Aesthetic External Dacryocystorhinostomy

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ABSTRACT
Background: acquired obstruction of the lacrimal excretory outflow system whether functional, structural or both will produce the symptoms of epiphora, mucopurulent discharge, pain, dacryocystitis and even cellulitis, promoting the patient to seek the ophthalmologist for evaluation and treatment.
Objective: comparative study between conventional external DCR with postoperative scar modulating treatment, external DCR via subciliary incision and DCR via transconjunctival approach evaluating their functional outcome and final cosmetic scar.
Patients and Methods: study cases were non-randomized 30 eyes in patients who inclusion and exclusion criteria are applied for them and dacryocystorhinostomy operation was done. Transconjunctival approach was done for 10 eyes, subciliary approach was done for 10 eyes while conventional approach with scar modulating treatment was done for last 10 eyes.
Results: Aesthetic outcome of our study showed improvement in postoperative conventional approach scar with using scar modulatory treatment postoperatively and the results were 30% invisible, 50% minimally visible and 20% moderately visible after three months follow up. Also, subciliary approach study showed a significant improvement in scar outcome which was 60% invisible and 40% minimally visible.
Conclusion: in spite of all the new innovations and competition, external DCR remains the gold standard and the most successful surgery in the management of complete NLDO.
Keywords: Ex-DCR, Eye.

INTRODUCTION

External dacryocystorhinostomy (Ex-DCR) initially described by Toti has been the gold standard procedure for many decades to treat nasolacrimal duct obstruction [1]. Despite superior success rate, the inevitable downside of Ex-DCR had an external skin scar, which has led to evolution of endonasal and several other techniques [2]. Scarring following external DCR surgery is difficult to predict. Both physicians and their patients are highly concerned with minimizing scar appearance. Existing prophylactic and therapeutic strategies included planning incision site according to relaxed skin tension lines and use of postoperative topical preparations (scar modulating treatment) that have been used and proved their efficacy in reducing postoperative possible scar. Since the early 1980s, silicone gel sheeting has been widely used in the treatment of hypertrophic scars and keloids. Several clinical studies and reviews have confirmed its efficacy [3].

While many treatments have been suggested in the past for scars, only a few of them have been supported by prospective studies with adequate control group. Treatments can be said to have sufficient evidence for scar management as topical application of silicone gel sheeting and the intralesional injection of corticosteroids [5]. The former generally is indicated as both a preventive and therapeutic device while the latter as a therapeutic agent only [6]. Topical silicone gel sheeting is cumbersome to keep on the scar and the patient compliance often is low for lesions in visible areas [4].

Tapes or bandaging frequently is not accepted. It may also lead to skin irritation, which may require discontinuation of treatment, especially in hot climates. Gel sheeting is effective for scar control, but patient compliance with the method is not always satisfactory. Steroid injections are painful and may lead to skin atrophy and dyschromia. They usually are contraindicated for large areas and for children. Topical silicone gel application can overcome some of these limitations [7].

AIM OF THE WORK

Comparative study between conventional external DCR with postoperative scar modulating treatment, external DCR via subciliary incision and DCR via transconjunctival approach evaluating their functional outcome and final cosmetic scar.

PATIENTS AND METHODS

The study is prospective study which was carried out on patients attending at "Ophthalmology Department at Al-Azhar University Hospitals and Mataria Teaching Hospital ". All participants were hidden & replaced by code numbers to maintain privacy of the patients. Study cases were non-randomized 30 eyes in patients who inclusion and exclusion criteria are applied for them and dacryocystorhinostomy operation was done.

Transconjunctival approach was done for 10 eyes, subciliary approach was done for 10 eyes while conventional approach with scar modulating treatment was done for last 10 eyes.

Exclusion criteria:
1. Non symptomatic nasolacrimal duct obstruction.
2. Congenital nasolacrimal duct obstruction.
3. Patients planned for endoscopic or endonasal DCR.
4. Patients with epiphora due to dry eye syndrome.
5. Patients with epiphora due to acquired punctal stenosis.
6. Patients who had previous DCR surgery.

