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Long-term follow-up outcomes of nonlaser intranasal endoscopic dacryocystorhinostomy: How suitable and useful are conventional surgical instruments?

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PURPOSE. *To investigate the long-term follow-up outcomes of nonlaser intranasal endoscopic dacryocystorhinostomy (IEDCR) using a nasal endoscope and conventional surgical instruments available in all operating rooms, the advantages of this technique, and the usability and suitability of conventional instruments.*

METHODS. *Twenty-seven IEDCRs were performed in combination with bicanalicular silicone intubation on 24 patients with primary nasolacrimal sac or duct obstruction who had undergone no previous procedures. Ablation of the nasal mucosa was performed with a sickle blade (12 operations) or insulated sickle blade allowing simultaneous intranasal monopolar cauterization (15 operations); a bony window was opened with a drill; and ablation of the medial wall of the lacrimal sac was performed with a sickle blade, Blakesley forceps, and Bellucci ear microscissors. Revision intranasal endoscopic surgery was performed in unsuccessful cases.*

RESULTS. *Patients were followed up for 35 to 71 months (average 49.3 months). In 7 (25.9%) of the 27 IEDCRs, nasolacrimal obstruction recurred within 3 months. Success rates were as follows: 66.7% (8 operations) for the first 12 operations; 80% (12 operations) for the second 15 operations; and 74.1% overall. There were seven cases of surgical failure; revision surgery was successful in four, increasing the overall success rate to 88.9%.*

CONCLUSIONS. *IEDCR can be performed with acceptable facility with standard conventional surgical instruments (sickle blade, endoscopic forceps, and scissors) and surgical tools (drill, monopolar cautery) found in all operating rooms, and the nonlaser intranasal endoscopic approach may be a reasonable alternative to the laser assisted surgery approach. (Eur J Ophthalmol 2004; 14: 453-60)*

KEY WORDS. *Endoscopic dacryocystorhinostomy, Nonlaser, Conventional surgical instruments, Monopolar cauterization, Revision intranasal endoscopic surgery*

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INTRODUCTION

Aside from external dacryocystorhinostomy's (EXDCR) successful outcomes in nasolacrimal obstruction, problems with EXDCR such as risk of damage to the lacrimal pump and the medial canthal ligament, the chance of scarring due to skin incision, bleeding, and early postoperative morbidity (e.g., periorbital ecchymosis, epistaxis) have helped to popularize the intranasal approach, the conceptual foundations of which had been

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laid much earlier. This approach was first performed by trephination of the nasolacrimal duct (1) and later modified by window resection over the lacrimal sac (2), but was abandoned because of technical difficulties. In the present day, nasal endoscopes and surgical tools such as lasers and radiofrequency units have been added and other modifications made, and successful outcomes are reported (3-16). At present, increasing numbers of doctors and patients prefer intranasal endoscopic dacryocystorhinostomy (IEDCR) to EXDCR, despite its somewhat lower success rate, because of advantages such as a low risk of surgical trauma, the ease of achieving intraoperative hemostasis, low postoperative morbidity, and no need for skin incision. Laser types such as argon (4, 8), carbon dioxide (CO_2) (5, 7), potassium titanyl phosphate (5, 15, 17), holmium:YAG (6, 9, 10, 12-14, 18), neodymium:YAG (Nd:YAG) (9), combined CO_2-Nd:YAG (3, 11), and diode laser (19) are used in IEDCR during laser mucosal incision and/or opening of the bony window and/or ablation of the medial wall of the lacrimal sac. Although many surgeons prefer laser in IEDCR, successful outcomes have been reported with conventional surgical instruments and drills used in combination with nasal endoscopy (17-29). The purpose of the present study was to review such operations, and investigate this technique's advantages and long-term follow-up outcomes and the usability and suitability of conventional instruments.

