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Original Article

Monocanalicular Versus Bicanalicular Stent in Transcanalicular Diode Laser Dacryocystorhinostomy

Quratulain Paracha, Ubaidullah Yasin, Muhammad Kamran Saeed, Omer Farooq, Summaiya Urooj

Department of Ophthalmology, Pakistan Navy Station Shifa Hospital, Karachi Pakistan

ABSTRACT

Objective: To assess the success rate of monocanalicular versus bicanalicular intubation to maintain the patency of ostium following TDL-DCR.

Study design: Quasi-Experimental Study.

Place and Duration of Study: Ophthalmology Department PNS Shifa Hospital, Karachi, Pakistan from Mar to Aug 2023.

Methodology: A total of 246 patients with acquired nasolacrimal duct obstruction were operated for TDL-DCR using an Intermedic Diode laser (810nm) to create the bony ostium. They were randomly divided into Groups I and II for monocanalicular and bicanalicular stents respectively. Sac syringing and probing were done at follow-up visits on day 1, week 1, months 1, 3, and 6.

Results: There were 129(52.84%) females and 116(47.15%) males. Their mean age was 46.30±13.44 years. The right side was affected in 115(46.74%) and left in 105(42.68%) while bilateral blockade was present in 26 (10.6%) cases.

At 6 months postoperatively 90(73.2%) in Group I and 94(76.4%) in Group II (p:0.68) patients had patent ostium and no epiphora was present in 75 (61%) and 80 (65%) patients (p:0.71) respectively.

At 3 months postoperative 47(38.2%) patients in Group I and 91(74%) in Group II had the silicone stent removed by the surgeon. Spontaneous stent prolapse was noted in 68(55.3%) patients in Group I and 22(17.9%) in Group II. (*p*:0.27)

Conclusion: Both monocanalicular and bicanalicular intubation are effective in keeping the ostium patent after TDL-DCR. We recommend large-scale studies to establish any preference for mono or bicanalicular intubation.

Keywords: Bicanalicular, Monocanalicular, Silicone stent, Transcanalicular diode laser.

How to Cite This Article: *Paracha Q, Yasin U, Saeed MK, Farooq O, Urooj S. Monocanalicular Versus Bicanalicular Stent in Transcanalicular Diode Laser Dacryocystorhinostomy. Pak Armed Forces Med J 2026; 76(3): 357-361. DOI: https://doi.org/10.51253/pafmj.v76i3.12288*

INTRODUCTION

Epiphora is a common clinical presentation in ophthalmology occurring due to blockade anywhere from the punctum down to the nasolacrimal duct.[1] Among these Primary nasolacrimal duct obstruction is the commonest cause frequently seen in females and needs surgical correction as a definitive treatment. If not addressed timely it can lead to painful acute dacryocystitis or presents as chronic dacryocystitis. In the era of modern-day technology aesthetic medicine is in demand and patients are looking for incision-free solutions to their surgical needs. The dacryocystorhinostomy, a standard procedure to relieve nasolacrimal duct obstruction has also evolved from an external approach to endonasal and now to a trans canalicular route to create an ostium in the lacrimal fossa using a Diode Laser.[2]

The ophthalmologist prefers to do an external dacryocystorhinostomy. The success rate of external dacryocystorhinostomy is 63% to 97%[3] however, the reported failure rate of primary DCR is 4% to 13%.[3] The possible reasons for this failure could be intranasal pathology, insufficient ostium size, inappropriate ostium location, sump syndrome, fibrous tissue growth, etc. Placement of stent through the ostium or adjunctive application of Mitomycin C can minimize the failure rate. Silicone tube plays a significant role in the lacrimal drainage of tears.[4]

With the advent of endoscopic sinus surgery and better visualization, endoscopic nasal DCR became increasingly popular owing to scarless surgery, shorter procedural as well as patient recovery time, and preservation of lacrimal pump function.[5] But it has a long learning curve, sometimes adjunctive nasal surgery is required in the presence of deviated nasal septum for better access and visualization, by ENT colleagues. The success rate is comparable to external DCR.[6]

However, recently the transcanalicular diode laser DCR has been gaining increased attention from the ophthalmologist. It also provides aesthetic advantages along with short surgical and recovery time. It has a short learning curve in contrast to endoscopic endonasal DCR.[5] The success rates for

Correspondence: Dr Quratulain Paracha, Department of Ophthalmology, Pakistan Navy Station Shifa Hospital, Karachi Pakistan

Received: 30 May 2024; revision received: 04 Nov 2024; accepted: 20 Nov 2024

laser-assisted DCR range between 74% to 80%.[7] It also preserves the lacrimal pump mechanism thus minimizing the epiphora due to ineffective blinking after the External approach. Patient selection, type of laser, and technique of laser ablation play a significant role in determining the outcome.