Patient counseling and consent:
An informed consent was obtained from the studied patients after discussing the surgical details (elaborating expected results and any possible complications). **The study was approved by the Ethics Board of Al-Azhar University.**

Pre-operative evaluation:
Each patient will undergo the following assessments:
- history
- Slit-lamp examination to exclude causes of hyper secretion.
- Schirmer test I & II
- Tear film break up time (BUT)
- Regurge test
- Dye disappearance test
- Jones dye test (Jones I & II)
- Lacrimal probing.
- Lacrimal irrigation.
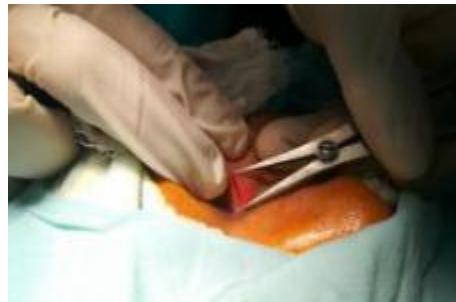- ENT consultation.
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Operative procedure:
1-Conventional external DCR
1. Exposing the sac
2. Creating the osteotomy
3. Forming the flaps
4. Suturing the posterior flaps
5. Intubating the system
6. Closing the anterior flaps
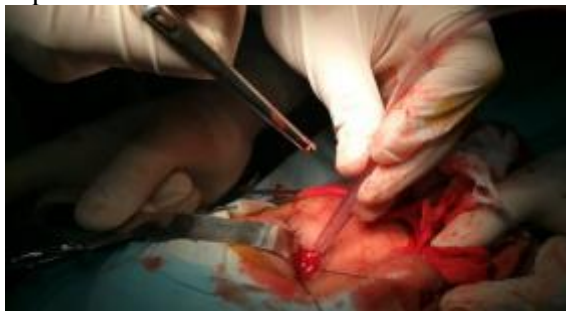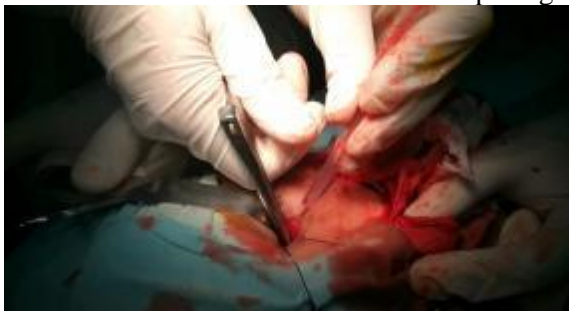7. Closing the incision

