

## Comparison of different surgical methods in endonasal dacryocystorhinostomy

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### Abstract

**Objective:** The objective of this study is to compare three different techniques applied during dacryocystorhinostomy in terms of recurrence and operative times.

**Methods:** Operative times and follow-up results of the patients who underwent endoscopic dacryocystorhinostomy surgery between January 2011 and April 2014 due to nasolacrimal duct occlusion were compared. Lacrimal sacs of the patients in Group 1 (n=15) were explored using gouge hammer and surrounding bony structures were dilated with diamond drilling instrument. Lacrimal sacs of the patients in Group 2 (n=11) were identified and dilated using Diamond drill. Lacrimal sacs of the patients in Group 3 (n=15), were found with the aid of a gouge hammer and enlarged using Smith-Kerrison punch forceps.

**Results:** There was no significant difference between Groups 1 and 2 as for recurrence rates. However, recurrence rates in Group 3 were found to be higher compared to Groups 1 and 2. Operative times demonstrated significant differences among 3 groups, with at its highest and lowest operative times detected in Groups 1 and 2, respectively.

**Conclusion:** With this study, it was concluded that exploration and identification of lacrimal sac using gouge hammer and expansion of the surrounding bony structure with diamond tipped drills during dacryocystorhinostomy is an improved method with relative shortness of the operative time and lower recurrence rates.

**Keywords:** Nasolacrimal canal, dacryocystorhinostomy, epiphora, dacryocystitis.

### Özet: Endonazal dakriyosistorinostomide farklı cerrahi yöntemlerin karşılaştırılması

**Amaç:** Bu çalışmanın amacı, dakriyosistorinostomi cerrahisi sırasında uygulanan üç farklı tekniğin nüks ve süre açısından karşılaştırılmasıdır.

**Yöntem:** Ocak 2011 – Nisan 2014 tarihleri arasında nazolakrimal kanal tıkanıklığı nedeniyle endoskopik dakriyosistorinostomi cerrahisi uygulanan hastaların cerrahi süreleri ve takip sonuçları karşılaştırıldı. Grup 1'deki hastaların (n=15) lakrimal kesesi guj-çekiç ile bulunup, etrafındaki kemik doku elmas tur ile genişletildi. Grup 2'deki hastaların (n=11) lakrimal kesesi sadece elmas tur ile bulunup genişletildi. Grup 3'teki hastaların (n=15) lakrimal keseleri guj-çekiç yardımıyla bulundu ve Smith-Kerrison *punch forceps* ile genişletildi.

**Bulgular:** Nüks açısından Grup 1 ve Grup 2 arasında anlamlı farklılık yoktu. Buna karşılık Grup 3'teki nüks oranı, Grup 1 ve Grup 2'ye kıyasla anlamlı olarak daha yüksek bulundu. Ameliyat süresi her üç grupta da anlamlı farklılık gösterdi ve Grup 2'de en yüksek, Grup 3'te ise en düşük değerde idi.

**Sonuç:** Bu çalışma, dakriyosistorinostomi cerrahisi sırasında lakrimal kesenin guj-çekiç ile bulunup, etrafındaki kemik dokunun elmas tur ile genişletildiği yöntemin cerrahi süresinin nispeten kısa olması yanında düşük nüks oranlarıyla iyi bir yöntem olduğu sonucuna ulaşılmıştır.

**Anahtar sözcükler:** Nazolakrimal kanal, dakriyosistorinostomi, epifora, dakriyosistit.

Nasolacrimal canal (NC) obstruction impairs tear flowing from the eye into nasal cavity and causes symptoms of epiphora. Epiphora signifies watering of eyes secondary to

imbalance between production and absorption of tear fluid.<sup>[1]</sup> Tears released from lacrimal gland situated in the superolateral part of the orbita, passes through punctum,

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canalicule and nasolacrimal duct after moistening eye lids and globe and finally drains into nasal cavity at the level of lower concha.<sup>[2]</sup> NC obstruction is caused by many congenital and/or acquired etiological factors. Among them, acute and chronic inflammation, trauma and congenital malformations are the most frequently seen etiological factors.<sup>[3,4]</sup>

