·Clinical Research·

Endoscopic *vs* external dacryocystorhinostomy-comparison from the patients´ aspect

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Abstract

• AIM: To compare the success and complication rates, duration of surgeries and clinical comfort after endoscopic dacryocystorhinostomy (END-DCR) or external dacryocysto-rhinostomy (EXT-DCR).

• METHODS: Fifty patients who underwent EXT- or END-DCR between January 2010-2012 were involved in the study. A questionnaire was applied to patients preoperatively, and postoperatively. Subjective success was defined by absence of epiphora, objective success by a normal nasolacrimal lavage and a positive functional endoscopic dye test (FEDT). Postoperative pain and cosmetic result of surgery were interpreted by the patients, who were also asked whether they would offer this surgery to a friend or would prefer this surgery once more if necessary.

• RESULTS: Twenty-five patients underwent END-DCR and 25 underwent EXT-DCR. Mean duration of surgeries were 35min both for EXT-DCR (30-50) and END-DCR (35-50) (P=0.778). Intraoperative bleeding were documented in 48% of EXT-DCR and 4% of END-DCR cases (P<0.001). In total 96% of EXT-DCR and 100% of END-DCR patients had subjective success. Objective success was 100% in each group. There was no significant difference between the epiphora scorings and FDDT results in postoperative visits among the groups. END-DCR group reported less pain in first week and month (P<0.05, P<0.05). More patients in END-DCR group were happy with the cosmetic result in first week and month (P<0.001, P<0.001). More patients in END-DCR group offered this surgery to a friend (P<0.001). All patients in END-DCR group preferred this surgery once more if necessary, only 48% in EXT-DCR preferred the same method (P<0.001).

• CONCLUSION: Although both END- and EXT-DCRs provide satisfactory outcomes with similar objective and subjective success rates, we demonstrated that the endonasal approach caused significantly less pain in early postoperative period than the external approach. Clinical comfort defined by the patients was quite higher in END-DCR group, in which patients mainly were pleased to encounter a sutureless surgical area.

• **KEYWORDS:** endoscopic dacryocystorhinostomy; external dacryocystorhinostomy; subjective success; objective success; nasolacrimal lavage; functional endoscopic dye test
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INTRODUCTION

Primary acquired nasolacrimal duct obstruction (NLDO) is a common cause of epiphora in adults, and it is 4-5 times more common in females [1,2]. Many factors were considered in the etiology of acquired NLDO, chronic inflammation being the most popular one [2]. Local trauma, iatrogenic causes, including complications of maxillary sinus surgery, rhinoplastic surgery, and midfacial fracture repair were assumed to be some other causative factors [2].

Either carried externally (EXT) or endoscopically (END), dacryocystorhinostomy (DCR) is the gold standart in the treatment of patients with acquired nasolacrimal duct obstruction. It is performed by a standart skin incision, followed by removal of the lacrimal and maxillary bones and a passage formed by the connection of nasal and lacrimal sac mucosas. The reported success rates in the literature with this surgery ranges between 80%-95%. Major complications are listed as scar formation over the incision, infection, ectropion, or disruption of the medial canthal ligament and epistaxis [3].

The endonasal technique was poorly helpful as a surgical method alone before the use of modern technical devices used to visualise endonasal anatomy. After 1990s, endonasal method assisted with modern endoscopic devices become popular for the treatment of nasolacrimal duct obstructions, both for primary and revision cases [3]. Advantages of the endonasal approach include absence of surgical scarring; less reports of skin infections, ectropion, or disruption of the medial canthal ligament [3]. However, several disadvantages of the endonasal approach also exist-such as a higher learning

curve and surgical skills compared with an external approach, and the need for expensive instrumentation [4].

Both approaches have been numerously modified over the years. The main criticism of END-DCR versus EXT-DCR has been a decreased success rate with END-DCR [2,4]. However, recent literature reports END-DCR to be an effective alternative to EXT-DCR [5].

The purpose of this study was to compare the success and complication rates, duration of surgeries and postoperative clinical comfort of patients who experienced END-DCR or EXT-DCR by a questionnaire applied to patients preoperatively; and postoperatively in the first week, first month and first year visits.