1-Subciliary external DCR

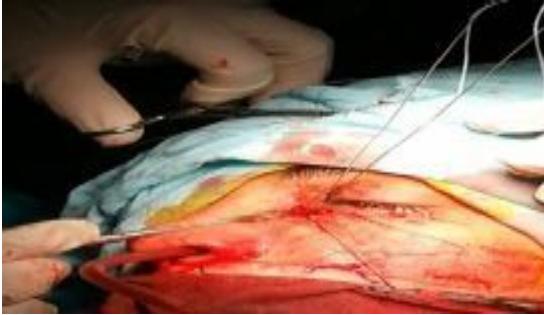a. Marking site of incision

b. Making the incision

c. Exposing the periosteum

d- Making of osteotomy using Kerrison rongeur

e- Creation of nasal mucosal flap

f- Silicone tube insertion through upper and lower canaliculi

g- Suturing of anterior flaps using double armed 6/0 vicryl sutures

y- Skin closure using 6/0 vicryl sutures

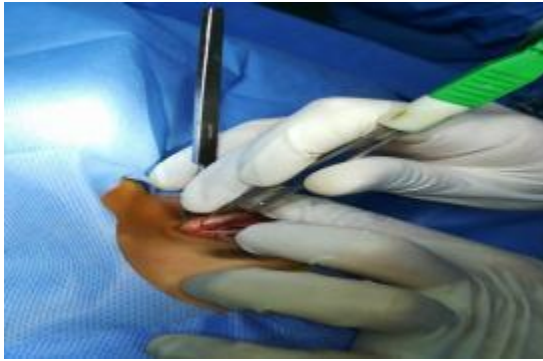**Figure (1)**: Subciliary external DCR
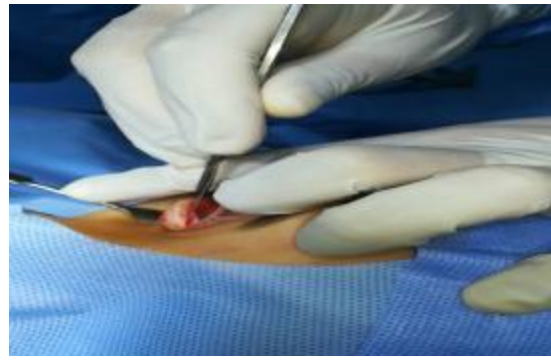
2- Transconjunctival DCR

a- Desmarrelid retractor is used to evert the lid

b- Cornea protective shellis placed

c- Mild cautery is applied to papebral conjunctiva

d- An inferomedial transconjunctival incisionis done using no. 15 blade

e- Blunt dissection is done to reach the anterior lacrimal crest

f- Traction suture with 4-0 silk is used to provide better exposure
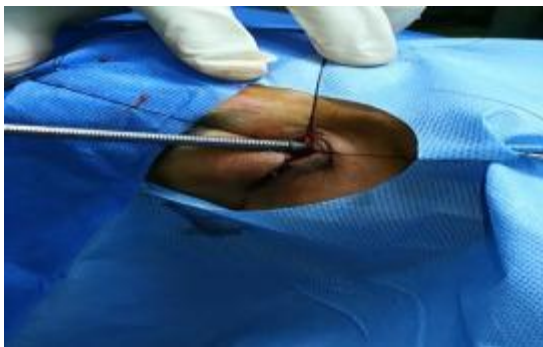
g- The periosteum is incised with the blade just anterior to the anterior lacrimal crest
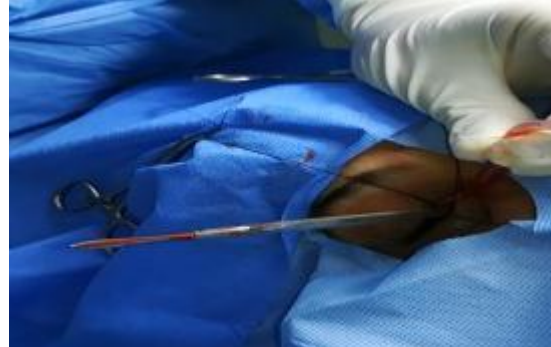
h- Thin bone at the suture between the lacrimal bone and the frontal process of the maxilla is breached with a Traquaire's periosteal elevator
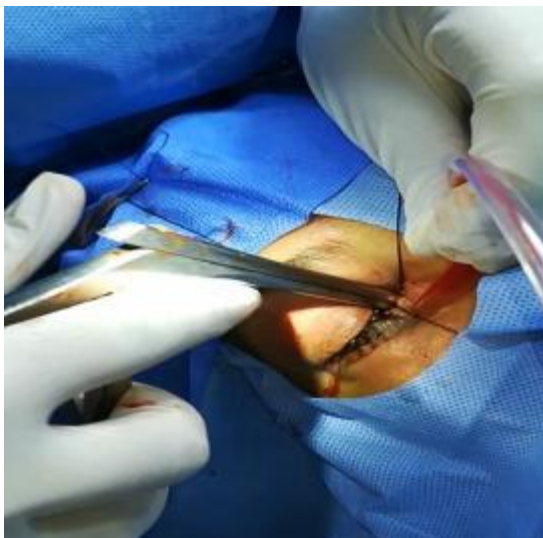
i- The bony ostium is created by using Kerrison rongeur

