

Efficacy of Diode Laser-Assisted Endoscopic Dacryocystorhinostomy (DCR)

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Abstract

Original Research Article

Background: Dacryocystorhinostomy (DCR) is a standard procedure for treating nasolacrimal duct obstruction (NLDO), a condition that causes chronic tearing, dacryocystitis, and discomfort. Traditional external DCR has been effective but involves visible scarring, prolonged recovery, and potential bleeding. The advent of minimally invasive, endoscopic DCR offers aesthetic benefits and quicker recovery. The addition of diode laser technology to endoscopic DCR aims to enhance precision, minimize tissue trauma, and improve patient outcomes. **Objective:** This study evaluates the efficacy of diode laser-assisted endoscopic DCR (LA-DCR) by assessing surgical outcomes, complication rates, and recovery parameters. **Methods:** A prospective, non-randomized clinical trial was conducted at a tertiary care hospital in Dhaka, Bangladesh, from January 2023 to January 2024. The study included 49 patients diagnosed with acquired NLDO, who underwent diode laser-assisted endoscopic DCR. The 980 nm diode laser was employed for mucosal incision and osteotomy creation. Postoperative care included antibiotic and steroid eye drops, with follow-up at 7, 15 days, 1, 3, and 6 months. Success rates, complications, and recovery were assessed via endoscopic examination and lacrimal system irrigation. **Results:** The study population had a diverse age distribution, with most patients (41.0%) in the 40-60 years range. The majority of patients were female (71.0%). The overall success rate was 88.0%, with a 12.0% failure rate. Associated nasal surgeries, such as septoplasty (16.5%) and turbinoplasty (2.0%), were performed. Minimal complications were noted, including middle turbinate injury (4.0%) and minor issues like sump syndrome, synechiae, and granulomas (2.0% each). **Conclusion:** Diode laser-assisted endoscopic DCR is a highly effective and minimally invasive treatment for NLDO, with a high success rate, minimal complications, and a low need for additional nasal surgeries. These findings align with existing literature, supporting the role of diode laser-assisted DCR as a reliable option for managing NLDO.

Keywords: Diode laser, endoscopic DCR, nasolacrimal duct obstruction, laser-assisted surgery.

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INTRODUCTION

Dacryocystorhinostomy (DCR) is a well-established surgical procedure used to treat nasolacrimal duct obstruction (NLDO), a condition that leads to chronic tearing (epiphora), recurrent dacryocystitis, and significant discomfort. The traditional external approach to DCR, although effective, involves an external incision and has certain drawbacks including visible scarring, prolonged recovery time, and intraoperative bleeding. With the evolution of minimally invasive techniques, endoscopic DCR has gained popularity for its aesthetic advantages and faster postoperative recovery [1-3].

The incorporation of laser technology into endoscopic DCR has opened new avenues for improving surgical precision and minimizing tissue trauma. Among various laser types, the diode laser has emerged as a preferred modality due to its compact size, cost-effectiveness, and efficient soft tissue ablation properties [4-5]. The diode laser operates typically in the 810-980 nm wavelength range and provides good hemostasis, making it particularly suitable for intranasal procedures where bleeding can obstruct visibility.

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Laser-assisted endoscopic DCR (LA-DCR) using a diode laser allows for the creation of a precise osteotomy and mucosal opening without the need for extensive tissue dissection. This reduces intraoperative bleeding, improves surgical field visibility, and potentially shortens operative time. Additionally, the thermal coagulative effect of the diode laser contributes to decreased postoperative inflammation and pain [6-8].

Numerous studies have evaluated the outcomes of diode laser-assisted endoscopic DCR, focusing on success rates, complication profiles, and patient satisfaction. While success rates vary depending on patient selection and surgical expertise, emerging evidence suggests that diode LA-DCR offers comparable or even superior outcomes to conventional techniques in selected cases. However, the learning curve and equipment availability remain limiting factors in widespread adoption [9-10].

In evaluating the efficacy of diode laser-assisted endoscopic DCR, it is crucial to consider both anatomical and functional success. Anatomical success refers to the patency of the surgically created passage as confirmed by endoscopic or radiologic methods, while functional success is determined by symptom resolution and improved quality of life. This dual outcome assessment helps provide a more comprehensive understanding of the clinical benefits and limitations of the technique.

Objective

This study aims to assess the efficacy of diode laser-assisted endoscopic DCR by analyzing surgical outcomes, complication rates, and postoperative recovery parameters.

METHODOLOGY

This was a prospective, non-randomized interventional clinical trial designed to evaluate the outcomes of diode laser-assisted endoscopic dacryocystorhinostomy (DCR). The study was conducted at a tertiary care hospital in Dhaka, Bangladesh, over a period of one year, from January 2023 to January 2024.

A total of 49 consecutive patients diagnosed with acquired nasolacrimal duct obstruction (NLDO), with or without associated nasal pathology, and referred for diode laser-assisted endoscopic DCR, were included in the study. All patients underwent detailed clinical evaluation and diagnostic confirmation before being selected for the procedure.

The procedure was performed using a 980 nm diode laser in a repetitive pulse mode. Laser settings were maintained between 8–10 watts with a pulse duration of 90 milliseconds. The laser energy was delivered through a 0.35 mm optic fiber to achieve

mucosal incision and osteotomy creation under endoscopic guidance.

In most cases, a bicanalicular silicone tube was inserted through the canaliculi and retained in position for 2.5 to 3 months. In select cases, the procedure was completed without silicone intubation, based on intraoperative findings and surgeon discretion. Postoperative care included the administration of identical topical antibiotic and steroid eye drops in tapering doses over a period of one month.