SUBJECTS AND METHODS

Fifty patients with acquired NLDO who underwent EXT-DCR or END-DCR between January 2010 and January 2012 were involved in the study. This submission has received Institutional Review Board/Ethics Committee approval from our institution. Informed consent was obtained from each subject prior to the study. Described research adhered to the tenets of the Declaration of Helsinki.

A diagnosis of NLDO was made from ophthalmic examination confirmed by radiological findings. All patients included to the study described epiphora as the major complaint. Documented obstruction on syringing and probing, combined with obstruction on lacrimal dacriosystography were used in the diagnosis of NLDO.

Patients with acquired NLDO were informed about both EXT- and END-DCR procedures, the surgical techniques and the possible complications. Then they were allowed to choose one of the procedures for their treatment. Patients with hypersecretion from ocular surface disease, epiphora from lid laxity or malposition, facial nerve weakness, canalicular or punctal stenosis, or obstruction identified on probing, and those with a history of previous nasolacrimal surgery, trauma, tumour or clinically suspected tumour, and granulomatous disease were not included in the study.

Preoperatively patients underwent an ophthalmic examination including irrigation of the nasolacrimal drainage system, fluorescein dye disappearance test, and a pre-operative nasoendoscopic evaluation to identify potentially significant intranasal pathology and those with nasal septal deviation in whom a septoplasty might be required. No patients were found to have a significant nasal pathology or septal deviation that could affect the surgery.

EXT-DCR was performed by an ophthalmologist (PAO), END- DCR was performed by an otorhinolaryngologist (SO). All patients had silicone tubes inserted intra-operatively.

Groups were compared statistically in terms of gender and age distribution, duration of surgeries and follow-up times. Groups were also compared according to the success rates objective and subjectively, and comfort of the patients cosmetically and clinically in every postoperative visit. A standard pre-operative assessment sheet about demographics of the patients, and a questionnaire including questions about postoperative experiences of the patients mainly about pain and cosmetic results of the surgery was used.

END-DCR was performed under general anesthesia, by using standard functional endoscopic sinus surgery (FESS) instruments and a 4 mm 01 rigid Hopkins nasal endoscope. A fibre optic light pipe was inserted into the lacrimal sac *via* either the upper or lower canaliculus. The resultant transillumination of the nasal cavity was visualised endonasally. The transilluminated nasal mucoperiosteum over the light pipe was incised with a Freer's periosteal elevator and removed using Blakesley forceps. The rhinostomy was made using FESS instruments and occasionally a small osteotome. The lacrimal bone was excised with limited maxillary bone removal. A standard keratome (2.8 mm) was used to open the lower part of the lacrimal sac and upper nasolacrimal duct vertically. Silicone tubes were inserted and knotted.

Standard EXT-DCR surgery was performed under general anesthesia. A 1.2 cm vertical skin incision was made at 1 cm nasal to the medial canthus, avoiding the angular vessels. The periosteum at the anterior lacrimal crest was incised using a Traquair's periosteal elevator and the lacrimal fossa entered. The lacrimal and maxilla bones were removed with Kerrison rongeurs to create a large rhinostomy. Posterior and anterior mucosal flaps were made and all patients were intubated with silicone tubes, followed by standard skin closure.

Post-operative care after both types of surgeries included amoxicillin/clavulanate potassium 1 g BID tablets p.o for 10d (Augmentin ® , GlaxoSmithKline, Turkey), combination 0.3% Tobramycin (3 mg/mL) and 0.1% Dexamethasone (1 mg/mL) eye drops (Tobradex ® , Alcon, USA) 4 times daily for 10d. Patients were also given Oximethasoline HCl 0.25 mg/mL nasal spray (Iliadin ® , Santa Farma) to use through the nostril on the operation side twice daily for 5d.

Patients were examined and questioned in the first postoperative week, first month, and first year after the surgery. Removal of the silicone tubes in each patient was done in the 6th mo visit after surgery. The final success rates were calculated at the first year of surgery.

