A comparative study for the management of nasolacrimal duct obstruction; transcanalicular laser DCR vs conventional external DCR

Aparajita Choudhary[1,*], Ramyash Singh Yadav[2], Praveen Kumar[3]

[1]Associate Professor, MLN Medical College, [2]Associate Professor, BRD Medical College, [3]Doctor, Private Practice

***Corresponding Author:**
Email: dr.aparajita.ald@gmail.com

Abstract

Purpose: To evaluate the incidence and severity of intra operative and Postoperative complication and success rate of transcanalicular laser DCR and compare it with conventional external DCR.

Method: This is a prospective randomized interventional comparative clinical study. In which 163 patients having complain of epiphora due to nasolacrimal duct obstruction were included. 168 operations were done out of which 79 patients underwent TLDCR and 84 patients underwent External DCR (Ext DCR) surgery. Patient between the ages of 15 to 65 yrs were included. Patient were evaluated postoperatively after one week, two week, one month, two month, six monthly and one yearly. Postoperatively patients were evaluated for improvement of symptoms and patency of nasolacrimal duct system by irrigation with syringing. Success were defined as patent lacrimal passage.

Result: TLDCR and Ext DCR both treatment modalities are equally good for management of nasolacrimal duct obstruction. But Intraoperative and postoperative complications are less with TLDCR as compared to Ext DCR.

Conclusion: In this prospective clinical trial TLDCR was minimally invasive surgical technique with less complication rate as compared to Ext DCR but result were same in both the procedures.

Keywords: External Dacryocystorhinostomy- Ext DCR, Transcanalicular laser Dacryocystorhinostomy- TLDCR, Endonasal Dacryocystorhinostomy- ENDCR.

Introduction

Ext DCR has been the gold standard in the treatment of acquired nasolacrimal duct obstruction with the success rate of more than 90%. However; the cutaneous incision and disruption of medial canthal tendon with resultant lacrimal pump dysfunction have been cited as significant disadvantages. The first intranasal approach was described by the Killian in 1889 and ENDCR was first performed by Cardwell in 1893, but was soon abandoned due to difficult visualization and numerous complication. However with advent of laser and endoscopic technique permitting better visualization, minimally invasive surgical technique. Transcanalicular approach is the less Traumatic DCR first described by Jack in 1963. A probe is inserted through the lower lacrimal punctum via canaliculus in to the lacrimal sac following the anatomical pathway of tear outflow. Osteotomy was performed either by mechanical drill or laser energy to an optic fiber, which is inserted within the probe. Following the study of Silkiss RZ et al on human cadavers, the TLDCR has been topic of much debate among the ophthalmologist. Although success rate of TLDCR has been described to be 80-90% as compared to 90-95% of Ext DCR. TLDCR can provide a series of advantage over External approach. It avoid external skin scar, useful in patient on anticoagulant therapy or having bleeding disorders, less operative time, minimal intra and post-operative complications with better patient satisfaction. TLDCR can be used in failed DCR where it can provide higher success rate. Several laser wavelengths have been used to perform osteotomy as a part of DCR procedure. **Holmium**: Yttrium-Aluminum garnet (HO: YAG) laser, potassium Tytanyl phosphate (KTP) laser, **Neodymium**: YAG (ND: YAG), **Erbium**: Yag laser (ER: YAG) and diode laser have been used. Diode laser assisted DCR is the topic of current papers. This laser seems to be offer specific advantages for DCR. Yet there are other consideration to take into the account, mainly unwanted collateral heating of probe & residual thermal damage of target tissue. TLDCR must be compared against standard alternatives like Ext DCR. The purpose of this study is to comparing the efficacy and complication of TLDCR against Ext DCR in case series of 168 procedures.

Aims & Objectives

To study the intraoperative and postoperative complication and success rate of transcanalicular laser assisted DCR as compared to conventional external DCR.

Material & Methods

The study was carried out at the RIO Allahabad after taking permission from National Medical Ethical Committee. This study was a randomized, prospective, interventional and comparative clinical trial. Case selection was done on the basis of clinical finding and after discussing the benefits and risks, informed consent was obtained before surgery, in the all patients. The patients having chronic dacryocystitis with obstruction distal to common canaliculus were included in study. Exclusion criteria were younger pt<4yr of age, too old patients in whom normal healing process may be

hindered. Patients having lacrimal block proximal to common canaliculus, patient having tumors of lacrimal passage and the patients with gross nasal pathologies like nasal polyp, nasal tumor, severely deviated nasal septum etc. were excluded. All the patients were randomly divided into two groups.

Group A: Included patients who underwent transcanalicular laser assisted DCR.

