Transcanalicular Laser-Assisted Dacryocystorhinostomy

N. Rosen, MD; A. Barak, MD; M. Rosner, MD

**BACKGROUND AND OBJECTIVE:** Current techniques of laser-assisted dacryocystorhinostomy are mostly endonasal. In this report, the authors describe their technique of laser-assisted dacryocystorhinostomy performed through the canaliculi and the surgical results they achieved.

**RESULTS:** Nine of the 14 patients (64%) reported the disappearance of epiphora following surgery. In 3 patients, no relief of epiphora was obtained. In 1 patient the operation was not completed because of severe nasal bleeding. In another, tearing began 12 months after surgery (6 months after tube removal).

**CONCLUSIONS:** Transcanalicular laser-assisted dacryocystorhinostomy is a potentially useful method for performing dacryocystorhinostomy. Technical modifications and improvements are needed to increase the success rate.


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**INTRODUCTION**

Various techniques of laser-assisted dacryocystorhinostomy (DCR) have been described during the past few years.1-7 In most of these reports, a laser beam was applied intranasally in the course of an endonasal DCR.1,2,6 In this report, we describe the technique and the surgical results of a simple laser-assisted DCR, in which we delivered the laser beam transcanaliculary to create a fistula between the lacrimal sac and the nose.

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**PATIENTS AND METHODS**

**Patient Selection**

This study included 14 consecutive patients, 10 women and 4 men, who suffered from epiphora due to nasolacrimal duct obstruction without any signs or history of infection. The patients’ ages ranged from 47 to 74 years (mean 64.28 years). Informed consent was obtained from each patient.

Prior to surgery, the diagnosis of lacrimal duct obstruction was confirmed in all patients through probing and irrigation. Follow-up examinations were performed at the outpatient clinic 1 day, 1 week, 1 month, and 3 months after the operation, and thereafter at 3-month intervals for 18 to 22 months. All of
the patients were instructed to return immediately to the clinic should any adverse event occur. The procedure was defined as successful if epiphora had disappeared by the end of the follow-up period. Failure was defined as either continuation or recurrence of tearing symptoms or any signs of lacrimal sac infection following the procedure.

Surgical Technique

All patients were operated on by one surgeon (NR) under local anesthesia. Drops of 0.4% benoxinate hydrochloride were instilled in the eye, and the region of the lacrimal sac was infiltrated with a 1:1 mixture of bupivacaine hydrochloride with adrenaline and 2% lidocaine. The nasal mucosa was anesthetized by inserting a cotton pledget soaked in 4% cocaine into the nasal cavity. Both the upper and the lower puncta and canaliculi were dilated using punctal dilators and lacrimal probes. A silica probe, 0.6 mm in diameter, was inserted through the lower canaliculus to the bony wall of the lacrimal fossa. The nasal pledget was then removed from the nose, and the nasal cavity was inspected.

The fiber-optic probe was properly positioned by visualizing and directing the helium–neon aiming beam in the area of the middle turbinate. The fiber-optic probe was then connected to the Nd:YAG laser, which was applied until a bony ostium was created. The initial opening in the bone was enlarged by pulling back the fiber-optic probe and applying more laser energy. This procedure was repeated at the upper canaliculus, thus creating two openings. Using Quickert probes, the two ends of a silicone tube were inserted through the upper and lower canaliculi and then through the laser-produced rhinostomy into the nasal cavity. The two ends of the silicone tube were tied in the nose and secured to the nasal mucosa close to the nostril with a 6-0 polypropylene suture.

The patients were instructed to use a combination of dexamethasone and neomycin eyedrops for a period of 2 weeks after the procedure.

If the operation was successful, the tubes were kept in place for 5 to 7 months before being removed. If operation had failed to eliminate tearing, the tubes were removed relatively soon after surgery (6 to 12 weeks).

Laser System

The laser used in the trial was a compact Nd:YAG laser (1064 nm). The laser operated in the new giant-pulse mode, which delivers up to 200 W of peak power at a pulse width of 20 or 40 msec, with a repetition rate of 10 pulses per second. The energy per pulse ranged from 0.5 to 4 J, and the total energy used to create an ostium was 18 to 34 J. The laser was transmitted through an optical fiber of silica-silica with a core diameter of 0.6 mm.