Statistical Analysis Data were analyzed using the Statistical Package for Social Sciences (SPSS) software (version 11.5 for Windows). Proximity of the distribution of discontinuous numeric variables to the normal was analyzed with Shapiro-Wilk test. Descriptive statistics for the discontinuous numeric variables was expressed as mean ±standard deviation or median (minimum-maximum). Categoric variables were expressed as number of cases and percentage (%). Significance of the difference between groups in terms of means was analyzed by Student's *t*-test and the significance

Table 1 Epiphora among groups

Time of examination	Grade of epiphora	EXT-DCR (n=25)	END-DCR (n=25)	P
Preop.	Grade 2	25 (100%)	25 (100%)	-
Postop.				
1st wk	Grade 0	18 (72%)	22 (88%)	0.289
	Grade 1	7 (28%)	3 (12%)	
1st mo	Grade 0	24 (96%)	23 (92%)	1.000
	Grade 1	1 (4%)	2 (8%)	
1st a	Grade 0	24 (96%)	25 (100%)	1.000
	Grade 1	1 (4%)	-	

of the difference between groups in terms of medians was analyzed by Mann-Whitney U test. Categoric variables were analyzed by continuity correction Chi-square test or Fisher's exact test. All differences associated with a chance probability of 0.05 or less were considered statistically significant.

Main Outcome Measures Overall outcome was assessed at the first year after surgery, being 6mo after removal of the silicone tubes. Subjective success was based on patient's symptoms, objective success on patency with syringing, and the presence of a functioning rhinostomy, evaluated using the functional endoscopic dye test (FEDT). Subjective success was based on the degree of epiphora, which was graded by the patients as no epiphora (0 point), moderate (1 point), high (2 points). Objective success was determined by a patent nasolacrimal passage confirmed by a normal nasolacrimal lavage and a functioning rhinostomy confirmed by the appearence of flourescein dropped over the conjunctival fornix from the rhinostomy side-FEDT. Investigation of the nasolacrimal passage was made by the examation of the ophthalmologist with lacrimal syringing and by the examination of the otorhinolaryngologist with rigid nasoendoscopy to assess the FEDT and appearance of the rhinostomy. A functioning rhinostomy with a positive FEDT was determined when a drop of 2% fluorescein instilled in the conjunctival fornix was visualised emerging from the rhinostomy at 2-10s later [6]. Post-operative outcome was assessed at the end of 1y.

Epiphora was graded by the patient as no epiphora (0 point), moderate (1 point), high (2 points). Clinical comfort was assesed by postoperative pain graded by the patient and the cosmetic result of the surgery interpreted by the patient. Patients graded postoperative pain as no pain (0 point), moderate (1 point) and high (2 points) in every postoperative visit. Cosmetic result of the surgery was assessed by questioning the patient in each visit whether he or she is happy with the cosmetic result or not. Patients were also asked at the end of one year whether they would offer this surgery to a friend and whether they would prefer this surgery once more if necessary or not.

RESULTS

Fifty patients were involved in the study, 50% were managed by EXT-DCR and 50% by END-DCR. Both groups were age and sex matched (P=0.120, P=1.00 respectively). Mean age of patients was 43.4±9.4y in EXT-DCR group and 47.1±7.1 in END-DCR group. The average follow-up time was 14mo (14-20) for EXT-DCR and 16mo (14-20) for END-DCR group (P=0.04). Mean duration of surgery was 35min for EXT-DCR (30-50) and 35min for END-DCR (35-50) (P=0.778).

Subjective Success In the first postoperative week, 12% of END-DCR patients had marked reduction, and 88% had complete resolution of epiphora. In EXT-DCR group, 28% had marked reduction and 72% had complete resolution of epiphora. In total 96% of the EXT-DCR patients and 100% of END-DCR patients had a subjective success which was defined by the total absence of the epiphora at the end of 1y. There was no significant difference between the epiphora scorings in the first week, first month and first year visits among the DCR groups (Table 1). Maximum subjective success rate (96%) of the EXT-DCR was maintained in the first postoperative month whereas the maximum success rate (100%) of the END-DCR group was maintained at the end of first postoperative year.