METHODS

The study included 24 patients (20 women, 4 men) attending the Outpatient Clinics, the Department of Ophthalmology, Harran University Medical Faculty, who were diagnosed with primary acquired obstruction of the nasolacrimal sac or duct in accordance with the criteria below, operated and followed up long term. Prior to surgery, the lacrimal drainage system was assessed by inspection, palpation, lacrimal sac compression, lacrimal sac irrigation, conventional and/or computed tomographic dacryocystography with radiopaque agent (lipiodol ultra fluide, Guerbet). The condition of the paranasal sinuses, in particular, middle meatus abnormalities such as pneumatized middle turbinate and ethmoid air cell anomalies, and the condition of the septum nasi and lacrimal sac were investigated by computed tomographic scanning performed in coronal and axial planes (Fig. 1). All patients, who had primary acquired obstruction of the nasolacrimal sac or duct and normal or dilated lacrimal sac in computed tomographic dacryocystography, had one or more of the following symptoms:

1) Continuous epiphora for at least 1 year
2) Purulent discharge from the canaliculi when the lacrimal sac region was compressed
3) A mass below the inner canthus

Patients with canalicular or common canalicular obstruction demonstrated by lacrimal sac irrigation, those who had previously undergone lacrimal surgery, those whose etiology involved trauma (due to post-traumatic bony deformity), and those who were diagnosed with atrophic-scarred lacrimal sac in computed tomographic dacryocystography were excluded. Patients with infection were treated, and underwent surgery after all symptoms had subsided. Twenty-seven primer IEDCRs, three of which were bilateral, were performed on 24 patients and they were followed up for 35 to 71 months (average 49.3 months). All operations were performed under general anesthesia.

The patient was placed in the supine position with the head slightly elevated to decrease venous pressure at the operative site. An image from a 0- and 30-degree nasal optic (Karl Storz 7200A) 4 mm in diameter was displayed on the monitor, allowing simultaneous viewing by both surgeons. Prior to mucosal incision, patients were given an injection of 1/100,000 adrenaline-2% lidocaine in order to reduce bleeding and facilitate mucosal elevation. In all patients, after the superior or inferior punctum was dilated with a lacrimal dilator, a 20-gauge fiber optic light probe (Endo-illuminator, Karl Storz Instruments, 495 NL) lubricated with antibiotic pomade was used for transillumination of lacrimal sac (Fig. 2). After the sac was located, a square incision was made with a sickle blade in the nasal mucosa corresponding to the sac location in the first 12 operations. The mucosa was elevated and removed with ethmoid forceps. In the later operations, mucosal incision was made with an insulated sickle blade with a 2-mm metallic opening on the end (Fig. 3), which allows simultaneous cauterization to reduce bleeding. Osteotomy was carried out by drill and hammer gauge in only one patient, and by drill alone in all other patients.