RESULTS

The operations were uneventful in all but one case, in which the patient had severe nasal bleeding during silicone tube insertion. Because cautery failed to stop the hemorrhage and because a nasal tamponade was used, a silicone tube could not be inserted. This patient subsequently underwent a successful operation in which an external DCR approach and local infiltration anesthesia were used.

Our surgical results are summarized in the table.

Ten patients (71.4%) reported that their tearing problems had disappeared 1 to 10 days after the operation. Nine of them remained free of epiphora for the entire period of follow-up. The remaining patient, however, started to have tearing 12 months after surgery (6 months after tube removal). Because re-probing and irrigation were to no avail, this patient’s operation was considered a failure, bringing the long-term success rate of the study to 64%.

In four patients, the failure of the procedure was noted immediately after surgery. In one case, the operation was not completed, due to the severe bleeding described above. Omitting this case from our series raises the postoperative success rate to 76.9% (10 of 13) and the long-term success rate to 69.2% (9 of 13). The three patients whose completed operations failed experienced no relief of epiphora, not even for a brief period after surgery, and the removal of their silicone tubes 6 to 12 weeks after the procedure did not result in improvement of their symptoms. Two of these patients successfully underwent a conventional DCR procedure 9 months after the failed procedure.

DISCUSSION

Most of the literature on laser-assisted DCR describes an endoscopic transnasal approach.1,2,6 Silkiss et al.4 and Levin et al.5 described the transcanalicular technique performed experimentally on fresh human cadavers. Silkiss et al. used chromium-sensitized, thulium-doped and holmium-doped:YAG lasers. Levin et al. used a potassium titanyl phos-
<table>
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<th>Follow-up Period (mo)</th>
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S = success; F = failure.

*Operation was stopped due to severe bleeding.
†This patient showed delayed failure 6 months after tube removal (12 months after the operation).

phate:YAG laser. Both groups easily achieved penetration of the bone with the laser beam, and both expressed the opinion that the transcanalicular technique is safe and easy to perform. Christenbury, described his clinical experience in creating a lacrimal-nasal fistula using an argon blue laser. Patency was achieved in 6 of 12 operations, and the author noted that thick bone was difficult to penetrate with the power setting that was used (3.2 W).

We tried the transcanalicular approach on 14 patients, using a newly developed giant-pulse Nd:YAG laser. The functional success rate immediately after surgery was 76.9% (10 of 13), and the long-term success rate was 69.2% (9 of 13). This is lower than the mean reported success rate of endonasal techniques (82%) and substantially lower than that achieved by conventional DCR (approximately 90%). The lower success rate achieved with our technique could be largely due to the fact that the fistula created is smaller than that formed by the endonasal approach and even smaller when compared with that from non-laser DCR. However, Linberg et al. suggested that functional lacrimal drainage may be achieved even with a very small fistula. In his review of laser DCR, Bartley mentions anecdotal reports suggesting that in the long term only about 75% of patients maintain a patent nasolacrimal fistula after endonasal laser DCR, despite encouraging short-term results.

The transcanalicular technique using the giant pulse Nd:YAG laser has several potential advantages. The laser that we used was a compact Nd:YAG laser operating in the new mode of giant pulse. The action of giant-pulse Nd:YAG laser on tissue is thought to be primarily photodisruption, with only marginal thermal effects. Because of its relatively long pulse, the giant-pulse energy creates minimal shock waves in adjacent tissues. This makes it possible to create a fistula in the bone and soft tissues with minimal surrounding damage, which may help to reduce postoperative inflammation and scarring. The Nd:YAG laser beam is easily delivered through silica fibers, which are flexible and can be manipulated in the canaliculi. They are relatively inexpensive and can be sterilized for recurrent use, thereby reducing the costs of the operation. We found it easy to create a fistula with the laser, and bone penetration was smooth and extremely rapid.
We suggest that the transcanalicular technique may not be suitable in cases of dacryocystitis with distended lacrimal sacs full of pus or dacryolith. It would probably be more appropriate in these patients to use either the conventional external method or endonasal techniques where a large rhinostomy can be performed. Application of mitomycin-C during surgery, as suggested by Boush et al., might improve the long-term patency of the rhinostomy and the functional surgical results.

If a method were developed in which larger fistula could be created without inducing more damage to the surrounding tissues, one could expect an increase in the success rate of the transcanalicular technique and an extension of the indications for its usage. Once such a technique is developed, the transcanalicular approach will become widely used. Until then, the technique should be considered experimental.

REFERENCES