There were no patients in the END- or EXT-DCR group with a score of 2 in first postoperative week. This means epiphora had improved or completely resolved in all patients in very early postoperative period. But no statistical significance was found among the groups when the subjective success rates were compared in each visit.

Objective Success In the first postoperative week, 96% of END-DCR patients had a positive FEDT and a normal nasolacrimal lavage. In EXT-DCR group, this rate was 92% (P=1.000). In total 100% of the EXT-DCR patients and 100% of END-DCR patients had an objective success which was defined by the FEDT and syringing. There was no significant difference between the objective success results in the first week, first month and first year visits among the DCR groups (Table 2). Maximum subjective success rate (100%) of both groups was maintained in the first postoperative month of the surgery.

Table 2 Nasolacrimal lavage and FEDT results among groups

Time of examination	Lavage and FEDT	EXT-DCR (*n*=25)	END-DCR (*n*=25)	*P*
Preoperative	Negative	25 (100%)	25 (100%)	-
	Positive	0	0	
Postoperative				
1st wk	Negative	2 (8%)	1 (4%)	1.000
	Positive	23 (92%)	24 (96%)	
1st mo	Negative	0	0	-
	Positive	25 (100%)	25 (100%)	
1st a	Negative	0	0	-
	Positive	25 (100%)	25 (100%)	

Table 3 Grades of pain among groups

Time of examination	Grade of pain	EXT-DCR (*n*=25)	END-DCR (*n*=25)	*P*
Postoperative				
1st wk	Grade 1	11 (44%)	25 (100%)	<0.001
	Grade 2	14 (56%)	0	
1st mo	Grade 0	10 (40%)	24 (96%)	<0.001
	Grade 1	15 (60%)	1 (4%)	
1st a	Grade 0	24 (96%)	25 (100%)	1.000
	Grade 1	1 (4%)	-	

Table 4 Cosmetic results of surgery among groups

Time of examination	Happy/unhappy	EXT-DCR (*n*=25)	END-DCR (*n*=25)	*P*
Postoperative				
1st wk	Unhappy	23 (92%)	1 (4%)	<0.001
	Happy	2 (8%)	24 (96%)	
1st mo	Unhappy	11 (44%)	0	<0.001
	Happy	14(56%)	25 (100%)	
1st a	Unhappy	-	-	-
	Happy	25 (100%)	25 (100%)	

There were 2 patients (8%) in the EXT-DCR and 1 patient (4%) in END-DCR group with a negative FEDT and nasolacrimal lavage in first postoperative week (P>0.01). But all patients had a patent lavage and positive FDDT at the end of first postoperative month. No statistical significance was found among the groups when the objective success rates were compared in each visit.

Pain In the first postoperative week, 56% of EXT-DCR patients had a high amount of pain graded as grade 2 and 44% had moderate amount of pain graded as grade 1, whereas in END-DCR group, all patients had a moderate amount of pain. END-DCR group resulted in significantly less amount of pain in first postoperative visit (P<0.05). In the first postoperative month, 60% of EXT-DCR patients and only 4% of END-DCR patients had moderate amount of pain (grade 1). END-DCR group resulted in significantly less amount of pain also in first postoperative month (P<0.05). Ninety-six percent of patients in EXT-DCR and 100% of them in END-DCR were devoid of pain at the end of first year (P=1.000) (Table 3).

Cosmetic Result In the first postoperative week, 92% of EXT-DCR patients were unhappy with the cosmetic result whereas this ratio was only 4% in END-DCR patients (P<0.001). Ratio of the unhappy patients of EXT-DCR group decreased to 44% in first postoperative month, which was still significantly higher than the END-DCR group at the end of 1mo. Overall ratios were similar in the first postoperative year, in which all patients were happy with the result (Table 4).

Offer to a Friend Patients were also asked at the end of one year whether they would offer this surgery to a friend or not. Fifty two percent of the patients in EXT-DCR group offered this surgery to a friend, whereas 96% of the patients in END-DCR group offered it to a friend. Only one patient of the END-DCR group did not offer. This difference among the rates were significant (P<0.001) (Table 5).