Silicone intubation facilitates epithelialization of the bypass channel and prevents the scarring of ostium8. Thus it also affects the successful outcome of DCR surgery. Monocanalicular stenting is easy to insert and remove later, and also less traumatizing as only one canaliculus is involved, with little risk of punctual cheese wiring effect as seen with bi-canalicular stenting. Both bicanalicular and monocanalicular silicone intubation have achieved success in congenital NLD obstruction as well as following DCR in acquired NLD blockade.[9,10]

This study aimed to assess the success rate of monocanalicular versus bicanalicular intubation to maintain the patency of the ostium following TDL-DCR.

METHODOLOGY

This Quasi-experimental study was conducted at the ophthalmology department of PNS Shifa Hospital from March 2023 to August 2023. It was conducted as per the declaration of Helsinki, following the Institutional Ethics Review Board approval (ERC-2023/EYE/4273&ERC/2024/EYE/95). Informed written consent was obtained from the patients.

The sample size calculated by Openepi software was 245 taking the reported incidence of nasolacrimal duct obstruction as 20.24 per 100,000.[11]

Inclusion Criteria: All the patients attending the ophthalmology department with complaints of epiphora secondary to acquired nasolacrimal duct obstruction, chronic dacryocystitis, and previously failed DCR were included.

Exclusion Criteria: Patients with acute dacryocystitis, punctual stenosis, canalicular obstruction, congenital nasolacrimal duct obstructions, and nasal pathology were excluded.

The patients were examined thoroughly including puncta assessment for any stenosis, malposition, or atresia, the lower eyelid laxity by doing a snapback and distraction test, the level of obstruction by performing fluorescein dye disappearance test, regurgitation test, probing and syringing of the lacrimal sac. The surgical procedure was done either under local or general anesthesia. The patients were randomly Grouped as I and II for monocanalicular and bicanalicular stent insertion respectively as shown in Figure-1.

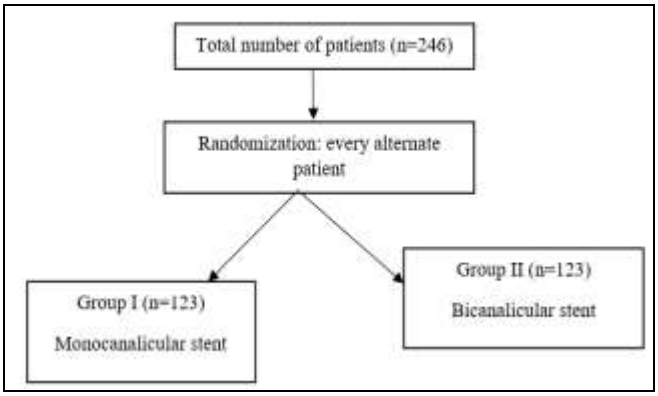

Figure-1: Patient Flow Diagram (n=246)

All the patients underwent TDL-DCR using an Intermedic Diode laser (810nm). The laser settings were 5-10 W power, pulse length 90ms, and fiber optic size 300-400 microns to create the nasal ostium (Figure-2) via direct visualization through the nasal endoscope. The ostium was then flushed with a cocktail of normal saline, triamcinolone acetonide, and, 0.01% mitomycin C (1:1:1). Finally, a silicone stent was inserted. A Lacrijet injector was used to insert an improvised monocanalicular stent (as shown in Figure-3) through either of the puncta in Group I. A bicanalicular silicone stent (as shown in Figure-2) was placed in Group II patients. The silicone stent was planned to be removed at 12 weeks postoperatively.

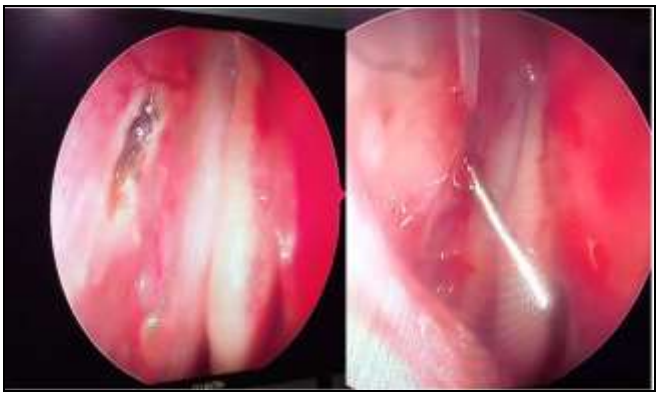

Figure-2: Nasal Ostium following Diode Laser Application and Bicanalicular Intubation

Success was defined as the free flow of fluid with the absence of symptoms at the last follow-up visit and failure as persistent epiphora with blocked ostium on doing syringing probing of the sac.

The patients were followed up on day 1, week 1, months 1, 3 and 6. The parameters assessed at each follow-up visit were the absence of epiphora, patency of ostium on syringing, and probing, and presence or prolapse of silicone stent.