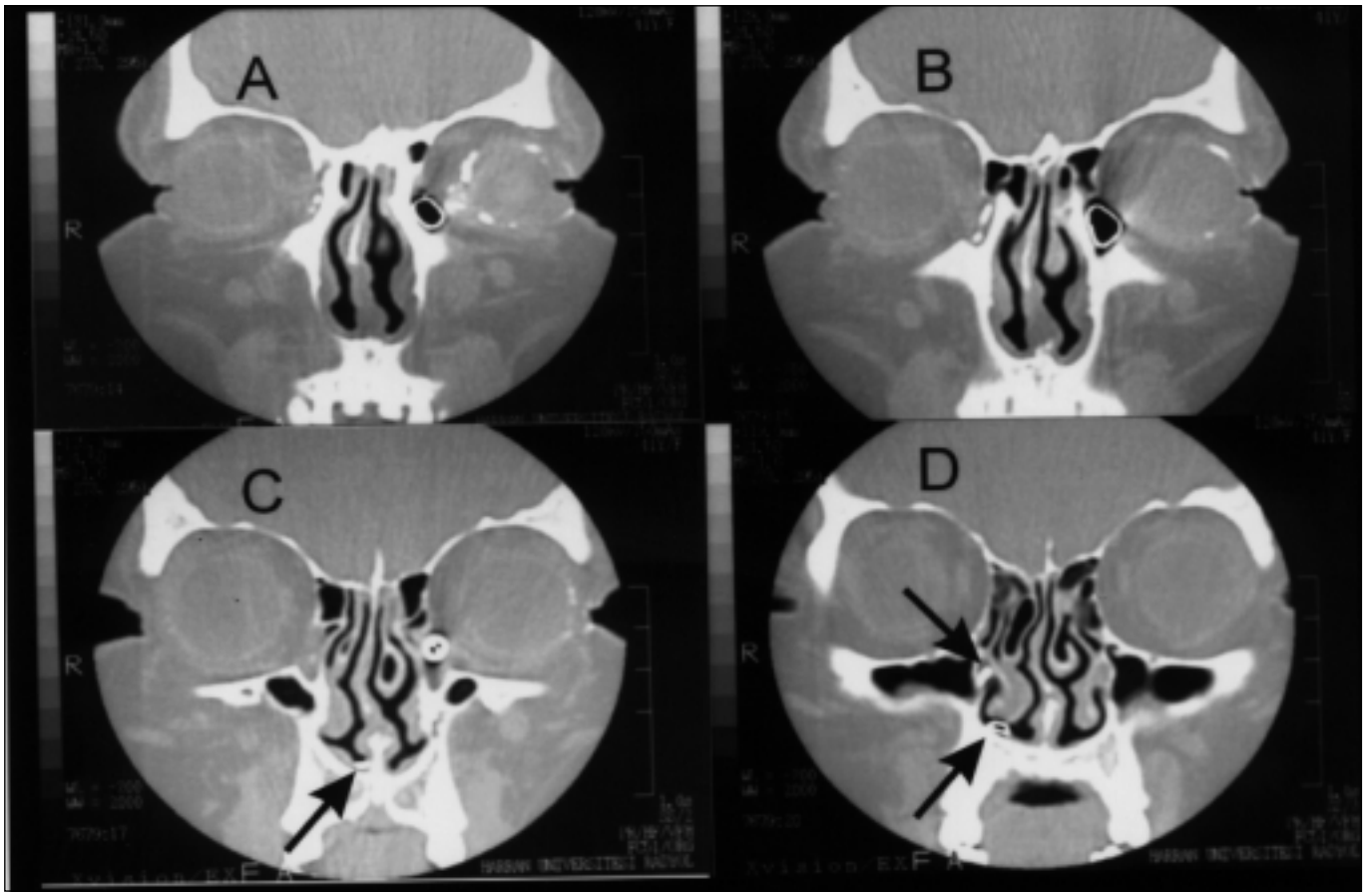

Fig. 1 - *Coronal computed tomographic dacryocystography of a patient with a left nasolacrimal duct obstruction.* **(A, B)** *A left dilated sac with postsaccal obstruction after radiopaque agent injection.* **(C, D)** *Right normal nasolacrimal duct shows that radiopaque agent presents both in the nasolacrimal duct and in the meatus nasi inferior (note the arrows). Left nasolacrimal duct shows that radiopaque agent does not transfer into duct.*

In five patients whose middle turbinate threatened to obstruct the osteotomy area, making surgical manipulation difficult, middle turbinate infracture and/or anterior partial middle turbinectomy were performed. In the event of bleeding that interfered with visibility, a cotton nasal tampon with adrenaline was applied intraoperatively. After the medial bony wall in the projection of the lacrimal sac was exposed approximately 10 x 7 mm-14 x 10 mm, the punctum was dilated with a punctal lacrimal dilator. In six operations, the nasolacrimal sac was tented with a Bowman lacrimal probe and an incision was made in the sac with a sickle blade from top to bottom. In the remaining operations, after the sac was similarly tented, a cross shape incision, using Belluci ear microscissor, was performed on the sac. Nearly all of the visible medial sac wall was removed from the osteotomy area with ear microsurgical instruments. A silicone tube (Probe Lacrimal Bodian, Karl Storz E4221) was placed bicanalicularly in all of the cases and tied in the nose, then sutured with 4/0 Prolene to the interior surface of ala of the nose.