j- Creating and exposing the nasal mucosa
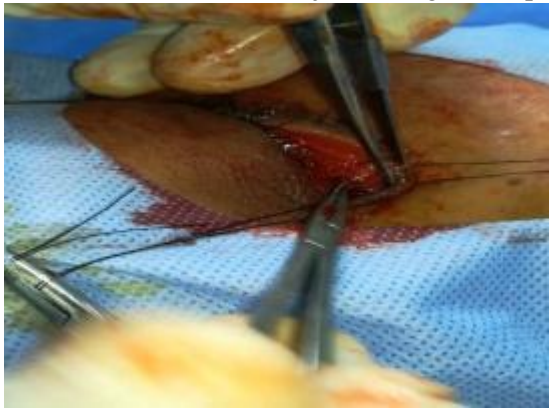
k- The anterior nasal flap is hanged with double armed vicryl 6/0 suture

l- Bowman probes was used to tent the medial wall of the lacrimal sac

m- Silicone tubes are passed through the upper and lower canaliculi and retrieved from the nose using a groove director

n- The anterior flaps (nasal mucosa and lacrimal sac) are sutured with the double armed 6-0 vicryl sutures

Figure (2): Transconjunctival DCR

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:
- A one-way analysis of variance (ANOVA) when comparing between more than two means.
- Chi-square (χ^2) test of significance was used in order to compare proportions between qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:
- Probability (P-value)
– P-value < 0.05 was considered significant.
– P-value < 0.001 was considered as highly significant.
– P-value > 0.05 was considered insignificant.

RESULTS

Table (1): Comparison between groups according to demographic data

Demographic Data	Group A: Conventional *(n=10)*	Group B: Subciliary *(n=10)*	Group C: Transconjunctival *(n=10)*	F/x2	P - value
Age (years) Mean±SD Range	45.70 ± 6.07 36-53	39.40 ± 8.54 24-48	38.90 ± 16.31 12-67	1.146	0.333
Sex Female Male	9 (90.0%) 1 (10.0%)	8 (80.0%) 2 (20.0%)	9 (90.0%) 1 (10.0%)	0.577	0.749

F-One Way Analysis of Variance; #x^2: Chi-square test .**p-value** >0.05 NS; ***p-value** <0.05 S; ****p-value** <0.001 HS
Statistically insignificant differences were seen between the three groups

Table (2): Comparison between groups according to preoperative examination.

Preoperative Examination	Group A: Conventional *(n=10)*	Group B: Subciliary *(n=10)*	Group C: Transconjunctival *(n=10)*	x2	P - value
Regurge test Positive Negative	10 (100.0%) 0 (0.0%)	10 (100%) 0 (0.0%)	10 (100.0%) 0 (0.0%)	0.000	1.000
FDT 2+ 3+	3 (30.0%) 7 (70.0%)	4 (40.0%) 6 (60.0%)	4 (40.0%) 6 (60.0%)	0.287	0.866
Jones 1 test Negative Positive	10 (100.0%) 0 (0.0%)	10 (100%) 0 (0.0%)	10 (100.0%) 0 (0.0%)	0.000	1.000
Skin type I II III IV V	0 (0%) 3 (30.0%) 5 (50.0%) 2 (20.0%) 0 (0.0%)	0 (0%) 4 (40.0%) 5 (50.0%) 1 (10.0%) 0 (0.0%)	0 (0%) 0 (0.0%) 5 (50.0%) 3 (30.0%) 2 (20.0%)	8.714	0.190
MCT laxity					
Grade 1	8 (80.0%)	6 (60.0%)	3 (30.0%)		
Grade 2	2 (20.0%)	4 (40.0%)	5 (50.0%)	7.508	0.276
Grade 3	0 (0.0%)	0 (0.0%)	2 (20.0%)		

x^2: Chi-square test; p-value >0.05 NS
Skin Type: according to Fitzpatrick Scale **FDT:** Fluorescein Dye Test **MCT**: Medial Canthal Tendon
Statistically insignificant differences between the three groups regarding preoperative examination (table **2**).