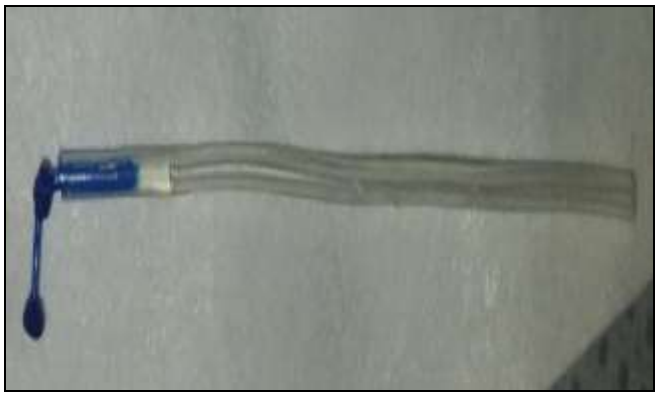

Figure-3: Improvised Monocanalicular Stent

The Statistical Package for Social Sciences 22 was used for statistical analysis. Quantitative variables were assessed as Mean±SD while quantitative variables as frequency and percentages. The statistical significance was calculated by chi-square for ostium patency and epiphora between Groups I & II. The *p*-value of ≤0.05 was taken as significant.

RESULTS

A total of 246 patients with blocked nasolacrimal ducts had TDL-DCR surgery. The patient's mean age was 46.30±13.44 years. Out of 246 patients, 129 (52.84%) were female and 116(47.15%) were male. In Group I the right eye was affected in 57(46.3%) and left in 53(43.1%) patients. In Group II 58 (47.2%) had the right and 52(42.3%) had the left eye involved. The bilateral blockade was present in 13(10.6%) cases in either Group.

There was a statistically insignificant (*p*:0.68) difference in the patency of the ostium at 6 months postoperatively between Group I and II patients (Table- I). A slightly greater number of patients in Group I had epiphora at 6 months than in Group II (*p*:0.71). The length of stay of a stent in Groups I and II are shown in Table-II.

In Group "I" where an improvised monocanalicular stent was inserted, 20 patients (16.2%) had previous TDL-DCR, 6(4.8%) had external DCR, and 5(4.06%) had 3 snip punctoplasty for epiphora. In Group II 7(5.69%) had a history of previous DCR surgery.

Postoperatively in Group I, 3(2.4%) patients developed conjunctival granuloma at six months, 8 (6.5%) did not come up for the follow-up, and stent removal at 3 months, 4(3.2%) showed retraction of the prolene dumbbell inside the punctum and 1(0.81%) patient had cheese wiring of the punctum.

In Group "II" 8(6.5%) patients with a bicanalicular stent had cheese wiring of puncta, 10(8.1%) had not visited at 3 months for tube removal while early prolapse was seen in 18(14.6%) patients.

Table-I: Anatomical and Functional Success of Transcanalicular Diode Laser Dacryocystorhinostomy (TDL-DCR) (n=246)

	Ostium Patency						Epiphora		
	Month 1		Month 3		Month 6		Month 6		
	Patent	Nonpatent	Patent	Nonpatent	Patent	Nonpatent	Epiphora	No Epiphora	Loss to Followup
Group I n=123	114(92.7%)	9(7.3%)	97(78.9%)	26(21.1%)	90(73.2%)	22(17.9%)	37(30.1%)	75(61.0%)	11(8.9%)
Group II n=123	116(94.3%)	7(5.7%)	106(86.2%)	17(13.8%)	94(76.4%)	19(15.4%)	33(26.8%)	80(65.0%)	10(8.1%)
p-value	0.440		0.700		0.680		0.710		

Table-II: Presence of Stent at Follow-up Visit (n=246)

	Month 1			Month 3		
	Stent in place	Stent lost	Loss to Followup	Stent in place	Stent lost	Loss to Followup
Group I n=123	75(61.0%)	47(38.2%)	01(0.8%)	47(38.2%)	68(55.3%)	8(6.5%)
Group II n=123	99(80.5%)	18(14.6%)	6(4.9%)	91(74.0%)	22(17.9%)	10(8.1%)
p-value	0.800			0.200		

DISCUSSION

In our study, at six months we revealed a success rate of 73.2% and 76.4% with monocanalicular and bicanalicular intubation following TDL-DCR respectively. It is comparable to the 65.8% success rate reported by Ozturker1 who performed TDL-DCR without intubation and used Mitomycin C at the ostium site. Muhammad Awais *et al*. 12 found a success rate of 93.2% following TDL-DCR with bicanalicular intubation. Pinto *et al*.[13] found an anatomical success rate of 80% and functional success of 70.8% at six months.