After this procedure, lacrimal irrigation along the silicone tube was carried out, both confirming the patency of the passage and removing material from inside the sac and the ostium such as coagulum and bone dusts as the help of nasal irrigation (fine bone dust spreads and sticks to nasal mucosa and lacrimal sac surface during drilling). The silicone tube was removed 4 to 6 months later. A nasal tampon was used at the end of surgery due to bleeding in two patients, but it was removed promptly on the first postoperative day. Along with IEDCR, septoplasty was performed in two patients whose septa were de-

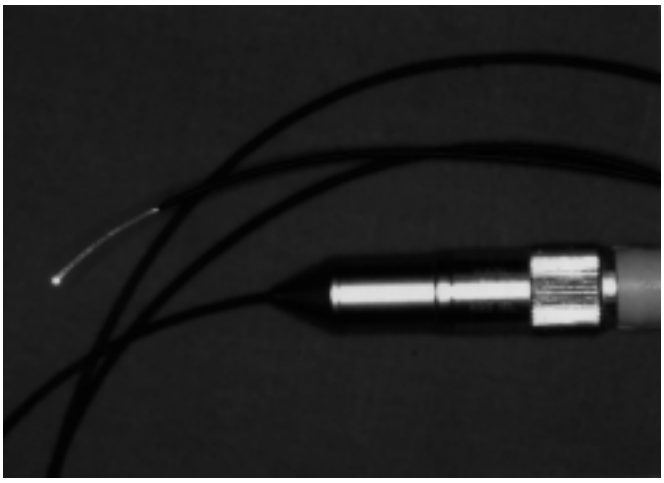

Fig. 2 - *A 20-gauge fiber optic light probe which was used for transillumination of lacrimal sac.*

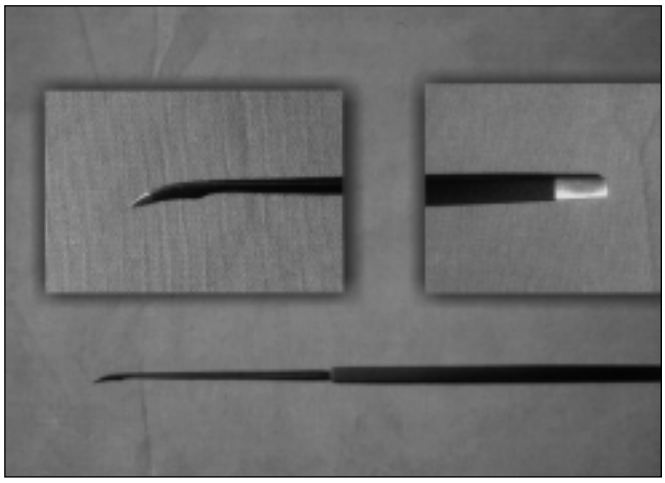

Fig. 3 - *An insulated sickle blade with a 2-mm metallic opening on the end, which allows simultaneous cauterization to reduce bleeding.*

viated to such an extent as to threaten obstruction of the osteotomy area. Patients were hospitalized only on the night of the surgery. For 1 week postoperatively, systemic broad-spectrum antibiotics were given, and for 2 weeks topical tobramycin and fluorometholone eyedrops were used as intranasal moisturizing ointment.

Patients were generally examined postoperatively twice the first week, once at the second and fourth weeks, and then once 2 months until the tubes were removed. Afterwards, patients were examined only once every 6 months as long as there were no complaints. Postoperatively, crusts and debris around the ostium were removed endoscopically, generally twice the first week and once the second week; further removal was generally not necessary in patients with successful outcomes. In order to help maintain the patency of the passage, the lacrimal sac was irrigated during the first two visits in all patients, and during subsequent visits only in patients in whom it was required. The success of surgery was evaluated based on patients' postoperative complaints, lacrimal sac irrigations, and intranasal endoscopy.