When those who did not offer this surgery to a friend among each group were compared, it was found that they were similar in terms of epiphora grades and FEDT results. The only one patient in END-DCR group that did not offer it to a friend was a patent in which no intraoperative complication was seen and patient had no epiphora and had a positive FEDT and a normal lacrimal lavage at the end of 1y. It was seen that this patient said she would prefer this DCR method

Table 5 Ratios of offering this surgery to a friend and preferring this surgery once more if necessary

Question	Answer	EXT-DCR (*n*=25)	END-DCR (*n*=25)	*P*
Would you offer this surgery to a friend ?	Yes	13 (52%)	24 (96%)	<0.001
	No	12 (48%)	1 (4%)	
Would you prefer this surgery once more if necessary?	Yes	12 (48%)	25 (100%)	<0.001
	No	13 (52%)	-	

Table 6 Characteristics of the EXT-DCR group versus offering surgery to a friend

Time of examination (postoperative)	Characteristics of the group	EXT-DCR (*n*=25)		*P*
		Not offer (*n*=12)	Offer (*n*=13)	
1st wk	Epiphora grade 0	10 (83.3%)	8 (61.5%)	0.378
	Epiphora grade 1	2 (16.7%)	5 (38.5%)	
1st mo	Epiphora grade 0	11 (91.7%)	13 (100%)	0.480
	Epiphora grade 1	1 (8.3%)	-	
1st a	Epiphora grade 0	11 (91.7%)	13 (100%)	0.480
	Epiphora grade 1	1 (8.3%)	-	
1st wk	Negative lavage and FDDT	2 (16.7%)	-	0.220
	Positive lavage and FDDT	10 (83.3%)	13 (100%)	
1st wk	Pain grade 1	-	11 (84.6%)	<0.001
	Pain grade 2	12 (100%)	2 (15.4%)	
1st mo	Pain grade 0	-	10 (76.9%)	<0.001
	Pain grade 1	12 (100%)	3 (23.1%)	
1st a	Pain grade 0	11 (91.7%)	13 (100%)	0.480
	Pain grade 1	1 (8.3%)	-	
1st wk	Unhappy cosmetic result	12 (100%)	11 (84.6%)	0.480
	Happy cosmetic result	-	2 (15.4%)	
1st mo	Unhappy cosmetic result	11 (91.7%)	1 (8.3%)	<0.001
	Happy cosmetic result	13 (100%)		

once more if necessary. But interestingly said that she would not offer it to another friend. Patients who did not offer it to a friend in EXT-DCR group were significantly higher among the patients with higher grades of pain in first the postoperative week and month visits, and among those who were unhappy with the cosmetic result in the first postoperative month (Table 6).

Prefer This Surgery Once More If Necessary All patients in END-DCR group mentioned they would prefer this surgery once more if necessary, but only 48% of those in EXT-DCR said they would prefer the same method. There was a significant difference among groups (P<0.001) (Table 5).

When those who did not prefer this surgery once more were compared, it was found that they were similar in terms of epiphora grades and FEDT results. Patients who did not prefer this surgery once more in EXT-DCR group were significantly higher among the patients with higher grades of pain in first the postoperative month visit, and among those who were unhappy with the cosmetic result in the first postoperative month (Table 7).

Complications Intraoperative bleed requiring nasal packing were documented in 48% of cases in EXT-DCR and 4% of cases in END-DCR (P<0.001). The surgeon encountered dacrioliths in the lacrimal sac during END-DCR in one case intraoperatively. No other complications were observed intra or post operatively.

DISCUSSION

EXT-DCR had been the major choice of surgery for years for the lacrimal surgeons in the treatment of acquied NLDO. It offers a high success rate and surgeons come across with the lacrimal anatomy directly instead of indirect visualisation by using an assistant device. But a cutaneous scar over the incision and the risk of injury to medial canthal structures, impairment in the function of lacrimal pump mechanism and even cerebrospinal fluid rhinorrhea are some of the hazardous complications of this surgery [7] .

