Endoscopic dacryocystorhinostomy: Modified technique

HUMBERT MASSEGUR, MD, ENRIC TRIAS, MD, and **JUAN MANUEL ADEMÀ, MD,** Barcelona, Spain

BACKGROUND: **Dacryocystorhinostomy (DCR) is a surgical technique that has been increasingly used by otolaryngologists in recent years due to the improved endonasal approach with endoscopes. Although it was first described in 1893 by Caldwell, it has been performed by ophthalmologists.**

OBJECTIVES: **Even though permeability results are similar in long-term follow-up, we present some modifications that in our opinion contribute to the improvement of the results and the simplification of the surgical technique: mucosal flap design that helps to improve the postoperative mucosal recovery, careful dissection of the bony suture between the frontal process of the maxillary bone and the lacrimal bone, and osteotomy using a Smith-Kerrison forceps.**

STUDY DESIGN AND SETTING: **Two groups are compared. In the first group (96 DCRs), patients underwent chisel osteotomies without a mucosal flap of the lacrimal duct, and in the second group (40 DCRs), the modified technique was applied.**

RESULTS: **Final permeability results are similar (92.7% versus 87.5%). No major complications were found, and the most common minor complication was postoperative eyelid hematoma in cases where orbital fat was exposed (5 cases versus 7 cases).**

CONCLUSIONS: **There are no differences in final results, but the modified technique is easier to perform, improves postoperative mucosal recovery, is more functional and less aggressive, and improves the cost-benefit ratio.** (Otolaryngol Head Neck Surg 2004;130:39-46.)

In this era where new technologies are applied to all kinds of surgery,[1-3] the proposal to recover or modify old surgical techniques and instruments can be surprising.

From the ENT Department, Hospital de la Sta Creu i Sant Pau (Dr Massegur), Private Practice (Dr Mis), and ENT Department, Hospital General de Catalunya (Dr Alcover).

Reprint requests: Humbert Massegur, MD, Pl Catalunya 28 2 E-17002 Girona, Spain; e-mail, hmassegurs@seorl.net.

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The first reference to the endonasal lacrimal sac approach was made by Caldwell in 1893,[4] and the fenestration of the lacrimal sac as we perform it currently is based on the techniques described by West in 1911.[5] The use of optical instruments (microscope) for endonasal surgery was described by Heermann in 1958,[6] Prades in 1970,[7] and Rouvier et al in 1981.[8] First reference to the use of endoscopes in dacryocystorhinostomy (DCR) was made by Rice in 1988[9] and McDonogh and Meiring in 1989.[10]

Several authors have suggested technical modifications using burrs[11-16] or laser,[1,2] with their advantages and disadvantages. Long-term results are similar, ranging from 75% to 96%, but the laser has some disadvantages concerning results and the cost-benefit ratio.

The authors propose an endoscopic technique with the following technical modifications: (1) inferior and posterior nasal mucosal flap design, (2) dissection of the bony suture between the frontal process of the maxillary bone and the lacrimal bone, and the use of the Smith-Kerrison forceps to perform the osteotomies, and (3) creation of a mucosal flap of the lacrimal duct and its insertion in the posterior nasal mucosal flap.

Two groups of patients undergoing endoscopic DCR are compared. In the first group, we used the Cottle angled chisel for the osteotomies and only an inferior nasal mucosal flap was made, whereas in the second group we applied all the aforementioned modifications.

MATERIALS AND METHODS

From January 1998 to October 2000, 114 patients were operated on by the senior author (H.M.), performing a total of 136 DCRs (bilaterally in 22 cases).

In the first group we used the Cottle curved chisel (Fig 1) to in-fracture the frontal process of the maxillary bone. From January 1998 to April 2000, 84 patients were operated on (96 DCR); the age range was 20 to 80 years (average age, 67 years); male/female ratio, 4:1; and 57 and 39 cases on the right and left side, respectively.