Silicone stents prevent the blockade of lacrimal passages, facilitates epithelisation, and enhance the success of patent ostium. Lacrimal irrigation is regarded as a good postoperative test to evaluate DCR

outcomes, having a sensitivity of 98% and specificity of 87%.[14]

Bicanalicular intubation following TDL-DCR achieved a success rate of 95.2% by Nuhoglu *et al*.[15] and 85.7% functional success at 7 years by Yener et al16. Al-Asadi17 found a success rate of 93.75% with bicanalicular intubation and 62.5% without intubation after TDL-DCR. Yildirim *et al.* recommended the use of bicanalicular silicone intubation following TDL-DCR for an increased success rate which was 84.4% with and 63.3% without intubation in their study.[18]

In TDL-DCR small ostium size, incorrect localization, and more fibroblastic activity may be contributing factors to the failure. Laser has a good coagulative effect, causes less damage to the mucosa, and hence less tissue granulation after surgery.[14] Patient selection is an important factor in the success of laser DCR. Preoperative patient counseling plays a significant role.[8]

We used triamcinolone acetonide and Mitomycin C to reduce the inflammatory response and tissue granulation at the ostium. Dogan,[19] *et al*. found increased success with the use of silicone intubation and Mitomycin-C. Kar,[20] has also used Mitomycin-C with no significant effect on the success rate following TDL-DCR.

Kashkouli,[21] studied the results of intubation for NLD Stenosis in adults with 59.1% and 61.53% success in bicanalicular and monocanalicular intubation respectively. Chi,[22] studied the monocanalicular versus bicanalicular intubation in endoscopic endonasal DCR and found better results with bicanalicular (87%) than monocanalicular (82%) at 3 months post-treatment. Saleh,[10] has seen significantly lower success rates with monocanalicular intubation after external dacryocystorhinostomy than bicanalicular. Similar findings are observed in our study 76.4% vs 73.2% for bicanalicular and monocanalicular intubation respectively.

In our study, we found that monocanalicular intubation has certain advantages over bicanalicular especially following TDL-DCR, it is easier to insert, there is no need to secure the distal end of the tube in the nose, and the other punctum is available for doing PSS at follow-up visits which is difficult to perform in presence of bicanalicular stent. Also, monocanalicular intubation is the only choice in patients with a single patent punctum and canaliculus.

We used an improvised stent, which was inserted with a lacrijet cannula, noted the earlier loss of stent, and encountered pyogenic granuloma secondary to prolene suture in three of our patients. However, an improvised stent is economical and readily available.

Bicanalicular intubation is smooth and better tolerated by the cornea. Monocanalicular tube may cause corneal ulceration particularly if inserted through the upper punctum. Komínek observed corneal abrasion in only one child.[9] In our study, we have not encountered any cornea-related complications.

The disadvantages of monocanalicular intubation reported in the literature are premature dislocation due to excessive punctum dilation, meatal ring rupture, and slit punctum.[9] Saleh *et al*. revealed that a monocanalicular stent has to be placed for a longer period than a bicanalicular stent for a successful patent ostium.[10] The early tube expulsion reported in the literature varies between 3% to 44%.[23] In our study, we found that monocanalicular stent was lost in 47(38.2%) of patients at 1 month postoperatively while 18 (14.6%) patients lost the tube at 1 month in the bicanalicular Group. Pinto reported 6.1% premature, accidental loss of bicanalicular intubation.[14]

Kominek et9 al reported that 2 of the 35 patients who underwent monocanalicular intubation had pyogenic granulomas. Yalaz *et al*. found granuloma in only one out of 29 patients with monocanalicular tubes. In our study, in the monocanalicular intubation Group, three patients developed pyogenic granuloma, probably due to failure to follow up at 3 months for tube removal, cheese wiring of the punctum was seen in one patient while in four patients the prolene dumbbell was pushed inside the punctum. In contrast, eight patients in bicanalicular Group had punctal cheese wiring.

The literature is available for the use of mono and bicanalicular intubation for congenital NLDO and acquired NLD stenosis in adults but little is found for acquired NLDO following Dacryocystorhinostomy, thus the current study will add to it.

LIMITATIONS OF STUDY

We used an improvised monocanalicular stent instead of commercially available mini monoka, this can be a contributing factor to the premature expulsion of the silicone tube. The probable reason for the longer stay of the bicanalicular stent is that it was tied at the distal end of the nose.

Following TDL-DCR frequent syringing and probing of the ostium is needed, due to which the success rate has decreased at 6 months postoperative. Some patients failed to turn up for follow-up visits despite calling them for review.

CONCLUSION

Both monocanalicular and bicanalicular intubation are effective in keeping the ostium patent after TDL-DCR. We recommend large-scale studies to establish any preference for mono or bicanalicular intubation.

Conflict of Interest: None.

Funding Source: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

QP & UY: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

MKS & OF: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SU: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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