Transcanalicular Endoscope Combined Laser Assisted Dacryocystorhinostomy

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Abstract

Transcanalicular endoscope combined laser assisted dacryocystorhinostomy (Transcanalicular ECLAD) is a new minimally invasive dacryocystorhinostomy procedure which is performed by diode laser through lacrimal canaliculi with the help of a cannula and fibre optic cable. The interior of nasal cavity is visualized with the help of nasal endoscope. The view of interior of nasal cavity is projected on a monitor with the help of video camera which is incorporated in nasal endoscope. The Transcanalicular ECLAD have various advantages over conventional dacryocystorhinostomy (DCR) and easy to learn without compromising the result.

Del J Ophthalmol 2012;23(4):271-274.

Key Words: transcanalicular, turbinate, fibre optic cable, diode laser

DOI: \texttt{http://dx.doi.org/10.7869/djo.2012.82}

External or conventional dacryocystorhinostomy (DCR) is the gold standard surgical procedure for the management of nasolacrimal duct obstruction in adult with a high success rate (93-95%). The Italian otolaryngologist A. Toti first described the method of external dacryocystorhinostomy for treating stenosis of the lacrimal sac in 1994 but it is a difficult and time consuming procedure with certain limitations. To overcome these limitations a new technique this is known as Transcanalicular Endoscope Combined Laser Assisted Dacryocystorhinostomy (ECLAD) is described here.

Transcanalicular ECLAD

It is a new, minimally invasive DCR procedure which is performed by diode laser through lacrimal canaliculi with the help of a nasal endoscope. It has advantages of minimal discomfort to patient and is quick and effective (may be performed on OPD basis). Further no incision is required and ligaments and muscles of internal canthus are well preserved. The simplicity of the technique and its excellent aesthetic results has made the technique desirable and popular.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
\textbf{Table 1 Technical specifications of ECLAD Machine} & \\
\hline
Wavelength & 980 nm (Infra red) \\
Optical power & 10 watt (Maximum) \\
Aiming beam & 635nm, 4mw, brightness adjustable \\
Operating mode & Cw pulsed \\
Weight & 5kg \\
\hline
\end{tabular}
\end{table}

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Figure 1: ECLAD diode laser with footpedal
The only disadvantage is the cost of machine which is high.

The technical specifications of the machine is described in table-1.

The components of machine includes Ecład diode laser with footpedal (figure 1a &b), Ecład laser fibres 600 micron with 360micron core, ECLAD –DCR introducer (cannula with steleate) (Figure-2) and nasal endoscope with camera with attached monitor (figure 3a & 3b).

Principle of surgery

Unlike external DCR, fibre optic cable for laser delivery is introduced in cannula through the lacrimal canaliculi and an opening is created with the help of diode laser through the inner wall of lacrimal sac, lacrimal bone and nasal mucosa by vaporization of soft and hard tissue along with coagulation.

Method

The preoperative evaluation includes complete hemogram (Hb, TLC, DLC, BT, and CT), blood glucose estimation and nasal evaluation

Surgical Technique

The surgery can be performed in local or general anaesthesia. The lower or upper punctum is dilated with punctum dilator. Probing (starts with lower number 0-0 and increases up to desired level) is done and hard stop is felt. Cannula along with steleate is passed in canaliculi and cannula advanced up to hard stop, steleate is removed and cannula is rotated at 45 degrees. Laser fibre optic cable is introduced into the cannula with aiming beam in on position. Another person holds the nasal endoscope and introduces it in nostril of nose on side to be operated and focussing of area of middle turbinate is done.

Now as the picture of inside of nose is visualised on monitor, aiming beam is localised and positioned between turbinates and nasal septum. If localization is difficult intensity of beam can be increased and blinking light may be used figure-4. As the aiming beam is localised in correct position the ‘ready button’ is pushed on and warm machine and foot pedal is pressed to deliver laser energy simultaneously advancing fibre optics gently (not pushing cannula). Now cutting of bone is felt and as you pierce through and through using laser energy, bony opening is made and the aiming beam with laser probe is visualised on the monitor (Figure-5).Now power is stopped and probe is pulled backward and just move probe with cannula, again focus aiming beam at margin of previous opening and again cut the margin in this way the ostium is enlarged up to the formation of sufficient sized (4-5 mm) opening (avoiding damage to the turbinate and nasal septum) (Figure-6). Syringing is done with normal saline, betadine 5% solution and then with mitomycin-c (0.02%) solution. During syringing we look for flow of solution on monitor. If it is sufficient cannula is removed and a drop of antibiotic-steroid eye drop placed in conjunctival cul-de-sac. No dressing or pad is required.
Post operatively the patient is put on oral antibiotic and NSAID for 5 days, gatifloxacin-steroid eye drop 6-times daily 1.5 month (tapering manner) and xylomatazoline nasal drops for two weeks. Syringing is performed on 2nd, 7th and 30th post operative days.