Group B: Included patients who underwent conventional external DCR.

Preoperative evaluation was done. Complete relevant history was taken. A complete ophthalmological examination was performed to rule out other causes of watering eyes like blepharitis, ectropion, entropion lagophthalmos, trichiasis, conjunctivitis, keratitis etc. Lacrimal syringing & probing was done to determine the site of obstruction. if required contrast dacryocystography was done to determine exact site of obstruction, complete blood count including bleeding & clotting time, a rhinological examination was also performed to rule out concomitant nasal pathology such as deviated nasal septum, nasal polyposis. For Transcanalicular laser assisted dacryocystorhinostomy. We used 980 mm diode laser (Biolitec, cream optic Gmbh, Germany) with 600 micron laser fiber and 0 degree nasal endoscope.

Operative Procedure

Surgery was performed under local anesthesia. Local vasoconstriction was achieved by nasal packing with cotton sponge soaked with 4% lignocaine and epinephrine 1:100000 which was left in place for 15 min. before procedure. Local infiltration of medial canthal region and anterior ethmoid block was performed using 2% lignocaine with epinephrine 1:10000. The upper punctum was dilated with punctum dilator. A 0.5mm metal stent with guiding wire was introduced through upper punctum via canaliculus to reach the medial wall of lacrimal sac until a hard stop was felt. The stent was then directed slightly at an inferior angle. The cotton swab was removed from the nasal cavity and a right nasal video endoscope was introduced. A guiding wire was then removed. A 980 nm diode laser probe was introduced through the stent up to the medial wall of the sac. The infrared target light at the probe end was visualized at the lateral wall of nose through bone & mucosa. Once ideally positioned in the antero-inferior part of middle meatus, laser delivery was started in a pulse mode. The power setting ranged from 3-10 watts. Lacrimal sac wall, bone, nasal mucosa was vaporized to create a fistula. Finally an opening of minimum 5 mm diameter was made. At the end of procedure, canalicular irrigation was performed with dexamethasone and tobramycin suspension. Bicanalicular sialistic intubation was performed & tubes were left in position for 3 months.

Postoperative medication consisted of tobramycin and dexamethasone eye drops 4 times a day which tapered gradually over a 12 weeks period. External Dacryocystorhinostomy: Surgery was done under local anesthesia. Operative area was painted with betadine solution. A 15 mm straight incision was placed 10-12 mm nasal to medial can thus avoiding the angular vein. After that orbicularis occuli muscle bluntly dissected, anterior limb of medial canthal tendon & periosteum were exposed. Anterior limb of medial canthal tendon was incised exposing the lacrimal sac. Periostium was incised & lacrimal fossa were exposed. A 10x15 mm wide osteotomy was created on lateral nasal wall with the help of trephine & bone punch. Nasal mucosa was exposed. An H shaped incision was made on lacrimal sac as well as on exposed nasal mucosa to create anterior & posterior flap. Anterior mucosa flap and posterior mucosa flap was sutured separately with three separate 6.0 vicry l suture. In this way anastomosis was created between lacrimal sac and nasal cavity. Periostium & orbicularis muscle were sutured with 6.0 icryl. Skin sutured with 6.0 silk sutures. In both the procedure total operative time, intraoperative pain score and intraoperative complication were noted. Pain score was arbitrator based on subjective reactions during surgery Score 1-Absences of pain, 2-mild pain not interfering with surgery, 3-need for reinforcing local anesthesia.

Statistical Analysis

Student unpaired "t" test & chi square test were used to analysis the quantitative and qualitative date respectively. $P<0.05$ was considered statistically significant.

Result

We performed 168 operations in a total of 163 patients. 79 patient (of group A) underwent TLDCR out of which 2 had bilateral surgery and 84 patients (of group B) underwent conventional external DCR out of which 3 had bilateral surgery. 9 out of 79 patients of group A had previous failed external DCR operation. The mean age was 45.32 years (15-68 years) in group A and 42.89 years (14-65 years) in group B. The P value was 0.215 indicate that there was no significant age difference in both the group. 31 patients (39.21%) in group A and 38 patients in group B were male while 48 patients in group A & 46 patients in group B were female.