In cases of surgical failure, endoscopic revision DCR was performed under local anesthesia, submucosal scar and granulation tissue was removed, and, if there were any synechiae, synecholysis was performed and patients were reintubated with silicone tube.

RESULTS

The women had an average age of 35.6±10.2 years, and the men an average age of 36±11.8 years, and the follow-up periods lasted for 35 to 71 months (average 49.3±11.2 months). Twenty-one patients had unilateral surgery and three had bilateral surgery, and thus a total of 27 IEDCRs were overviewed. There were no early postoperative complications other than periorbital ecchymosis in one patient who had undergone large osteotomy, and mild epistaxis that did not require intervention in three patients. The average duration of surgery in the first 12 IEDCRs (11 patients, one of which is bilateral) was 53.5±8.85 minutes, while that in the second 15 IEDCRs (13 patients, two of which are bilateral), who underwent intranasal monopolar cautery, was 39.73±10.31 minutes (Student *t* test; $p<0.001$).

After the first 12 IEDCRs, success was achieved in 8 operations (66.7%), and after the second 15, success was achieved in 12 operations (80%) (chi-square test; $p>0.05$) (Fig. 4). Three patients who had complaints of mild epiphora in windy environments but who had none in normal environments and whose ostia were patent were included in the successful group. In the 7 patients (25.9%) who had recurrent nasolacrimal obstruction, all recurrences occurred within 3 months. The cause of recurrence was considered to be primary closure of the ostium with nasal mucosa due to

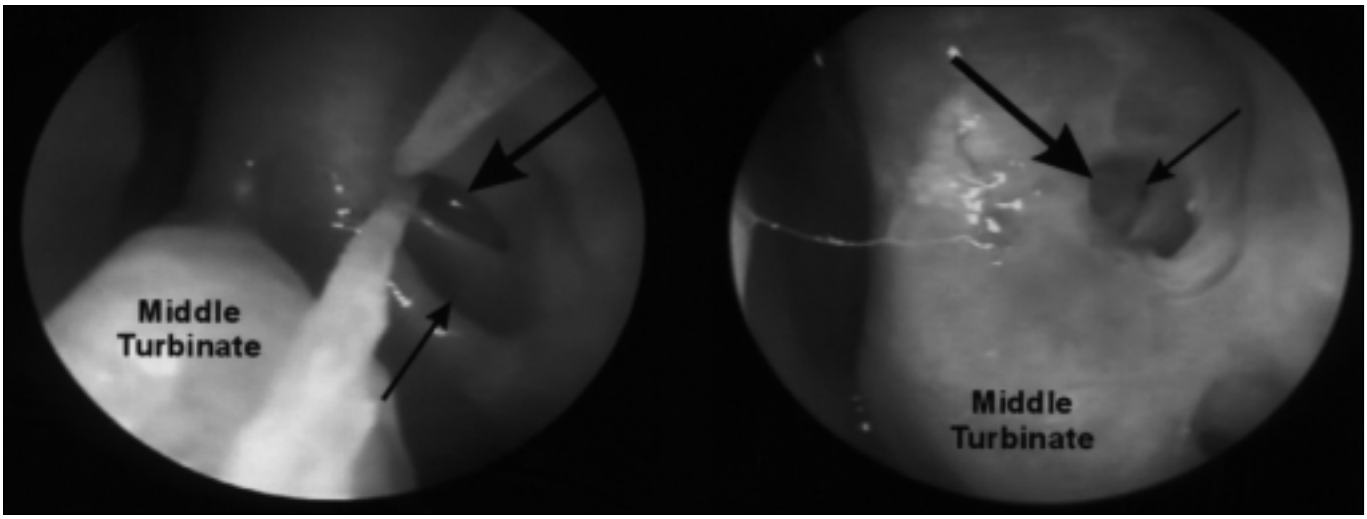

Fig. 4 - (Left) *The appearance of the ostium in a case after 2 months from nonlaser intranasal endoscopic dacryocystorhinostomy. Big arrow indicates ostium, and small arrow indicates an opened agger nasi.* **(Right)** *The ostium of a patient with premature loss of silicone tube. Big arrow indicates ostium, and small arrow indicates canaliculus opens to ostium.*