Dacryocystorhinostomy (DCR) is a surgical procedure used for the treatment of NC obstruction. DCR creates a fistula between lacrimal sac and nasal cavity to ensure lacrimal flow.<sup>[5]</sup> Nowadays, to this end, two basic techniques have been used as external and endonasal dacryocystorhinostomy.<sup>[6]</sup>

External DCR was described by Toti in 1904 and various modifications of the original technique have been developed in subsequent years.<sup>[6]</sup> In various series, success rates of external DCR change between 70 and 100 percent.<sup>[7]</sup>

Endonasal DCR was described by Caldwell in 1893 and then modified by West and Halle.<sup>[6]</sup> However, at that time, due to restricted visualization of the nasal cavity it was not frequently preferred method. In recent years, with the introduction of nasal endoscopes into use in 1989 McDonoughendo described the current method of endonasal DCR.<sup>[8]</sup> In various studies, success rates of this method have been reported to be between 75 and 93.5 percent.<sup>[7]</sup>

We planned this prospective study to compare some surgical parameters and postoperative outcomes in Group 1 where lacrimal sac was found using gouge hammer and the surrounding bony tissue was dilated with a diamond tipped drills and in Group 2 where only diamond tipped drills were used and surgery was carried out using only gouge hammer.

## Materials and Methods

### Study Design

A total of 41 patients who underwent DCR surgery between January 2011 and April 2014 were included in the study. Each patient was evaluated routinely by an ophthalmologist. Dacryoscintigraphy with the aid of a lacrimal sac lavage was applied for each patient. The patients with chronic dacryocystitis and acute exacerbations of chronic dacryocystitis who could not get therapeutic relief with lacrimal sac lavage were included in the study. Patients whose lacrimal canal obstruction was localized proximal to the lacrimal sac and those experiencing recurrences were not included in the study.

### Surgical Procedure

All DCR procedures were performed by the same ENT (Ear, Nose and Throat) specialist and an ophthalmologist. Operations of all patients were performed under general anesthesia. For an easier visualization and bloodless surgery nasal cavity was decongested with application of adrenaline solution (1:10000) impregnated cotton swabs (Adrenalin; Biofarma AS, Istanbul, Turkey) Infiltration anesthesia with 2 ml 2% lidocaine and 1:100.000 adrenaline (Jetokain; Adeka AS, Samsun, Turkey). Combination was applied on the lateral wall of the nasal cavity, at the level of maxillary line, insertion point of the middle concha and anterior aspect of the middle concha. During surgery, telescopes with 0° and 30° lenses were used. Incisions on nasal mucosa were performed using 15 G scalpels. Superior horizontal incision made at the level of insertion point of the middle concha was extended anteriorly for almost 10 mm. Inferior horizontal incision was extended immediately anterosuperior to the lower concha. Anterior edges of these two horizontal incisions were joined with a vertical incision. Mucosa was elevated using a suction elevator and a flap with a posterior pedicle was prepared. Thus, bone tissue covering the lacrimal sac was exposed. After this step, lacrimal sacs were exposed using 3 different techniques. In Group 1, lacrimal sacs were explored using gouge hammer and surrounding bone tissue was dilated by drilling. In Group 2, lacrimal sacs of 11 patients were identified and dilated using only a diamond tipped drills. In Group 3, lacrimal sacs of 15 patients were found with the aid of gouge hammer and dilated using Smith-Kerrison punch forceps. In all three groups, all of medial wall of the lacrimal sac was explored. At this stage, ophthalmologists attending the surgery dilated upper and lower puncta and lacrimal probes were advanced to the lacrimal sac. Medial wall was displaced further to the medial and a tent effect was formed. Medial wall marsupialized using sickle shape scalpel blade. All mucosal flaps formed were excised using through-cutting forceps with upper jaw. Then through superior and inferior puncta silicon DCR tubes were inserted and advanced into the nasal cavity. Afterwards, with the aid of an endoscope, an average of 6 knots were tied on the both ends of the tube within the nasal cavity, fixed at the level of the middle meatus and cut. We constructed a flap with a posterior pedicle in the nasal mucosa and its part corresponding to the newly-formed ostium was excised with through-cutting forceps and the remaining part of the flap was placed over the uncovered, bare bone

tissue and brought to its original position. A polyvinyl alcohol sponge with a string (Merocell®) was placed on the flap so as to keep the flap in a fixed position. If septoplasty was performed during the surgery, a silicon nasal splint (Doyle®) was applied, fixed to the skin of the columella with 2-0 silk sutures and removed 48 hours later.