When comparing the initial results of TLDCR in group A, a success of 72.72% was achieved in patient less than 40 years. Where as in patient above 40 years the success was 88.13%. However the difference was not statistically significant (p-value=01.69). During the follow up it was seen that most of failure occurred during first month after stent removal. Intraoperative complication like excessive hemorrhage not seen in any patients of group A. While seen in 9 patients of group

B. Average intraoperative pain score was 1.32 in group A and 1.51 in group B. Postoperative nasal bleeding observed in 2.46%, per orbital edema in 11.11%, stent granuloma in 1.23% & early removal of stent in 4(4.94%) and canalicular scarring lead to canalicular block seen in 2.46% patients of group A. In group B, postoperative complication were nasal bleeding in 14.58, per orbital edema seen in 19.54%, wound infection in 2.29%, excessive scarring seen in 12.64% patients. The mean total surgical time was 17.41 min (8 to 27 min) in group A and 49.49 min (range from 30-90 min) in group B. The P-value was 0.0001 indicating that there was significant difference in surgical time in two group.

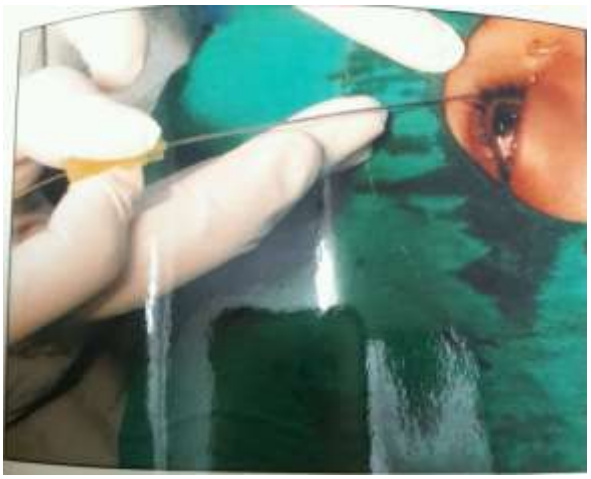

Fig. 1: Insertion of laser fiber in to stent

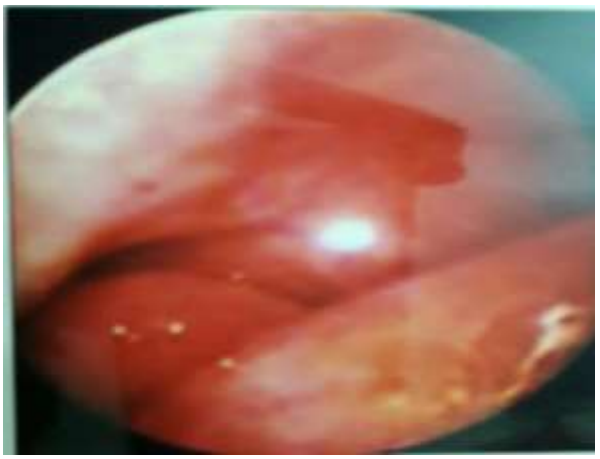

Fig. 2: Observing the position of laser fiber through nasal endoscope

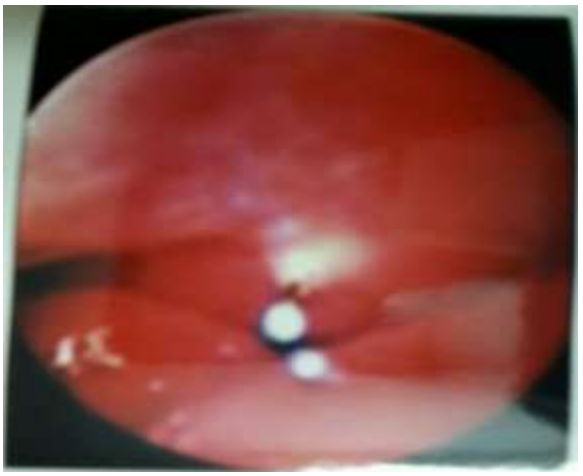

Fig. 3: Osteotomy being done with laser fiber

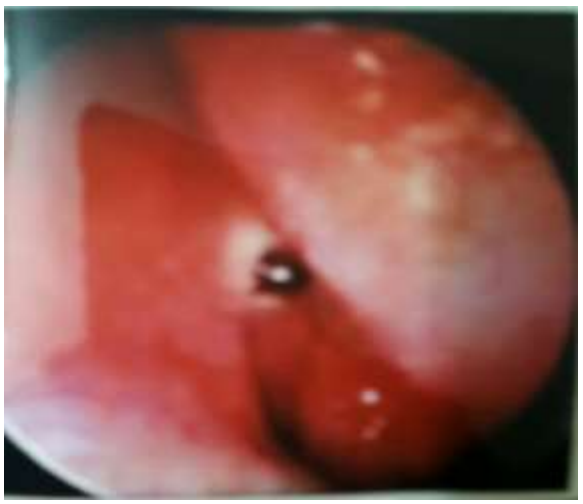

Fig. 4: Expending the osteotomy

Fig. 5: Placement of silicon stent

Table 1

	Result Following Initial Surgical Procedure		
	Success	Failure	p-value
Group A	68 (83.33%)	13 (16.67%)	0.019
Group B	83 (95.40%)	4 (4.460%)	