Patients were followed up at the 7th and 15th postoperative days, and then at 1 month, 3 months, and 6 months postoperatively. A final evaluation was conducted at least three months after silicone tube removal. Success and complications were assessed by nasal endoscopic examination and lacrimal system irrigation to determine the patency of the osteotomy site.

RESULTS

The demographic distribution of the study group indicated a varied age range, with the highest percentage of patients falling within the 40 to 60 years age group (41.0%), followed by those in the 20 to 40 years range (35.0%). A smaller proportion of patients were either under 20 years (8.0%) or over 60 years (16.0%). Regarding sex distribution, the majority of patients were female (71.0%), while 29.0% were male. This suggests a predominance of females in the study group across all age groups.

Table-1: Demographic distribution of the study group

Age Group	Percentage (%)
Less than 20 years	8.0
20 to 40 years	35.0
40 to 60 years	41.0
More than 60 years	16.0
Total	100.0
Sex	Percentage (%)
Male	29.0
Female	71.0
Total	100.0

The distribution of the study group according to the site of operation revealed a near-equal distribution between right and left-sided procedures. The majority of the operations were performed on the left side (51.0%), while 49.0% of the operations were performed on the right side. This suggests a balanced preference for both sides in performing diode laser-assisted endoscopic DCR.

Table II: Distribution of the Study Group according to Site of Operation Performed

Site of Operation	Percentage (%)
Right	49.0
Left	51.0
Total	100.0

The results of the study demonstrated a high overall success rate of 88.0% for diode laser-assisted endoscopic dacryocystorhinostomy (DCR), with a

failure rate of 12.0%. Associated nasal surgeries were performed in a subset of patients, with septoplasty being the most common (16.5%), followed by turbinoplasty (2.0%). Postoperative complications were minimal, with injury to the middle turbinate occurring in 4.0% of cases, while sump syndrome, synechia, and granuloma formation were each observed in 2.0% of patients. These findings indicate that the procedure is both effective and generally well-tolerated, with a low incidence of complications.

Table-III: Summary of Success Rate, Associated Nasal Procedures, and Postoperative Complications in Diode Laser-Assisted Endoscopic DCR (in %)

Section	Details	Percentage (%)
Overall Success Rate	Success	88.0
	Failure	12.0
Associated Nasal Surgery	Septoplasty	16.5
	Turbinoplasty	2.0
Surgical Complications	Injury to middle turbinate	4.0
	Sump syndrome	2.0
	Synaechia	2.0
	Granuloma	2.0

DISCUSSION

The demographic distribution in this study revealed a broad age range, with the highest percentage of patients falling within the 40 to 60 years group (41.0%), followed closely by those aged 20 to 40 years (35.0%). The representation of younger patients (under 20 years) was low (8.0%), and those over 60 years constituted 16.0% of the study population. This is consistent with the findings from other studies, which also report a higher prevalence of nasolacrimal duct obstruction (NLDO) in middle-aged adults [10]. The fact that the majority of the study cohort was female (71.0%) aligns with the gender disparity often observed in similar studies, where females constituted about 70% of the participants [11]. The higher incidence in females could be attributed to hormonal changes or anatomical factors that predispose them to NLDO.

When examining the site of operation, this study found a near-equal distribution between right (49.0%) and left-sided procedures, with a slight preference for the left side (51.0%). Similar results were noted in studies who also reported a balanced distribution of operations between the right and left sides [13]. This finding suggests that there is no significant bias in terms of the laterality of NLDO in the study cohort, aligning with the notion that nasolacrimal duct obstruction can occur in either side without a clear preference.

The overall success rate of 88.0% observed in this study for diode laser-assisted endoscopic dacryocystorhinostomy (DCR) is comparable to other reports in the literature. For instance, studies have reported success rates ranging from 85% to 90% [14]. The success of this minimally invasive procedure can be

attributed to the precision of the diode laser in creating the osteotomy and the ability to preserve surrounding structures. However, the failure rate of 12.0% observed in this study is slightly higher than the 5-10% failure rates noted in some studies, such as the one by Puscas *et al.*, (2021), which may reflect patient-specific factors or variations in surgical technique.

Associated nasal surgeries, including septoplasty (16.5%) and turbinoplasty (2.0%), were performed in a subset of patients. These findings are consistent with other studies who also noted that septoplasty is frequently combined with DCR when nasal pathology, such as septal deviation or turbinate hypertrophy, contributes to the obstruction [15]. The relatively low incidence of turbinoplasty (2.0%) in this study is in line with reports suggesting that turbinoplasty is only necessary in cases where significant nasal airway obstruction is present.

Postoperative complications in this study were minimal. Injury to the middle turbinate was the most common complication (4.0%), followed by sump syndrome, synechia, and granuloma formation (each 2.0%). These findings are consistent with those of other studies, which found a similarly low incidence of major complications following diode laser-assisted endoscopic DCR [16]. The complication rates in this study are in line with the literature, where the majority of complications are minor and can be managed conservatively, contributing to the overall safety and efficacy of the procedure.

CONCLUSION

In conclusion, this study supports the growing body of evidence suggesting that diode laser-assisted endoscopic DCR is a highly effective and minimally invasive treatment for nasolacrimal duct obstruction. The procedure has a high success rate, with minimal complications and a low requirement for associated nasal surgeries. The findings from this study align well with previous research, reinforcing the role of diode laser-assisted DCR as a reliable option in the management of NLDO.

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