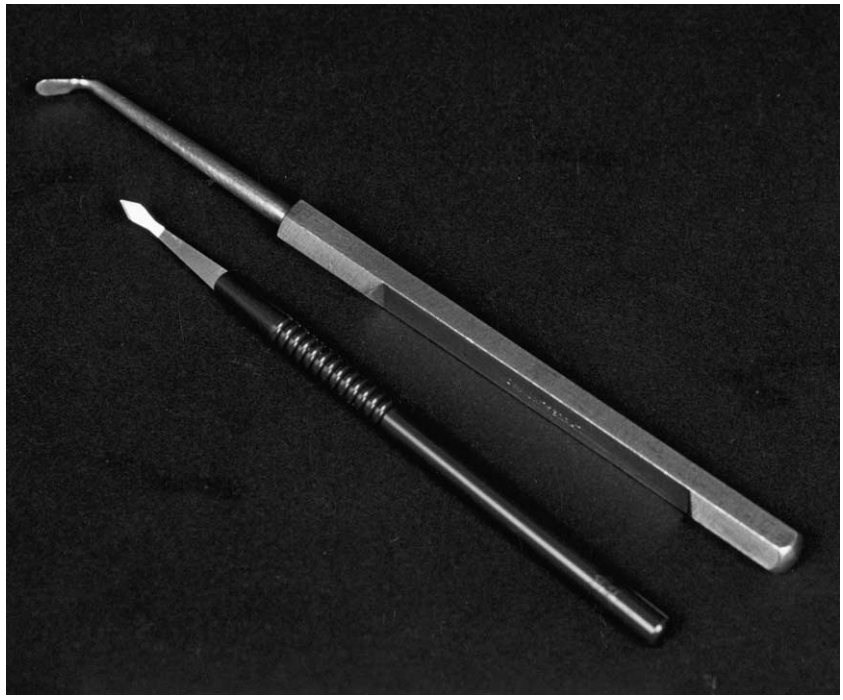

Fig 1. Top, Montserrat angled scalpel. **Bottom,** Facoemulsification angled scalpel.

In the second group, from May 2000 to October 2000, we used the Smith-Kerrison forceps (Fig 2) to fracture the ascending process of the maxillary bone (as described in Surgical Technique). This group included 30 patients (40 DCR), with an age range of 30 to 87 years (average age, 62 years), male/female ratio of 3/1, 21 cases on the right side, and 19 on the left.

The minimum follow-up was 6 months in both groups.

Surgical Technique

Surgical intervention was performed under general anesthesia with orotracheal intubation and nasal mucosa decongestion using oximetazoline 20 minutes before the intervention and cotton pledges soaked with epinephrine 1:1000 during surgery. No submucosal decongestant or anesthetic was injected. We chose the 0° and 45°, 4-mm telescopes (Karl Storz Endoscopia Ibérica SA, Madrid, Spain), which provide excellent vision of the operative field. Before the endonasal approach, we dilated the inferior canaliculi, inserting the Ritleng probe (Equipsa, Madrid, Spain) (Fig 3), which is very useful to identify the lacrimal sac position during surgery.

Group 1. *Mucosal flap.* Four incisions are made in the mucosa that overlies de frontal process of the maxillary bone.

1. A horizontal incision (0.5 to 1 cm long) beginning just anterior to the anterior attachment of the middle turbinate insertion and parallel to the bridge of the nose.
2. A second incision, parallel to the first one and 0.5 cm away.
3. Two incisions perpendicular to the bridge of the nose: one anterior, 2 or 3 cm away from the anterior insertion of the middle turbinate, and a second one, posterior and just over the suture line between the frontal process of the maxillary bone and the lacrimal bone (Fig 4).

The mucosa between the 2 horizontal incisions is removed and the remaining mucoperiosteal flap is reflected over the inferior turbinate. The frontal process of the maxillary bone is exposed.