Table 2

Overall results following repeat TLDCR in group A			
	Success	Failure	p-value
Group A	73 (90.12%)	8 (9.88%)	0.236
Group B	83 (95.40%)	4 (4.60%)	

Table 3

COMPLICATION			
Coplication		Group A	Group B
Intra-operative	Excessive Hemorrhage	0	9(10.34%)
	Average Pain Score	1.32	1.51
Post Operative	Nasal Bleeding	2 (2.46%)	7 (14.58%)
	Periorbital	9 (11.11%)	17 (19.54%)
	Nasal Synechiae	0	0
	Stent Granuloma	1 (1.23%)	0
	Early removal of stent	4 (4.94%)	0
	Wound Infection	0	2 (2.29%)
	Excessive scarring	0	11 (12.64%)
	Canalicular scarring	2 (2.46%)	0

Discussion

Minimally invasive microsurgical technique is the need of present time. Transcanalicular laser dacryocystorhinostomy is the non-incisional alternative of Ext. DCR. The obvious advantage of TLDCR is avoiding external incision, decreased operative time, diminished convalescence and enhanced cosmesis that related to the patient satisfaction. The success of EN DCR and TLDCR are comparable and around 80-90%. The main advantages of TLDCR over EN DCR are, it does not require general anesthesia, lower intra or perioperative morbidity and greater ease of performing interventions if it fails.

The comparison of TLDCR with Ext. DCR is challenging as reported success rate varies with TLDCR technique. This variation is due to wide range of surgical technique employed including use of different laser, antimetabolites. The success rate of Ext DCR has been reported to be 85% to 90%. The success in our study was 95.4%. The high success rate of Ext DCR associated with some limitation of the procedure like presence of cutaneous scar, potential of injury to medial canthal structure, CSF rhinorrhea and functional interference with the physiological action of lacrimal pump are few disadvantages of this procedure. Postoperative bruising, epistaxis and late DCR failure led to the search for a less invasive approach to the procedure. Success rate of TLDCR varies from 64% to 92% in different studies depends on multiple factor. The overall success rate in our study was 90.12%. Variation in the success rate might be due to variable osteotomy size, various surgical techniques, use of antimetabolites, use of silicon stent and different type of laser etc.

An osteotomy size of more than 10mm in diameter achieved by classical approach. Smaller osteotomy size 5-9mm is achieved with TLDCR. In our series osteotomy size of 5-7 mm was achieved in every patient. Osteotomy size of 5-7 mm is sufficient as there is minimal trauma to surrounding mucosa & connective tissue resulting in less postoperative scarring. Technique of making the osteotomy size is varies. In our study, we first made an initial small osteotomy with the laser fiber which is enlarged in a circular fashion burning the edges of the osteotomy, until adequate size was achieved while continuously monitored with the nasal endoscope. Another technique known as can opener technique was described by Jenny E Hong et al (2005). Use of silicon stent is important factor for successful outcome of TLDCR.

In our study we placed the silicon stent for duration of three months. The silicone stent is inert material and helps in forming a soft tissue tract for tear drainage. We believe that three months is sufficient time as chance of soft tissue proliferation after three months is minimal. Maeso Riera et al conclude that placement of silicon stent did not affect the final outcome. Type of laser used also affect the outcome of success. There are multiple studies on using the different type of laser for TLDCR. But success with diode laser is more than with any other laser. In our study we used the diode laser. The diode laser has been modified for tissue direction. Because of its high energy delivery system and its laser fiber optic apparatus, the diode laser has been used for TLDCR. The laser fiber used in this study is a fiber contact that only transmits the laser to the tissue in direct contact and this transmission take place solely at end. Due to its ability to release energy at the end, the tool becomes extremely precise. We performed osteotomy in pulse mode to prevent excessive burning and loss of energy. With pulse mode we control the amount of laser energy used. The success rate of TLDCR in our study is among the highest reported for any DCR procedure other than external DCR. We explain this by minimal trauma to tissue results in minimal postoperative inflammation and scarring. The success rate of repeat external DCR ranges from 83% or 92%. In this study we had overall success rate of 88.88% after second TLDCR.