premature loss of the silicone tube within the first month in three patients; the development of synechia between the middle turbinate and the ostium in two patients; and the closure of the ostium with granulomatous and/or fibrotic tissue wrapped around the silicone tubing in two patients. The seven patients with unsuccessful outcomes underwent endoscopic revision DCR, and success was achieved in four. Thus with the secondary operation, the success rate was increased from 74.1% to 88.9% (Tab. I).

DISCUSSION

Perhaps one of the most important advantages of the endoscopic approach is that it can be used to identify and correct simultaneously abnormal intranasal anatomies with IEDCR. In this way, in our series, middle turbinate infracture and/or anterior partial middle turbinectomy were performed during IEDCR on 5 patients (18.5%) whose middle turbinate threatened to obstruct the osteotomy area, making surgi-

TABLE I - DURATION AND OUTCOMES OF NONLASER INTRANASAL ENDOSCOPIC DACRYOCYSTORHINOSTOMY (IEDCR)

Mucosal cauterization status	IEDCR			Endonasal revision		Final success n (%)
	n.	Duration of surgery, minutes mean ± SD	Successful n (%)	n.	Successful	
Without mucosal cauterization	12	53.5±8.85*	8 (66.7)†	4	2	10 (83.3)
With mucosal cauterization	15	39.73±10.31	12 (80)	3	2	14 (93.3)
All cases	27	51.44±11.41	20 (74.1)	7	4	24 (88.9)*

*p=0.001 †p>0.05

cal manipulation difficult, and septoplasty was performed on 2 patients (8.3%) whose septum was deviated to such a degree as to have the potential to obstruct the osteotomy area. Similarly, in conjunction with IEDCR, many researchers report that they perform procedures like septoplasty, partial middle turbinectomy, anterior ethmoidectomy, and posterior ethmoidectomy (6, 8-10, 15, 19, 21, 22, 27).

In IEDCR, bleeding that may occur under general anesthesia because of the vasodilatation effect of anesthetic inhalants may interfere with endoscopic imaging, increasing surgical complications (8). In our first 12 operations, the most significant problem we encountered peroperatively was profuse bleeding during the mucosal incision despite the preparation of the nasal mucosa with an injection of 1/100,000 adrenaline–2% lidocaine. It was thus necessary to apply a nasal tampon in two of these patients during surgery. Bleeding frequently interfered with the intranasal image, so much as to interfere with the easy identification of anatomic structures, as well as getting blood on the optic and, hence, prolonging the duration of the operation. Thus, while the average duration of operation was 53.5±8.9 minutes in the first 12 operations, it was 39.7±10.3 minutes in the second 15 operations, in which the mucosal incision was carried out with monopolar cautery with an insulated sickle blade. When vaporization of the mucosa is performed by laser, bleeding is reported to be considerably reduced (4, 8, 9, 16, 19); in fact, as reported in Kong et al's study (9), the laser is sometimes even used for the sole purpose of reducing bleeding. In our series, mucosal cautery performed in conjunction with mucosal incision with an insulated sickle blade significantly reduced bleeding in 13 of 15 patients (bleeding occurred in two patients as a result of contact with the turbinate during drilling), thus improving intraoperative imaging, and the duration of surgery was decreased by 26%. Similarly, Hausler and Caversaccio (24) mentioned that there was no problem with bleeding after electrocautery during mucosal incision. In IEDCR, lasers are generally used for bleeding reduction, opening the bony window, and ablation of the medial wall of the lacrimal sac. However, in patients with thick bony walls, a laser may not be sufficient for opening the bony window, and conventional instruments such as drills, Jamison, Citelli, and Kerrison rongeurs and McKenty sphenoid punch are used to widen the bony window (6, 8, 9). A bony window can be made with a simple autodrill, as in our study. Despite performing IEDCR using a Holmium YAG laser, Kong et al (9) make the same point, reporting that an autodrill or microrongeur is both more effective and less painful in removing thick bone. Similarly, Shun-Shin (16) uses laser only for opening a window in very thin bones. Therefore, the use of laser solely for vaporization of the nasal mucosa is an expensive technique in patients whose bony walls are found to be thick in preoperative computed tomography. In place of this, we believe that the monopolar cautery, which is found in most operating rooms, will be of benefit in minimizing bleeding during incision of the nasal mucosa, as in our study. The low success rate in our first group of patients associated with profuse intranasal bleeding was significantly reduced as a result of monopolar cautery, making the most significant contribution to the higher success rate.