Bone Removal. With the 4-mm curved Cottle chisel placed 2 to 3 mm anterior to the union between the lacrimal bone and the frontal process of the maxillary bone, and parallel to it, the bone is fractured and a 4 × 20-mm piece of bone approx. is removed. The opening is completed

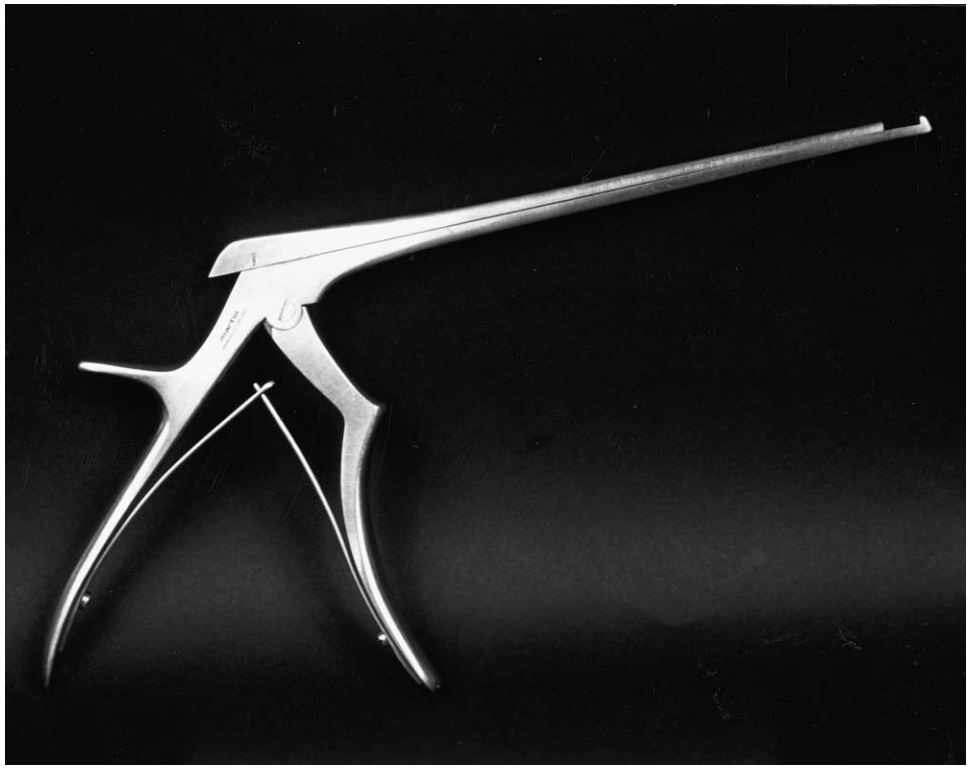

Fig 2. Smith-Kerrison forceps.

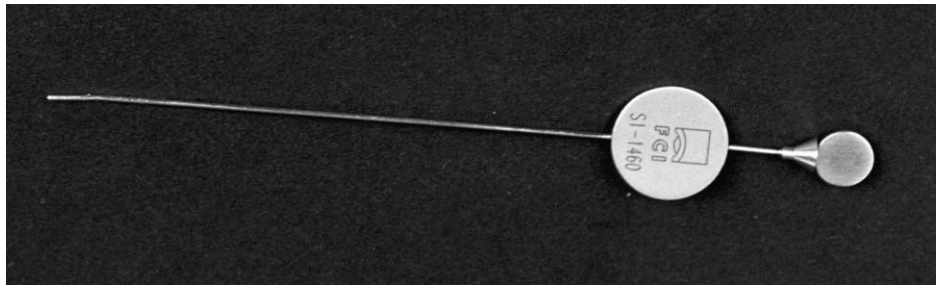

Fig 3. Ritleng probe.

using the Smith-Kerrison forceps up, just above the insertion of the middle turbinate, at least as high as the fundus of the sac, and down just to the insertion of the inferior turbinate. The lacrimal sac and the lacrimal duct are exposed in all the endonasal route.

Group 2. *Mucosal flap.* In addition to the mucosal flap just described, a second flap is created by dissection of the nasal mucosa that overlies the lacrimal bone from its union with the frontal process of the maxillary bone to the uncinate process, thus creating a "pocket" where the lacrimal sac mucosa flap will be placed (Fig 5).

Bone removal. We locate the suture line between the lacrimal bone and the frontal process of the maxillary bone. The 2 bones are carefully separated using the Montserrat angled scalpel (Fig 6). The Lacrimal sac is detached from the bone using the Khun-Bolger curette and the opening is widened using the Smith-Kerrison forceps anteriorly, superiorly and inferiorly, until the sac and lacrimal duct are completely exposed (Fig 7). Sometimes it is necessary to use the Cottle chisel above the insertion of the middle turbinate to remove the bone near the fundus of the sac and to obtain a good exposure.