Postoperatively each patient was started on antibiotherapy and analgesics for one week. The patients were followed up at first week intervals within the first month, then every 2 months. Silicon tubes placed intraoperatively were removed at postoperative 6th month with the aid of an endoscope. After the first postoperative year, the patients were followed up annually. At all follow-up visits, the patency of newly-formed canal was checked with the aid of nasal endoscopy and lacrimal lavage.

### Statistical Analysis

Data were analyzed using the IBM Statistical Package for Social Sciences v20 (SPSS Inc., Chicago, IL, USA). Kruskal-Wallis test and Mann-Whiney U test were used to compare groups. Bonferroni post hoc analysis was used for multiple comparison tests. Data are expressed as mean±SD or median (interquartile range), as appropriate. All differences associated with a chance probability of .05 or less were considered statistically significant.

### Results

A total of 41 patients (female, n=28; 68.29% and male, n=13; 31.71%) were included in the study. Median ages of the patients in Groups 1 (female, n=10 and 5 male) and 2 (female, n=8 and male, n=3) were 40 (32) and 37 (34) years, respectively.

The study participants underwent septoplasty (n=13) and radiofrequency ablation (n=8) with indications of septal deviation and lower concha hypertrophy, respectively. During the postoperative period, preorbital edema and ecchymosis were detected in 6 patients who required local ice pack applications.

Left (n=25) and right (n=16) eyes of the patients were operated. Our median follow-up period was 15.08±7.64 months (range: 7 to 34 months)

Median value of the variable for duration was determined as 28 min. (range: 9 min.) in Group 1, 49 min. (range: 6 min.) in Group 2, and 21 min. (range: 8 min.) in Group 3 with a significant intergroup difference (p<0.05). This variable has its peak in Group 2 and its nadir in Group 3 (Table 1).

During follow-ups, recurrences were seen in one patient both in Groups 1 and 2, and 6 patients in Group 3. No recurrence was seen in 80.5% of the patients participated in the study while 19.5% of the patients experienced recurrences. Any recurrence was not encountered during the period of silicon implantation. In patients with recurrences, the responsible pathology was granulation tissue, while in the remaining 3 patients, adhesions between newly-constructed rhinostomy and surrounding tissues were the causative factor of recurrences. Based on Kruskal-Wallis test results, as for variables for duration and recurrence, a significant difference was detected among three groups (p<0.05). For the recurrence variable, there was no significant difference between Groups 1 and 2 (p>0.05). However, recurrence rates in Group 3 were found to be significantly higher when compared with Groups 1 and 2 (p<0.05) (Table 1).

### Discussion

Dacryocystorhinostomy is a method of constructing an alternative new pathway for the drainage of tears via bypassing nasolacrimal canal between lacrimal sac and the nasal cavity. This procedure can be performed using external or endonasal methods.

Together with developments in nasal endoscopes, transnasal endoscopic DCR procedure has gained importance. Absence of skin scar, direct approach into rhinostomy region, evaluation of intranasal anatomy during surgery, intact lacrimal pump function because of avoidance

**Table 1.** Recurrence and surgery time (min.) among groups.

Variables		Group 1 (n=15)	Group 2 (n=11)	Group 3 (n=15)
Recurrence	Absent	14(93.3%)	10 (90.9%)	9 (60%)
	Present	1 (6.7%)	1 (9.1%)	6 (40%)
Surgery time (min.), median (IQR range)		28 (9)	49 (6)	21 (8)

of injury to the medial canthal tendon and shorter operative and postoperative healing time can be enumerated among superiorities of the endoscopic method over external method.<sup>[7]</sup> Endoscopic DCR technique has a difficult and longer learning curve relative to external DCR.<sup>[2]</sup>

Based on literature reviews, different success rates have been reported for endonasal and external DCR procedures. In some studies, the authors advocated that external DCR procedures had higher success rates when compared with the endonasal method, and some other authors had asserted that both methods had the same success rates or endonasal method is superior to external method.<sup>[9-11]</sup> Different opinions about success rates stated for DCR procedures in the literature stem from scarce number of prospective, randomized and controlled comparative studies between external and endoscopic DCR procedures.