Although the inital endonasal approach to DCR was first described in 1893, before the external approach, external method was carried out as the gold standard method for years, until the involvement of modern equipments and endoscopic devices [3]. The endonasal method was revised in 1990 and then, many surgeons have used END-DCR which brougt many advantages to the lacrimal surgery [3].

END-DCR has been a popular treatment over the years due to its comparative results for long-term success in nasolacrimal duct obstruction with the main utility of its respect to anatomical integrity and its noninvasive type of modality. Intervention of failed dacriocystorhinostomy cases can also be done endoscopically *via* direct visualisation. In any complicated case or those with a suspected lacrimal sac tumour the surgery can easily be converted to external approach from the endoscopic method [7].

Table 7 Characteristics of the groups versus preferring the surgery once more if necessary

Time of examination (postop.)	Characteristics of the group	EXT-DCR (n=25)		P
		Not prefer (n=13)	Prefer (n=12)	
1st wk	Epiphora grade 0	10 (83.3%)	8 (66.7%)	0.673
	Epiphora grade 1	3 (23.1%)	4 (33.3%)	
1st mo	Epiphora grade 0	13 (100%)	11 (91.7%)	0.480
	Epiphora grade 1	-	1 (8.3%)	
1st a	Epiphora grade 0	13 (100%)	11 (91.7%)	0.480
	Epiphora grade 1	-	1 (8.3%)	
1st wk	Negative lavage and FDDT	1 (7.7%)	1 (8.3%)	1.000
	Positive lavage and FDDT	12 (92.3%)	11 (91.7%)	
1st wk	Pain grade 1	2 (15.4%)	9 (75%)	0.009
	Pain grade 2	11 (84.6%)	3 (25%)	
1st mo	Pain grade 0	1 (7.7%)	9 (75%)	<0.001
	Pain grade 1	12 (92.3%)	3 (25%)	
1st a	Pain grade 0	13 (100%)	11 (91.7%)	0.480
	Pain grade 1	-	1 (8.3%)	
1st wk	Cosmetic result unhappy	13 (100%)	10 (83.3%)	0.220
	Cosmetic result happy	-	2 (16.7%)	
1st mo	Cosmetic result unhappy	11 (84.6%)	-	<0.001
	Cosmetic result happy	2 (15.4%)	12 (100%)	

Medial canthal tendon is preserved in endoscopic DCR just as the physiology of the lacrimal pump mechanism. No scar over the incision is observed, which is a main reason of choice especially for young female patients [8]. Young patients with a flat central nasal bridge or dark skin are more prone to an external scar, and therefore an endonasal approach is much more suitable for these cases. Also, patients with functioning filtration blebs should be specifically considered for END-DCR to avoid pressure on the globe [2].

It has a shorter operative time and additionally endonasal DCR surgery has been reported to be with earlier postoperative recovery time [2,7,9]. In our study, similar operation times were reported with both types of the surgeries. However disappearance of the epiphora in all patients of EXT-DCR group was maintained in the first postoperative month whereas it was managed at the end of first postoperative year in END-DCR group. This difference was not statistically significant and cannot be interpreted as an indication of longer recovery time due to the very limited number of patients in the compared groups.

Lower rates of air regurgitation while nose blowing, minimal risk of hemorrhage, very small risk of cerebrospinal fluid rhinorrhea are some other manifested advantages of END-DCR [7,10]. Dacryocystitis is not a direct contraindication to the endoscopic surgery, and patients with chronic dacryocystitis can also be treated with the endoscopic technique [10].

Although complication risk of END-DCR are reported to be small, failure of the intranasal rhinostomy opening, epistaxis, orbital injury, corneal abrasion, or canalicular damage, and lacrimal sump syndrome may be occasionally seen [7,11,12]. By both forms of DCR surgery, some z complications like orbital and subcutaneous emphysema, retrobulbar hemorrhage, medial rectus paresis, and orbital fat herniation are reported in the literature [11]. We observed no serious complications in our study. Intraoperative bleeding was the most common complication and was reported in 48% of cases in EXT-DCR and 4% of them in END-DCR which was significantly different in both surgeries (P <0.001). This higher rate of intraoperative bleeding with EXT-DCR may be due to the patient related factors (DM or HT like microvascular problems) which was ignored in our study, or surgeon related factors since EXT-DCR was carried on by an ophthalmologist who is less familiar to intranasal anatomy than an otorhinolaryngologist, or technique dependent factors which is the non assisted nature of the EXT-DCR which is devoid of intranasal monitoring with an endoscope that avoids the damage of mucosal and intranasal structures. However, a larger sample size would be necessary to adequately compare complication rates between the 2 approaches.