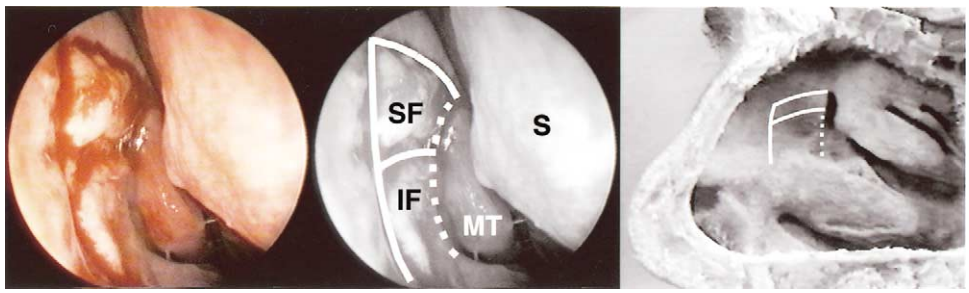

Fig 4. Incisions performed in the nasal mucosa covering the lacrimal area. Right nasal fossae. *SF*, Superior flap (to be removed); *IF*, inferior flap; *S*, septum nasi; *MT*, middle turbinate; *dotted line*, maxillary line.

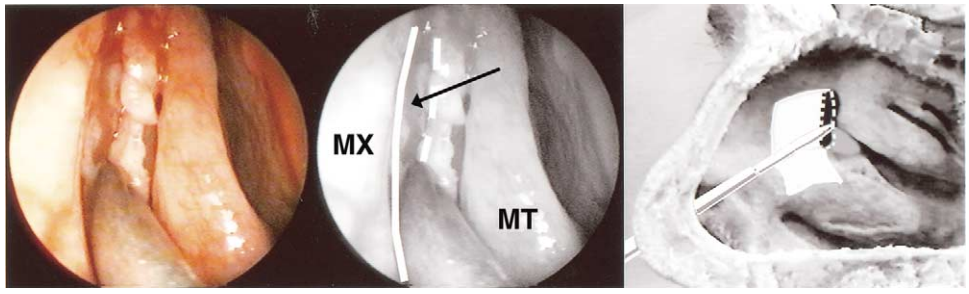

Fig 5. Mucosal pocket created over the lacrimal bone. Right nasal fossae. *Mx*, Frontal process of the maxillary bone; *MT*, middle turbinate; *arrow*, lacrimal bone.

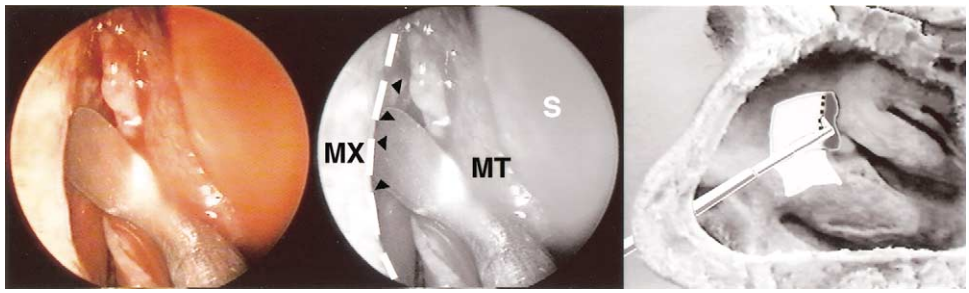

Fig 6. Bony suture between the lacrimal bone (*arrowheads*) and the frontal process of the maxillary bone (*Mx*), separation using the angulated Montserrat scalpel. *MT*, Middle turbinate; *S*, septum nasi.

With the use of the Ritleng probe, we check the lacrimal sac position and, by applying pressure, cause the lacrimal sac wall to protrude into the nasal fossa. Using the facoemulsification angled scalpel (Figs 1 and 8), a vertical incision and 2 parallel horizontal incisions are made to create a posteriorly pedicled flap that will be placed into the nasal mucosa pocket previously created, thus allowing the lacrimal sac to remain opened. The silicone catheter is inserted through the 2 canaliculi and tied inside the nasal fossa. The inferior mucosal flap is replaced over the denuded bone avoiding to cover rhinostomy and the catheter (the silicone catheter must not be left below the nasal mucosa) (Fig 9).