Table (3): Comparison between groups according to intraoperative complications.

Intraoperative complications	Group A: Conventional (n=10)	Group B: Subciliary (n=10)	Group C: Transconjunctival (n=10)	χ^2	p-value
No	8 (80.0%)	5 (50.0%)	5 (50.0%)	2.500	0.287
Yes	2 (20.0%)	5 (50.0%)	5 (50.0%)		
Canaliculer injury	1 (10.0%)	1 (10.0%)	1 (10.0%)		
Fat prolapse	0 (0.0%)	0 (0.0%)	3 (30.0%)		
Haemorrhage	1 (10.0%)	1 (10.0%)	0 (0.0%)		
Inadvertent incision extention	0 (0.0%)	3 (30.0%)	0 (0.0%)		
Loss of nasal mucosa	0 (0.0%)	0 (0.0%)	2 (20.0%)		
Prolongeal lid Retraction	0 (0.0%)	0 (0.0%)	2 (20.0%)		

x^2: Chi-square test; p-value >0.05 NS

Statistically insignificant differences were seen between the three groups regarding intraoperative complications as shown in table (**3**).

Table (4): Comparison between groups according to postoperative irrigation (3ry jones test)

Post-operative Irrigation (3ry Jones test)	Group A: Conventional (n=10)	Group B: Subciliary (n=10)	Group C: Transconjunctival (n=10)	x2	p-value
Negative	1 (10.0%)	2 (20.0%)	3 (30.0%)	1.250	0.535
Positive	9 (90.0%)	8 (80.0%)	7 (70.0%)		

x^2: Chi-square test; p-value >0.05 NS

Statistically insignificant differences were observed between the three groups according to postoperative irrigation (3ry Jones test) as shown in table (**4**).

Table (5): Comparison between groups according to postoperative scar **(scar grading)**

	Post-operative scar	Group A: Conventional (n=10)	Group B: Subciliary (n=10)	x2	p-value
First Month	Grade 0: Invisible	0 (0%)	0 (0%)	4.000	0.135
	Grade 1: Minimally visible	4 (40.0%)	8 (80.0%)		
	Grade 2: Moderately visible	4 (40.0%)	2 (20.0%)		
	Grade 3: Very visible	2 (20.0%)	0 (0.0%)		
Third month	Grade 0: Invisible	3 (30.0%)	6 (60.0%)	4.281	0.374
	Grade 1: Minimally visible	5 (50.0%)	4 (40.0%)		
	Grade 2: Moderately visible	2 (20.0%)	0 (0.0%)		
	Grade 3: Very visible	0 (0.0%)	0 (0.0%)		

x^2: Chi-square test; p-value >0.05 NS

Statistically insignificant differences between group A and group B regarding the postoperative scar (table **5**).

Table (6): Comparison between First month and third month concerning scar within the same group.

	Post-operative scar	Group A: Conventional (n=10)	Group B: Subciliary (n=10)
First Month	Grade 0: Invisible	0 (0%)	0 (0%)
	Grade 1: Minimally visible	4 (40.0%)	8 (80.0%)
	Grade 2: Moderately visible	4 (40.0%)	2 (20.0%)
	Grade 3: Very visible	2 (20.0%)	0 (0.0%)
Third month	Grade 0: Invisible	3 (30.0%)	6 (60.0%)
	Grade 1: Minimally visible	5 (50.0%)	4 (40.0%)
	Grade 2: Moderately visible	2 (20.0%)	0 (0.0%)
	Grade 3: Very visible	0 (0.0%)	0 (0.0%)
	Chi-square test	5.778	9.333
	p-value	0.123	0.009*

Statistically insignificant differences were observed at first and third months regarding the postoperative scar among group A, while, a statistically significant differences were seen at first and third months regarding postoperative scar in group B as shown in table (**6**).

CASE REPORTS

Case Report (1)

36 years old female, complaining of recurrent mucocele, right conventional DCR was done for her with three months follow up and use of scar modulating treatment after suture removal, no intraoperative complications occurred during surgery.