We observed 3 small lacrimal sac dacrioliths in the lacrimal sac of a patient during END-DCR intraoperatively, which was not noticed preoperatively by the dacriocystography. No other complications were observed intra or post operatively.

We defined the overall surgical success by both patency of nasolacrimal system (objective success) and by the reduction of the patient complaints of epiphora (subjective success). Rose [13] defined a discrepancy about the subjective and objective success results of DCR operations proposing that anatomical success may not correlate to success in control of symptoms and vice versa. He describes the signs and symptoms of drainage disorders to be either volume related or flow related. According to him, surgical interventions may

treat volume-related backwash from the lacrimal sac in most cases. However, flow-related characteristics are defined to be largely due to limitation or tear conductance from the lateral canthus to the nose. Symptom relief of flow-related symptoms may not be possible in every patient, especially if there is hydraulic resistance of the canaliculi and nasolacrimal duct [7,13] .

Although all patients in our study had a patent lacrimal lavage and a positive FDDT at the end of first postoperative month, one patient in EXT-DCR group mentioned a low grade of epiphora even at the end of one year. This may be explained by the disturbed lacrimal pump mechanism by the external approach. The benefit of END-DCR on preserving the lacrimal pump system by protecting the orbicularis oculi muscle the main driver of the lacrimal pump and superior results in patients with functional nasolacrimal duct rather than anatomical nasolacrimal duct obstruction is one of the main issues which should be emphasized in this study.

Since some studies define the success as patency to irrigation whereas others define it as symptom resolution, no exact evaluation of the surgical success of primary DCR surgery could be clearly done in most of the previous studies. A study of Karim *et al* [7] also evaluated both objective patency results and subjective patient symptom measurements resembling our study about the definition of surgical success. But our study also evaluated the grading and comparison of postoperative pain sensation and assessment of cosmetic results of the surgery by the patients (clinical comfort of the patient). This aspect of our study has not been previously investigated in any study of the literature up to now.

During the literature review, we met some similar studies aiming to investigate the patient comfort postoperatively after DCR procedure types. The Glasgow Benefit Inventory (GBI) scoring system-a patient-oriented measure of postoperative benefit-was used in these trials. In a study of Feretis *et al* [14] GBI scale along with an additional, department-based symptomatic questionnaire, was distributed to all patients. Results indicated positive scores for both groups for all four subscales of the GBI with no statistically significant differences between results for the external and endonasal procedures. The ocular symptomatology questionnaire results indicated better scores for the external procedure, but this difference was not found to reach statistical significance. Jutley *et al* [15] supported this study and showed that END-DCR gave patients improvement in quality of life, proven the same questionnaire. Bakri *et al* [16] used the GBI to retrospectively compare the postoperative benefit produced after endonasal laser and EXT-DCR. EXT-DCR was found to provide greater improvement in quality of life, but the difference between groups did not reach statistical significance. Ho *et al* [17] conducted a prospective nonrandomized series evaluating the impact of endonasal surgical DCR on quality of life. The GBI scores reported in this study appear to confirm past findings that external and endonasal surgical DCR produce positive postinterventional change in patient health status, but the difference between groups was negligible. In a study by Hii *et al* [18] due to the shorter mean surgical duration, direct staff costs of endonasal DCR were lower than the external technique. In this study, endonasal DCR was shown to produce comparable quality of life outcomes to EXT-DCR, with lower rates of postoperative complications. An analysis of the two techniques in regard to cost also yielded similar results; however, neither of these results reached statistical significance.