Collagen pledges are placed, and patients are advised to perform nasal cleansing with saline solution and to use antibiotic eye drops for 10 days. As a general rule, the Ritleng catheter is removed 1 month after the surgery and patients are followed every month for 6 months after surgery.

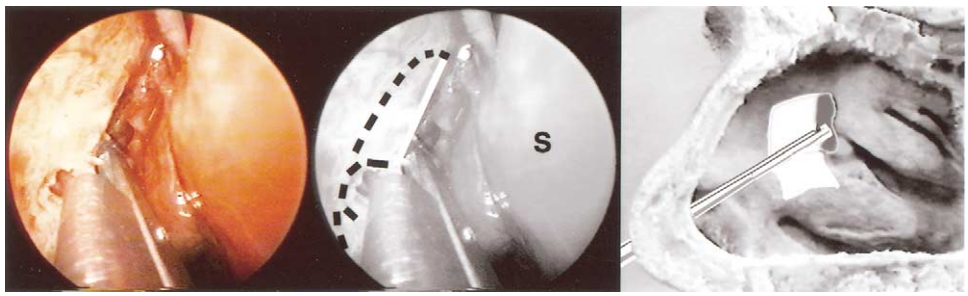

Fig 7. Osteotomies performed with the Smith-Kerrison forceps. *Dotted line*, Bone to be removed.

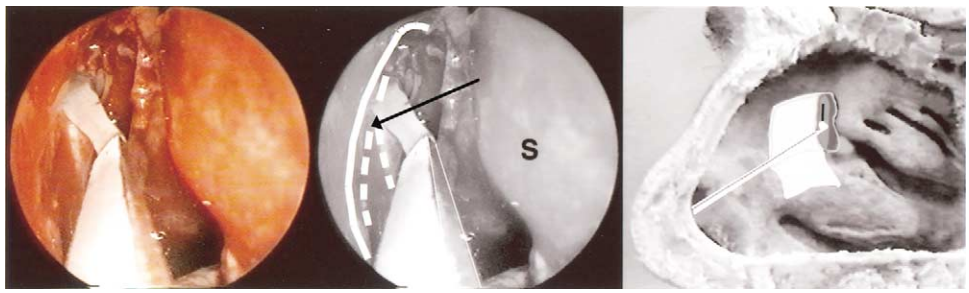

Fig 8. Lacrimal sac and lacrimal duct (*arrow*) section using the facoemulsification scalpel.

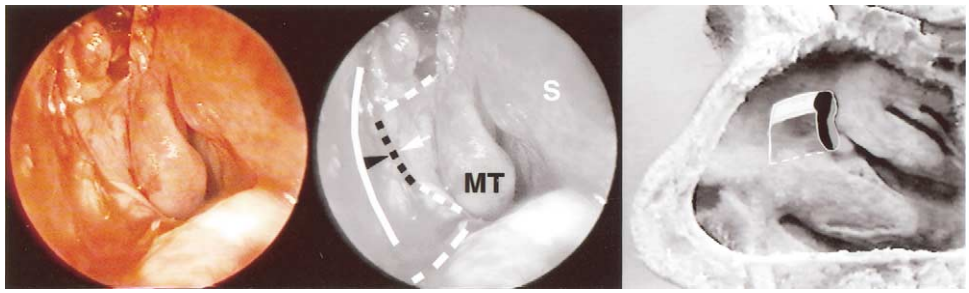

Fig 9. Insertion of the lacrimal sac mucosa flap (*black arrowhead*) in the posterior nasal mucosa pocket (*white arrow*), and reposition of the inferior nasal mucosa flap (*IF*).

RESULTS

In the first group (96 DCRs performed), 7 cases (7.29%) failed and 89 (92.7%) improved. In 3 cases, epiphora persisted but nasal permeability using fluorescein was appropriate, and in 3 cases, there was a granuloma around the rhinostomy that was cauterized using silver nitrate with epiphora improvement. The mean operative time was 30 minutes (range 11 minutes to 1 hour 45 minutes) The Ritleng catheter was left inside for a month in 82 cases, 15 days in 4 cases, 2 months in 5 cases, and 7 days in 4 cases. There was no difference in results concerning the time that the probe remained inside the patient.