Figure (3): Case No. 1, one week postoperatively

Figure (4): Case No.1, Three months post-operative picture (minimally visible, grade 1)

Case Report (2)

46 years old female patient, complaining of persistent epiphora, Left subciliary DCR was done for her and followed up after three months, intraoperative inadvertent skin incision extension occurred during surgery mostly due to excess traction and lower excess traction and lower eyelid skin friability.

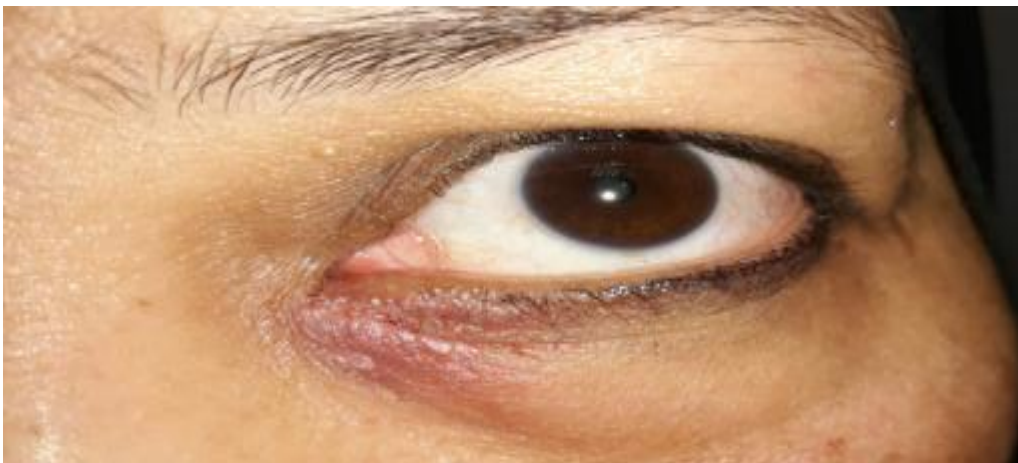Figure (5): Case No.2, immediate postoperatively with skin incision extension

Figure (6): Case No.2, one week postoperatively

Figure (7): Case No.2 three months postoperatively. (minimally visible scar, grade:1)

Case Report (3)

48 years old female patient, complaining of persistent epiphora, left Transconjunctival DCR was done for her and followed after three months, no intraoperative complications occured during surgery.

Figure (8): Case No.3, One week postoperative picture

Figure (9): Case No.3, Three months postoperative and after tube removal (scarless appearance).

DISCUSSION

The functional outcome of our study showed 90% success rate as for conventional DCR. This rate is close to results obtained by **Warren et al.** [8] who showed success rate up to 93% in their sample of 150 external DCR and the success rate of many studies [9, 10] that reported a success rate between 80% and 99% depending on the surgeon's experience.

Fayers et al. [11] assessed the success of external DCR done by a specialist lacrimal surgeon in 158 cases. They obtained 83% functional success and 100% anatomical success. In the present anatomical success was 90%.

These differences in the overall success rate between the present study and other studies due to several factors; mainly, the definition of complete success. In our study, it was complete disappearance of symptoms (subjective) with patent passages to irrigation (objective) while several of these studies defined success as only disappearance of tearing. The sample size and the cutoff point of follow up could also contribute to these findings. Other factors as the bony ostium size played a key role in affecting the overall outcome in these studies. All surgeries in the present study were conducted by highly trained specialists; hence the role of surgeon's experience in the outcome was minimized

In current study, the functional success outcome of subciliary DCR was 80% after three months follow up, while **AKaishi et al.** [12] showed a functional success rate 90.48% after six months follow up. The difference in outcome between the two studies may be due to the smaller patient sample of our study and also may be due to the longer follow up period of the other study. Intraoperative complications of subciliary DCR reported in present study were intraoperative haemorrhage 10%, canalicular injury 10% and inadvertent skin extension 30%. **Dave et al.** [13, 14] mentioned inadvertent skin extension in few patients. Higher difference in skin extension in the current study may be due to the learning curve needed for subciliary approach of DCR.

