (mean age 41.5 (SD 11.9) years), 19 treatments (two bilateral) were performed. In all cases the scar was observed using the endoscope and was excised by laser ablation. A silicone intubation was performed in all cases. In addition to the endoscopy an irrigation was performed to prove the intactness of the lacrimal pathway system after laser treatment.

Results—Membranous obstructions with a maximum length of 2.0 mm (14 procedures) in the canaliculus were opened easily using the laser, and the silicone intubation was subsequently performed without difficulty. Scars thicker than 2.0 mm could not be opened safely without canaliculus penetration (five procedures). Irrigation was positive in all cases up to the end of a 6 month period, providing the tubes remained in place. The maximum follow up is now 17 months (minimum 8 months) and in 16 cases (84.2%) the canalliculi are still intact.

Conclusion—Endoscopic laser treatment combined with silicone intubation enables us to recanalise presaccal stenoses of canalliculi under local anaesthesia up to a scar thickness of 2.0 mm. Best results can be achieved in cases where much tissue can be saved. Under such conditions this procedure can substitute for more invasive surgical techniques, especially a conjunctivo-dacryocystorhinostomy (CDCR).

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connected to a camera and a monitor which makes recording of the procedure possible. This fibre is inserted through the right channel of the probe. The Er-YAG laser (Schwind, Sklerostom) generates a laser beam of 800 nm and works in pulsed mode with 2 Hz, allowing a variable energy of 50–200 mW at the tip of 350 µm fibre. The sapphire fibre was fixed to the hand piece of the laser (Fig 1) and located in the central channel of the probe. The third opening of the Bowman probe was preserved for irrigation (Fig 2). With continuous irrigation of saline solution, the stenotic membrane and the tip of the laser fibre are visible by means of the attached endoscope. After reaching the blockage, laser energy of 100 mW was applied until the stenotic part had been excised. The ablation rate of one shot was 10–20 µm. Depending on the scar thickness it took 10–20 repetition shots to penetrate the stenotic tissue. Care was taken not to penetrate the walls of the canaliculus, thus preventing via falsa. When the distal lumen of the canaliculus or the lacrimal sac had been reached, it was observed and a positive irrigation confirmed the successful opening of the scarred canaliculus and an intact nasolacrimal duct. The thickness of the stenotic part cannot be determined preoperatively, but may be estimated by observing the marks at the insertion point of the Bowman probe after penetration of the obstructed canaliculus. Finally, a silicone intubation was performed either in the form of a ring (in lower canaliculus cases) or monocalanicular (in bicanalicular obstructions, where only the lower canaliculus was treated) by means of a Monoka or bicanalicular silicone intubation (in common canaliculus cases) using a 0.65 mm silicone tube. The entire procedure, including silicone intubation takes about 30 minutes.

The tube is left in place for about 6 months (depending on further developments).

Detumescent drops and antibiotic drops, each three times daily were prescribed for 2 weeks and 1 week respectively.

Results

In six cases the reason for the stenosis was chronic inflammation, in two cases a severe trauma of the eyelids proved to be the cause; in a further two cases repeated lacrimal probing had been performed preoperatively and in nine cases no particular reason could be found.

In seven cases, preoperative irrigation revealed a functional relative stenosis, which meant that high pressure irrigation was possible, whereas under physiological conditions an epiphora would have occurred. A total blockage of the system was found in the remaining 12 cases. Microendoscopy showed a lacrimal obstruction in six bicanalicular, eight lower canaliculus, and five canaliculus communis cases.

Six cases presented a thin membranous stenosis, four involved a stenosis of the lower canaliculus (Fig 3) and two of the common canaliculus, which required only a few laser shots to open the obstruction. In all these patients a canalicular penetration could be safely avoided. Eight cases showed an obstruction of the canalicular system up to 2.0 mm (two bicanalicular, three lower canaliculus, and three common canaliculus), which needed 20–30 laser shots to penetrate the obstruction.

![Figure 1](image1.png) The laser hand piece (Schwind) with the fixed sapphire laser fibre of 350 µm.

![Figure 2](image2.png) The modified Bowman probe (Geuder) with 1.1 mm outer and 0.9 mm inner diameter. At the upper end the connection for the endoscope, in the centre the laser fibre and at the third opening the syringe may be attached. The marks in a range of 5 mm are clearly detectable.