Regarding minor complications, there were 5 cases of eyelid hematoma in the immediate postoperative period. No major complications were found. In 10 cases, we found synechia between the middle turbinate and the lateral wall without clinical incidence.

In the second group (40 DCRs performed), 5 cases failed (12.5%) and 35 cases improved (87.5%). In 3 cases, cauterization with silver nitrate was performed over the granuloma around

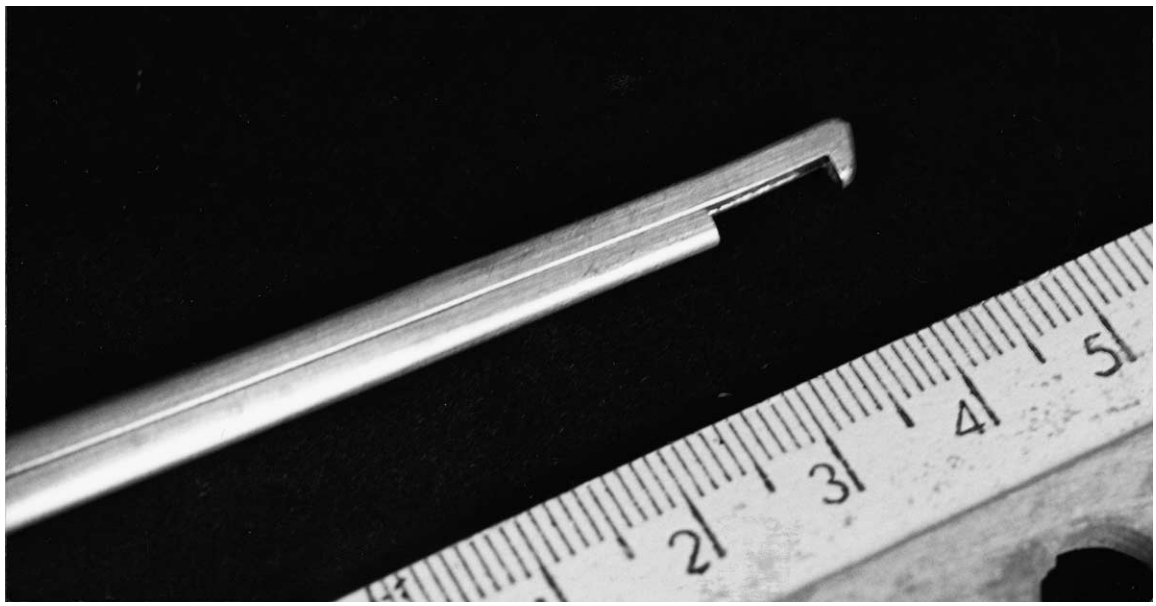

Fig 10. Smith-Kerrison forceps (detail).

the opening. The mean operative time was 25 minutes (range, 10 to 45 minutes). The Ritleng catheter was left in inside for 1 month in 34 cases, 2 months in 3 cases, and 15 days in 1 case, and in 2 cases no catheter was left inside. Regarding minor complications, there were 7 cases of eyelid hematoma, all of them in the first cases in which we applied the modified technique. In 3 cases, synechia was seen between the lateral wall and the middle turbinate.

DISCUSSION

Endoscopic DCR is a rather new indication for endonasal endoscopic surgery;[10] its endonasal approach is more natural and it avoids the sequelae of an external approach in the treatment of the obstructed lacrimal ducts.[12,17] Different kinds of techniques are described in the literature using burrs[10-14] or various kinds of lasers[1-3] or microscopes[7,8,16] with similar results.

The modified technique that we propose is based on the Rouvier et al[8] technique, modifying the position of the mucoperiosteal flaps, performing an inferiorly pedicled flap, and creating a mucosal pocket over the lacrimal bone, thus allowing the introduction of the mucosal flap of the lacrimal sac inside this pocket and avoiding the use of neurosurgical clips. We do not agree with Hartikainen et al[12] in their statement that it is impossible or very difficult to endoscopically create mucosal flaps inside the nose during surgery, but we recognize that bleeding can be an additional disadvantage. Osteotomies performed with the Smith-Kerrison forceps (group 2) help to create the opening with low risk of orbital trauma, such as with the use of the chisel, or of burns due to burr friction. We recommend the use of the 2-mm Smith-Kerrison forceps with marked distal inclination (Fig 10).