No post-operative complications reported in the present study but in **AKaishi et al.** [12], three elderly patients (61 to 85 years old) developed mild lacrimal ectropion after surgery, which improved in all patients within a few weeks after conservative treatment with corticosteroid cream massage. One patient developed a hypometric blink without lagophthalmos or keratopathy, which spontaneously resolved within the first postoperative month.

In the current study, transconjunctival DCR approach showed a success rate 70% with three months follow up after irrigation and none of our cases converted to the conventional approach. In a study by **Kaynak-Hekimhan and Yilmaz** [15], they reported epiphora resolved in 18 of 19 eyes (94.7%) in which transconjunctival dacryocystorhinostomy could

be completed. In 7 eyes (28%), only anterior flaps could be sutured. The authors needed to convert to Ex-DCR in 6 patients (34%) during whose surgeries the nasal mucosa could not be exposed adequately via the transconjunctival route. A study by **Kaynak *et al.*** [16] included 33 eyes (6 of them were converted to external DCR) showed success rate of 92.6 % of the remaining 27 eyes with complete relief of the epiphora and patency to irrigation while 7.4 % showed partial relief of epiphora and failure to irrigation at 4th month. Accordingly, the success rate of transconjunctival DCR in the studied sample including the converted cases will be 75.8 %) 25 out of 33). The difference in the success rate between our study and **Kaynak *et al.*** [15] may be due to that they were the first to describe the technique and the possibility of slower learning curve in our work based on his technique description. Both studies had comparable success rates that may be attributed to relatively similar exclusion criteria, excluding recurrent cases and any other associated pathology as canalicular obstruction

Intraoperative complications of transconjunctival DCR in current study were canalicular injury 10%, loss of nasal mucosa 20%, prolonged lid retraction 20% and fat prolapse in 30% of cases. Orbital fat prolapse was commonly encountered while performing transconjunctival DCR, which is considered to be one of the important reasons for DCR failure according to **Welham and Wulc** [17] who reported that, anteriorly located ethmoidal air cells can occasionally confuse the surgeon.

Talks and Hopkinson [18] reported that the ostium was opened via the standard lacrimal fissure in only 46% of DCRs. Ethmoidal cells beyond the agger nasi might occasionally be violated. Occasionally ethmoidal sinus entrance might be a hindrance in fashioning the appropriate rhinostomy site in transconjunctival DCR, although it does not mandate conversion to an external DCR. Eyelid laceration due to excessive traction for better visualization of the surgical site is possible and should be watched for from the beginning and meticulously sutured if they occur. It would be wise to choose patients with good eyelid elasticity and not to exert too much force for traction to the lower eyelid for surgical site exposure.

In our study most of our patients for transconjunctival approach with MCT laxity grade between 2 and 3 (7 cases) to avoid eyelid laceration during traction.

The aesthetic outcome of conventional DCR in the present study with using of scar modulatory treatment postoperatively for three months was subjective scar follow up done by two specialists and the results were invisible in 3 cases (30%), minimally visible in 5 cases (50%), moderately visible in 2 cases (20%) and very visible in 0% of cases as compared to first month follow up, which was invisible 0% of cases, minimally visible in 40% of cases, moderately

visible in 40% of cases and very visible in 20% of cases. **Devoto *et al.*** [19] studied thirty-four consecutive patients that were admitted and followed for 6 months. Six weeks after surgery, 13 of 34 graded it as minimally visible (38%), 9 of 34 (26%) graded it as moderately visible, and 3 of 34 patients (9%) graded as very visible (grade 3). Six months after surgery, 16 of 34 (47%) graded as minimally visible, 3 of 34 patients (9%) graded as moderately visible, and no patient graded as very visible.