![Figure 3](image3.png) Scarred lower canaliculus with bleeding after irrigation.
Only in one of these cases did a penetration of the upper canaliculus to the pericanalicular tissue occur (trauma case). In five cases a scar of more than 2.0 mm (three lower canaliculus, two common canaliculus) was assessed. These cases required more than 40 laser shots and a penetration was unavoidable in all cases. It took about 10–20 seconds for 20–50 laser applications of 130 mJ to penetrate the blocked system. The entire procedure, including silicone intubation, took about 30 minutes.

For all patients we succeeded in reaching the distal lumen of the canaliculus or the lacrimal sac. In one stenosis of less than 1.0 mm, slight bleeding occurred in one procedure; in dealing with stenoses over 1.0 mm, bleeding occurred in 70%. Intubation was possible in all cases. The mean follow up period is now 14 months. During the 6 month postoperative period while the lacrimal system was splinted by the silicone tubes (Fig 4), the lacrimal pathways were rinsable in all patients except one, who lost the silicone tube 2 weeks after the operation. After removal of the tubes 6 months postoperatively (Fig 5), all remaining 18 cases were rinsable. Three patients again suffered from epiphora within 4–12 weeks after tube removal. All these patients had had a stenosis of more than 2.0 mm (two canaliculus communis and one lower canaliculus). The results of successful treatment are detailed in Figure 6.

**Discussion**

Since we have been using lacrimal endoscopy in our outpatient department for 3 years in the field of lacrimal diagnosis, the next logical step was to develop a surgical device which could be used in combination with this mini-endoscope. A number of patients undergoing lacrimal drainage surgery needed more sophisticated investigations than mere syringing and probing to determine the location of an obstruction and the nature of surgery. The role of dacryocystography has been emphasised in recent years as a diagnostic tool. This is a very expensive method and achieves best results in postsaccal stenotic obstructions. Nevertheless, the endoscope enables direct visualisation of the entire lacrimal duct system. Therefore, we use this device only for diagnosis of stenotically obstructed canalicular systems.

Depending on the location of a presaccal stenosis various surgical procedures have been suggested. Lid tissues and sometimes the lacrimal sac have to be dissected and the embedded canaliculus with scarred tissue has to be excised. The stump of the canaliculus needs to be reattached to the common canaliculus or the lacrimal sac. Vein and mucous membrane transplants have also been reported for use in reconstructing a blocked canaliculus. All other procedures require a bypass of the proximal lacrimal duct system. The most common one is conjunctivo-dacryocystorhinostomy. In this procedure the aim is to establish a direct connection between the conjunctiva, the lacrimal sac, and the nasal mucosa, bypassing the physiological lacrimal duct system without reconstructing the canaliculi.

In a 16 year study of 75 patients, Steinsapir et al made no attempt to reconstruct a canalicular system if less than 5 mm of both proximal canaliculi remained open. Even Welham and Gutthof and Hurwitz and Rutherford concluded that if there is less than 8 mm of intact canaliculus, reconstructive pro-
recanalisation. Silkiss reported on duct and subsequent silicone intubation. In a Nd-YAG laser but without direct visualisation small fibre with a maximum e
laser beam, which can be sent through a very
efficient coagulation, a good cutting e
Canaliculus scar thickness depends on the rea-
standing with small obstructed
success rate. The most important factor is the
short standing with small obstructed
3.3 per cent of all cases of punctal and
canalicular atresia. These patients have the best
mucous membrane. Cases with only thin mem-
branes or small obstructions of up to 2 mm can
be expected to become recanalised and remain
intact. Unfortunately, it is not possible to
determine the length of a stenosis preopera-
tively. If one is familiar with the handling of the
doscope, obstructions can be detected and
subsequent laser therapy can be performed as
an initial approach in every canalicular ob-
struction. Depending on the length of the
obstruction the success rate will decrease.
In conclusion, this procedure is very well
suited for the reconstruction of lacrimal
pathway obstructions, where the scarred tissue
is not expected to be very thick; thus the exci-
sion can be performed within the canaliculus
and without penetrating the duct system,
providing a physiological recanalisation with a
high rate of success.

1 Cahill KV, Burns JA. Management of epiphora in the pres-
ence of congenital punctal and canalicular atresia. Ophthal-
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