Table 1. Results of both groups

Group	Relapse	
	Yes	No
Group 1 (n = 96)	7 (7.29%)	89 (92.7%)
Group 2 (n = 40)	5 (12.5%)	35 (87.5%)

Fisher's test, $P = 0.335$.

Results at 6-month follow-up are similar in both groups, with no significant differences (Fisher test $P = 0.335$) (Table 1) and are also similar to the results achieved by others (Table 2). The advantages offered by this modified technique compared with the other techniques are as follows.

1. The inferior mucoperiosteal flap allows coverage of the denuded bone without obstructing the rhinostomy and accelerates the healing of the area without the need of

Table 2. Review of the literature on the DCR techniques

Study	No. of patients	Technique	Results (%)
Weidenbecher et al[14]	56	END/burs	86
Bernal-Sprekelsen and Tomás Barberán[11]	152	END/burs	96
Eloy et al[13]	28	MICR/END/burs	89
Metson et al[1]	46	END/holmium:YAG	85
Pearlman et al[2]	46	END/Nd:YAG	85
Reifler[3]	19	END/KTP	68
Massegur	96	END/chisel	92
Massegur	40	END/Smith-Kerrison forceps	87

END, Endoscopy, *MICR,* microscopy.

exhaustive postoperative care in the immediate days after surgery. Only the nasal cleansing with saline solution by the patient is sufficient to keep the surgical area free of crusts and fibrin. Great care must be taken to avoid the Ritleng catheter inclusion below the nasal mucosal flap.

2. The "pocket" created with the posterior mucoperiosteal flap facilitates the introduction and fixation of the lacrimal sac mucosa flap without the use of neurosurgical clips, thus obtaining a good rhinostomy permeability. It also avoids lesions on the external aspect of the middle turbinate at surgery, preventing synechia.
3. When osteotomies are performed with a chisel or Smith-Kerrison forceps, burns caused by burrs are avoided, and mucosa healing is improved. The endoscope does not get steamed by the burr debris and no irrigation is needed.
4. With the use of the Smith-Kerrison forceps alone to perform the osteotomies, the risk of accidental orbital entrance is reduced compared with the use of burrs and chisel, since clear differentiation between the lacrimal bone and the frontal process of the maxillary bone is previously needed, and all the anatomical accidents that constitute the limits and landmarks have to be dissected and identified at surgery.
5. Due to its sharp edges, the use of the facoemulsification angled scalpel allows precise design of the posteriorly pedicled mucosal flap of the lacrimal sac, creating a great opening of the lacrimal duct.[15]
6. The cost-benefit ratio is very good because the material used is inexpensive and no special training is required.

The operative time is very short when the surgeon has sufficient experience with this technique. An essential condition is good bleeding control in the surgical field.

To achieve good results, it is very important to resect the most cranial end of the frontal process of the maxillary bone, above the middle turbinate insertion, removing the bone as high as the fundus of the lacrimal sac.[15,18-20] Once the bone is removed, it is advisable that the sac and the lacrimal duct should be seen in all the path and dissected before making the incision. The wide opening of the lacrimal sac and its opening to the nasal fossa (terminal DCR[15]) allow better results and prevent spontaneous mucous closure as well as retention pouches caudal to the rhinostomy (sump syndrome).

Concerning complications, there are no differences compared with other techniques. Eyelid hematomas were associated with orbital fat exposure and occurred in the first patients operated on in group 2 because we did not carefully separate the bony suture. Since we have been using the angled Montserrat scalpel to separate the bone, the incidence of eyelid hematoma has been significantly reduced. In summary, the modifications proposed in the endoscopic DCR technique contribute to the maintenance of the good results described in the literature; they improve the postoperative course, supply surgical steps without causing unnecessary trauma to surrounding tissues, and provide new arguments to use this technique in otolaryngology.

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