The soft tissue scars is responsible for all failures. TLDCR revision surgery has been particularly useful in failed Ext DCR. However we achieved 88.88% success rate in revision surgery. The number of patients was only nine. Hence more studies with a large number of patients and longer follow up need to be done. One interesting fact that we encountered during the follow-up was that most of failure 61.54% occurred during first month after removal of stent. The failure rate at second month and third month were less 23.08% and 15.38% respectively. This may be because most fibrosis occurs during the first one month as fibroblastic activity is more in early period. Duration of stay in hospital is less with TLDCR as compared to Ext DCR. All patients in TLDCR group were operated on the basis on OPD basis with total duration of stay in hospital of around of 3 hours. For Ext DCR, total duration of stay was around

48hours. Both Intraoperative and postoperative complications were less in TLDDCR as compared to Ext DCR. Anatomical success in Ext DCR group is more but functional success is reduced due to disruption of lacrimal pump mechanism. In TLDCR group the functional outcome is better as it is less traumatic. Limitation of study was its smaller follow-up and role in pediatric age group. Hence further study needs to be conducted with long term follow-up and TLDCR in pediatric age group.

Conclusion

Minimally invasive surgical technique is the need of present era. Anatomical success rate of Ext DCR is better than the TLDCR but functional success rate of TLDCR is better. TLDCR is minimally invasive, quick procedure with less operation time and minimal complication and easily revised. Major limiting factor is its high cost and limited availability. Further studies are needed for technical modification and laser fiber useful in pediatric patients, search for better ant metabolic agent and improvement in laser technique.

References

1. Piedrola Maroto D, Franco Sanchez J. End on asal versus transcanalicular endoscopic dacryocystorhinostomy using diode laser. Surgical Techniques and outcomes. Acta Otorrinolaringol Esp. 2008 Jun-Jul;59(6):283-7.
2. Garcia EA, Cintra PP. Transcanalicular dacryocystorhinostomy with diode laser: complications. Arq Bras Oftalmol. 2009 Jul-Aug:72(4):493-6.
3. Cakmak SS, Yildirim M. Use of end ocanalicular dacryocystorhinostomy with multidiode laser in children. Int J Pediatr Otorhinolaryngology. 2010Nov;74(11):1320-2.Epub 2010 Sep20.
4. Ozcimen M, Uysal IO et al. End ocanalicular diode laser dacryocystorhinostomy for nasolacrimal duct obstruction: short-term result of a new minimally invasive surgical technique. J Craniofac Surg. 2010 Nov'21(6):1932-4.
5. Drnovsek-Olup B, Beltrami M. Transcanalicular diode laser-assisted dacryocystorhinostomy. Indian J Ophthalmol.2010 May-Jun;58(3):213-7.
6. Uysal IO, Ozcimen M et al. Pediatric end ocanalicular diode laser dacryocystorhinostomy: result of a minimally invasive surgical technique. Eur Arch Otorhinolaryngology.2011 Sep;268(9):1283-8.Epub 2011Mar27.
7. Basmak H, Cakh H et al. Comparison of end ocanalicular laser dacrycystorhinostomy with and without end onasal procedure. Graefes Arch Clin Exp Ophthalmology. 2011 May249 (5):737-43, E pub 2010 Nov4.
8. J.C. Orcutt, A Hillel and E.A. Weymuller, End oscopic repair of failed dacryocystorhinostomy, Ophthal Plast Reconstr Surg 6 (1990),pp197-202.
9. R A Wel ham and A.E. Wulc, Management of unsuccessful lacrimal surgery, Br J Ophthalmology 71(1987) pp.152-157.
10. C.J. Mclean, I.A. Cree and G.E. Rose, Rhinostomies: an open and shunt case? Br J Ophthalmology 83(1999),pp.1300-1301.
11. D.L. McLachlan, G.M. Shannon and J.C. Flanagan, Result of dacryocystorhinostomy: analysis of reoperations, Ophthalmic surg 11(1980), pp427-430.
12. G. A. Boush, B.N. Lemke and R.K. Dortzbach, Results of end onasal laser-assisted dacryocystorhinostomy, Ophthalmology101 (1994) pp955-959.
13. M.W. Yung and S. Hardman-lea, Analysis of the results of surgical endoscopic dacryocystorhinostomy: effect of the level of obstruction, Br J Ophthalmology 86(2002), pp792-794.
14. R. Metson, Endoscopic surgery for lacrimal obstruction, Otolaryngology Head Neck surg 104 (1991), pp.473-479.
15. S.A Mickelson, D.K. Kim and I.M. Stein, Endoscopic laser-assisted dacryocystorhinostomy, Am J Otolaryngology 18 (1997), pp107-111.
16. Singh M. Singh SP, Jain V et al. Endoscopic dacryocystorhinostomy in cases of dacryocystitis due to atrophic rhinitis, J Laryngol Otol. 2004 Jun;118(6):426-8.