In our patients, after a bony window is opened, a sickle blade appears to be insufficient, especially in a dilated and thickened sac. The sickle blade has been observed to mechanically traumatize the sac, but it has been determined that Bellucci ear microscissors allow greater control over the incision without traumatizing the sac. Additional advantages are provided by multiple-angled scissors. In the literature, some authors have reported that they use only lasers in opening the medial wall of the lacrimal sac (4, 8, 11, 15). It is not disputed that the laser has advantages over conventional surgical instruments, particularly in minimizing bleeding. Nonetheless, some surgeons who perform laser-assisted IEDCR find it preferable to do so in combination with conventional instruments (e.g., sickle blade, endoscopic scissors, forceps) in ablation of the medial wall of the lacrimal sac (3, 6, 9, 10). Furthermore, although conventional instruments lead to bleeding - which does not generally cause much trouble - they are superior in taking histopathologic specimens from the sac.

After a long follow-up period, a 74.1% success rate was determined. In the 12 operations, a 66.7% success rate was achieved, and in the 15 operations, the success rate was 80%. In addition, endoscopic revision DCR was performed in the seven patients who had unsuccessful DCR. Success was achieved in four of these patients. Thus with the secondary operation, the 74.1% success rate was increased to 88.9%. In

the review of primary operations, success rates of 78.3% to 95% are reported in studies in which laser is not used at any stage of IEDCR (17-28), while those in operations in which lasers are used are 63% to 100% (3, 6, 8, 9, 11-13, 15). In studies that have reported revision IEDCR in failed cases, revision IEDCR increased the success rate from 70% to 80% in Boush et al (8); from 81% to 90% in Sadiq et al (13); from 70% to 90% in Seppa et al (11); from 77.2% to 91% in Kong et al (9); and from 82% to 87.5% in Woog et al (6). All these results are from studies in which lasers were used. As is clear from the results both of our study and those of the literature, the success rates of IEDCRs with and without laser are very close to each other. It is apparent that the facilitation, bleeding reduction, and time-saving effects of laser in nasal mucosal ablation, opening of a bony window, and ablation of the medial wall of the sac do not have a significant contribution to increased postoperative success rates. Apart from this, it is true that the success rate obtained in our series is below that of EXCDR carried out by experienced surgeons. However, in addition to the advantages mentioned for IEDCR, ease of reoperations and similarity of the success rate to that of standard EXDCR with reoperations, as supported by the data we obtained and data found in the literature, should not be overlooked.

IEDCR may be performed with acceptable comfort with standard conventional surgical instruments (sickle blade, endoscopic forceps, and scissors) and equipment (drill, monopolar cautery) found in all operating rooms; the outcomes are comparable to those obtained in laser-assisted surgery; and the nonlaser intranasal endoscopic approach may be a reasonable alternative to the laser-assisted approach, especially in clinics that are not laser equipped.

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