Rizvi *et al.* [20] studied 50 patients (50 eyes) of PANDO were included in their study, mean age of patients were 42.1 ± 14.6y. Anatomic success in their study was seen in 48 cases (96%). Thirty-four patients (68%) graded their scar maximally visible (grade 3) at 2 weeks, which is reduced to 7 (14%) at 6 weeks which further reduced to 1 (2%) patient at 12 weeks. Change in scar grading from grade 3 to grade 0 in consecutive follow-up (2, 6 and 12 weeks) was found to be highly significant.

The mild difference between the current study when using scar modulatory treatment and other studies without scar modulatory treatment, with better aesthetic outcome, that in current study, may be related to the darker skin type in our population according to (fitzpatrick's scale). In our study, 5 cases were grade III, 3 cases were grade II and 2 cases were grade IV. Also, sutures used to close the final scar (we used Vicryl 6\0 suture in all our patients), small patient sample and patient compliance to use scar modulatory treatment. All of these factors may affect the outcome of final scar postoperatively.

In the present study, the aesthetic outcome of subciliary DCR after three months follow up was invisible in 6 cases (60%), minimally visible in 4 cases (40%) compared to first month follow up, which was minimally visible in 8 cases (80%) and moderately visible in 2 cases (20%). **Dave *et al.*** [13] prospectively studied subciliary approach in 16 patients and reported that 88% of patients rated the scar as invisible at the final follow up. Objective grading by the physician showed that 47% of scars to be invisible. However, the length of the incisions were at least 10 mm and even up to 15 mm to ensure adequate exposure of the frontal process of maxilla for creation of a large bony ostium. In 2 eyes, the incision was found to extend 2 mm medial to the medial canthus and may have led to scar formation.

Dave *et al.* [14] studied 17 eyes of 16 patients who underwent a subciliary approach DCR, at an average follow up of 29 weeks (range 6 – 72 weeks), the objective grading reported 47% of the scars to be invisible (grade 0) and 88.2% to have invisible to minimally visible (grade 0–1) scars. The subjective grading by the patient reported 88% of the scars to be invisible (grade 0) and 100% scars to be invisible or minimally visible (grade 0 – 1). Hence subciliary approach provided excellent cosmetic outcomes.

AKaishi et al. [12] mentioned that the mean scores for scar appearance were 2.19 at one month, 1.65 at 3 months and 1.44 at 6 months after surgery.

There is mild difference in cosmetic outcome of the present study and other studies and although the classical nasal incision may also provide excellent cosmetic results[19][21] , It was believed that the lower eyelid approach has some advantages over the classical nasal incision. The dissection is in the lower eyelid minimizing bleeding, there is no concern about angular vessels lesions. The lacrimal sac is approached from below at the nasolacrimal duct entrance and the osteotomy site is thus quite low preventing any degree of sump syndrome. There is no need to detach the medial canthal tendon, which is left undisturbed. Finally, as the nose is not manipulated the patients are able to wear glasses immediately after surgery [22].

CONCLUSION

In spite of all the new innovations and competition, External DCR remains the gold standard and the most successful surgery in the management of complete NLDO. Conventional external DCR was performed with using of scar modulatory treatment postoperatively and it showed the highest success rate among the three studies and its aesthetic outcome became nearly close to subciliary DCR scar results.

Subciliary Ex- DCR showed a better aesthetic outcome than conventional approach due to presence of incision site at lower lid crease making its appearance lesser. As regards functional outcome, conventional approach showed a slightly better outcome than subciliary one. Transconjunctival external DCR showed the best aesthetic outcome because it is a scarless procedure but, its functional outcome was less than the other two groups. It may be due to the narrow field of view, narrow ostium, high learning curve and liability for more intraoperative complications.

RECOMMENDATIONS

DCR surgeries can be customized according to several factors: skin complexion, lid laxity, lacrimal excretory system and nasal pathology .

Coventional external DCR remains the corner stone and preferred in most patient coditions. Subciliary DCR is preferred if the patient was dark skinned with tendency to excess scar formation and if the patient has a previous bad conventional scar in other eye.

Transconjunctival DCR is preferred if there are skin diseases, tendency for keloid formation or old aged patients with excess lid laxity.

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