**Discussion**

In conventional DCR obliterated nasolacrimal duct is bypassed and the lacrimal sac is opened directly into the nasal cavity with the help of lacrimal and nasal mucosal flap after making a ostium in bone but this operation have following limitations like time taking and skilled procedure, bleeding, incision related complications, post surgical scarring and disturbance of medial canthal tendon and muscles. So during modern era when early rehabilitation and cosmetic appearance are great importance, it is the need of time that this surgery also crosses the need of incision without compromising the successes rate.

The first intranasal approach was described in 1889 by Killian, and endoscopic Dacryocystorhinostomy (DCR) was first performed by Caldwell in 1893, but was soon abandoned due to difficult visualization and numerous complications. The endonasal technique has gained popularity only in the past decade due to the developments in endoscopic surgery. It is performed endoscopically through the nose without the need for an external skin incision. The success rate is 70 to 90 %. The first cadaveric study in 1990 proved that osteotomy of lacrimal bone can be achieved by means of laser energy, delivered through an optic fiber by transnasal or endo-canalicular approach.

Lasers with several different wavelengths have been used to perform osteotomy as part of the DCR procedure, mostly as part of a transnasal approach: Holmium: Yttrium-Aluminum-Garnet (Ho: YAG) laser, potassium-titanyl-phosphate (KTP) laser, Neodymium: YAG (Nd: YAG) laser, Erbium: YAG (Er: YAG) laser, and diode laser. The use of a diode laser for EL-DCR has been first reported by Eloy et al. in 2000, followed by Fernandez et al. in 2004. Diode laser-assisted DCR seems to offer specific advantages for DCR.

The main technical obstacles in EL-DCR are to deliver a sufficiently powerful laser beam via a relatively narrow
optical fiber, which in turn fits into an endocanalicular probe. Several laser wavelengths successfully comply with this requirement. Yet there are other considerations to take into account, mainly unwanted collateral heating of the probe and residual thermal damage to the target tissue. Based on theoretical and our own preclinical studies, the 980 nm diode laser seems to adequately fulfill the entire above requirements.9 The last step in the development of less traumatic DCR is the endocanalicular/transcanalicular approach. In this approach, first described in 1963 by Jack9, a probe is inserted through the lower lacrimal punctum via the canaliculus into the lacrimal sac following the anatomical pathway of tear outflow. Osteotomy is performed either by a mechanical drill or laser energy through an optic fiber, which is inserted within the probe.10 Success in DCR surgery is compromised by a small osteum and blockage due to tissue growth and scarring.11 The small osteotomy term failure in DCR.15 An osteotomy of more than 10 mm in size is adequate osteotomy size, as restenosis at the primary acquired cases of NLDO.12,14,7 One of the main open questions is adequate osteotomy size, as restenosis at the site of osteotomy is one of the leading causes of long-term failure in DCR.13 An osteotomy of more than 10 mm in diameter can be routinely achieved by the classic approach, and a slightly smaller osteotomy of 7-9 mm is achieved with the transnasal approach.16 The osteotomy size in our series was on an average 5 mm.

We believe this is sufficient when using our technique, as there is minimal trauma to the surrounding mucosa and connective tissue, resulting in less postoperative scarring.12 An interesting computed tomography study by Yazici and Yazici showed that final nasal ostium size six months after surgery is in no correlation with osteotomy size at time of surgery and suturing of mucosal flaps, and measured from 3.1 to 3.8 mm in height.17

Conclusions

The T-ECLAD is a new contribution to the field of lacrimal surgery. It is a minimally invasive quick procedure; it may be a hope for future with better results if we continuously improve and analyzed the procedure.

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