In this study, we tried to minimize the bias by selecting all patients from female gender and by performing all surgeries under general anestesia to disregard the fear and anxiety factor of each patient that may effect the postoperative assessment of the personal surgical comfort. However, small number of patients enrolled in the study is a major limitation to our study.

One of the major determinants of the postoperative clinical comfort in our study is assumed to be the postoperative pain and END-DCR group mentioned significantly less amount of pain in the first week and first month visits postoperatively (P<0.05, P<0.05). But finally statistically similar ratios of cases in both groups (96% of patients in EXT-DCR and 100% of them in END-DCR) were devoid of pain at the end of first year.

In the first postoperative week and month visits, significantly higher amount of patients in END-DCR were happy with the cosmetic result (P <0.001, P <0.001). Nevertheless the overall ratios were similar in the first postoperative year, in which all patients were happy with the result. Early postoperative comfort of END-DCR patients demonstrated by this two entity documents that, END-DCR brings a higher patient satisfaction and comfort in earlier postoperative course which later seems to be similar with the EXT-DCR after the first postoperative year. All patients in END-DCR group mentioned they would prefer this surgery once more if necessary, but only 48% of those in EXD-DCR said they would prefer the same method. There was a significant difference among the groups, which seems to be a reflection of this earlier postoperative comfort of END-DCR.

Many studies show comparable success results of END-DCR compared with EXT-DCR success rates ranging from 75%- 97% [2,5,7,19-23]. The majority of recent studies reported a higher success rates (82% -100%) by EXT-DCR [2,4,19]. Hartikainen *et al* [20] reported the greatest difference between the two techniques. Our study revealed comparable and high success rates in both surgeries, but since the success rates in our study are estimated at the end of first year visit, this limited time of follow up may not give an exact idea of the surgical success of the two methods.

Learning curve of the endoscopic procedure is a major limitation in END-DCR applications against an easily applied EXT-DCR procedure after a short self orientation time to lacrimal anatomy. Onerci stratified success rates according to

experience of the surgeons and found high success rates of up to 94% with experienced surgeons, compared with inexperienced surgeons with success rates of only 58%[23]. This surgeon dependent limited success of END-DCR is nowadays observed to be more parallel to the success rates of EXT-DCR in recent studies due to a wider range of acceptance of the endoscopic method among ophthalmic surgeons by time and increased surgical experiences by their common practice.

Hartikainen *et al*[20] reported the importance of frequent, postoperative follow-up for intranasal cleaning of debris and mucous at the rhinostomy site after END-DCR to improve the success rate; however, usually only 1 or 2 follow-up visits are assumed to be enough for the postoperative evaluation in those who undergo EXT-DCR. In our practice, we also check the rhinostomy side in every follow up visit, but we observed to serious problems postoperatively around this region that would affect the success of the surgery.

The success rates of EXT- and END-DCR for acquired NLDO in our study was high with similar ratios in both groups. Objective success was 100% in both groups, determined by a normal lacrimal lavage with a positive FEDT; and subjective success was 96% *vs* 100% in EXT- and END-DCR groups respectively. As a result, a survey regarding patients' postoperative clinical comfort was firstly introduced to the literature by our study; and proved more patient comfort postoperatively after END-DCR in paralel to the general clinical impression of many surgeons. END-DCR seems to supply a more satisfactory cosmetic result with less pain postoperatively, but depends on surgeon based success rate. According to our opinion, choice of the surgical techniques should mainly depend on the patient's preference, unless a contraindication exists to the preferred technique and the availability of resources in existing health care units should be considered during the preferral.

A combined work of the otolaryngologists and the ophthalmologists yields a great advantage for the optimum management of the patient with NLDO. END-DCR surgery with its superiorities reported in new studies enforces its use in coming years for the primary treatment of nasolacrimal duct obstruction, even though the classical EXT-DCR technique seems to be still the preferred method of choice for the ophthalmic surgeons with less experience in endonasal endoscope use, due to its high predicted success rate consequently. As a conclusion, the point we want to highlight is that the final determinant of a DCR surgical technique must depend on patient's choice, patient's lacrimal and nasal anatomy and the surgeon's surgical training.

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