In general, multiple factors are effective on the failure rates of DCR procedure and formation of scar tissue in the newly-constructed ostium is the most frequently encountered reason.<sup>[12]</sup> Formation of a granulation tissue, adhesions, septal deviation, incomplete excision of the bony scaffold of the lacrimal sac, canalicular obstruction and inappropriate location of the *de novo* ostium can be considered among other reasons of procedure failure.<sup>[5]</sup>

In external DCR procedure, since anatomy of the nasal cavity could not be evaluated fully, agger nasi cells, anterior ethmoidal cell variations and nasal septum deviation can be overlooked. If these anatomic variations go unnoticed, then the *de novo* ostium would not be constructed at an optimal location subsequently lead to development of recurrences.<sup>[5]</sup> In nearly 46% of external DCR procedures, lacrimal sac opens into anterior ethmoid cells rather than nasal cavity with resultant surgical failure.<sup>[13]</sup> In addition, since external DCR procedure restricts complete visualization of the operative site, intraoperative injuries to the middle concha mucosa and surrounding tissues lead to scar formation on the *de novo* ostium with ensuing ostial obstruction.<sup>[14]</sup>

In the revision of recurrent external DCR cases, the advantage of using endoscopic DCR is that during endoscopic DCR, easy detection of variations in anatomical structures adjacent to the lacrimal sac which allows optimal localization of *de novo* ostium.<sup>[5]</sup> Endoscopic DCR approach provides an opportunity of performing dacryocystorhinostomy and also surgical correction of concomitant pathologies such as deviation of the nasal septum, concha hypertrophy and sinus abnormalities.<sup>[2]</sup>

DCR procedure is more frequently applied in women compared to men.<sup>[2]</sup> Similar to these data, female patients were more frequently (68.29%) detected in our study. In one of the anatomy studies performed using radiological methods, diameter of the nasal canal in women was found to be relatively smaller than those encountered in men.<sup>[1]</sup>

In the literature, surgical success was defined as elimination of complaints of epiphora within the first postoperative year and demonstration of a patent lacrimal system using lacrimal system lavage and endoscopic examination.<sup>[15]</sup> In their study, Tsirbar and Wormald expressed the secret of a successful DCR procedure as nearly complete excision of the bone tissue covering lacrimal sac and its approximation with mucosal flap constructed from nasal mucosa by marsupialization of lacrimal sac mucosa.<sup>[16]</sup> Liang et al. indicated that excision of bony processes surrounding newly-constructed ostium in order to create a cavity with a smooth surface increases surgical success rates.<sup>[5]</sup> In our series, we observed that newly-constructed ostia in Group 1 patients, where surgery was basically performed with gouge master, had irregular contours when compared with ostia of other groups. Higher recurrence rates in Group 3 compared to other groups were evaluated as a consequence of this condition.

In another study cited in the literature, in one group of patients where lacrimal sac flap technique was applied, higher surgical success rates were found when compared with the conventional DCR group where medial wall of the lacrimal sac was completely excised. As an explanation of this condition, lower risk of granulation tissue formation in the lacrimal sac flap technique can be suggested.<sup>[17]</sup> Hartikainen et al. compared external and endoscopic DCR procedures and suggested that surgical success is directly proportional to the width of the rhinostomy.<sup>[9]</sup>

In our study, one of the reasons of more frequently detected recurrences in Group 3 is the surgical method used traumatized surrounding tissues leading to the development of scar tissue with ensuing occlusion of the newly-formed ostia. Remnants of irregular bony processes within the ostium which result in the development of occlusive scar tissue are another factors for the occurrence of recurrences. In Group 1 where combined method was used, surgical success rate was equal to that detected in Group 2 while operative times were shorter in Group 1 compared to Group 2. When groups were compared as for recurrence and operative times, combined method used in Group 1 was found to be more successful in comparison with the other two techniques.



## Conclusion

With this study, we have concluded that the method, where identification of lacrimal sac using gouge hammer and dilation of surrounding bone tissue with diamond tipped drills are performed during dacryocystostomy, is an improved treatment modality with relatively shorter operative times and lower recurrence rates.

**Conflict of Interest:** No conflicts declared.

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