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Research Article

Comparison of external and endoscopic endonasal dacryocysto-rhinostomy: a hospital based retrospective study

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ABSTRACT

Background: The aim of the study was to compare and analyze the surgical outcome in doing external dacryocystorhinostomy (Ex-DCR) and endoscopic endonasal dacryocystorhinostomy (En-DCR), at our tertiary care referral hospital of this hilly region of northern India. Design was retrospective and comparative.
Methods: A retrospective review of total 106 patients with unilateral or bilateral primary nasolacrimal duct obstruction (NLDO), who had undergone either Ex-DCR or En-DCR surgery that included revision surgeries, with or without silicone tube intubation (STI), for a period of two years from October 2013 to September 2015, were enrolled in this study. Consecutive six months follow up was observed, in all. Surgical outcome was evaluated at each follow up, objectively and subjectively. Statistical data was analyzed using IBM SSPS 23.0 version software. P-value <0.05 was considered statistically significant.
Results: Total 111 DCR surgeries (55 Ex-DCR, 56 En-DCR), were performed on 106 primary NLDO patients, including 5 bilateral En-DCR. Mean age for Ex-DCR and En-DCR was 52±17years, 36±18years, respectively. Female preponderance was seen in both the groups (F:M=41:14 in Ex-DCR, 32:14 in En-DCR). Overall, the success rate of DCR surgery was 92.80% (n=103 out of 111). Intergroup success rate was found to be almost similar (Ex-DCR 52/55; 94.54%; En-DCR 51/56; 91.07%, P=1.00), whereas, ultimate success rate considering repeat /revision surgeries following failed DCR (n=8, Ex-DCR-3,En-DCR-5) was 100%. Commonest perioperative and late complication in both the groups were, hemorrhage and rhinostomy scarring, respectively.
Conclusions: Success and complication rate of both Ex-DCR and En-DCR surgeries are almost similar after primary DCR surgeries. We emphasize the advantage of doing En-DCR in bilateral NLDO, repeat/revision DCR, NLDO associated with additional intranasal disease, other than its esthetic advantage over Ex-DCR. However, further multicentric randomized controlled studies are required to substantiate our findings.

Keywords: External dacryocystorhinostomy, Endonasal dacryocystorhinostomy, Success, Failure, Complication

INTRODUCTION

As, number of cataract surgeries are increasing day by day, number of DCR surgeries are also increasing simultaneously with the same pace, because requirement of infection free patent lacrimal system is mandatory prior to cataract removal. Till date, the two most widely accepted treatment modalities of annoying epiphora resulting from NLDO are conventional external dacryocystorhinostomy (Ex-DCR) and endoscopic endonsasal dacryocystorhinostomy (En-DCR).[1]

Several studies reported comparing Ex-DCR and En-DCR, with a common notion that, Ex-DCR has higher

success rates ranging from 80 to 100%, but may be complicated by nasal bleeding, infection, cerebrospinal fluid leak, puncta eversion, and ugly external scar. Whereas, success rates for En-DCR reported vary from 74 to 100%, but may be complicated by nasal bleeding, nasal osteotomy scarring, granuloma, osteotomy-turbinate/septal synechiae, CSF-rhinorrhea, and damage to the orbital contents.[2-7]

Purpose of our study is to compare and analyze the surgical outcome of both Ex-DCR and En-DCR, in terms of their success, failure, and complications in a retrospective way, in our tertiary referral center of northern India. Patients and Methods: After obtaining approval from the Hospital medical ethics committee, retrospective data were collected, on patients who underwent DCR, for a period of two years from October 2013 to September 2015, at our medical college of north India. Patients having unilateral or bilateral epiphora due to primary acquired NLDO (as confirmed by lacrimal syriging and probing), with or without associated chronic dacryocystitis, mucocele, fistula or additional intranasal disease(s), were included in our study.

Patients with previous DCR surgery done elsewhere, eyelid anomaly or abnormality, canalicular or common canalicular obstruction, congenital NLDO, suspected malignancy of lacrimal system, acute lacrimal passage inflammation (e.g. canaliculitis, acute dacryocystitis, lacrimal abscess), history of radiation therapy, post-traumatic cases, lacrimal pump failure and partial NLDO (as confirmed by Jone's dye test), and those who missed any stage of follow-up till up to postoperative 6 months, were excluded from present study.

Detailed record of each patient that included patient's demographic profile, ocular history, pre-operative work up comprising of complete ocular and rhinological examination including assessment of nasolacrymal passage which were repeated at each postoperative follow-up visits, peri and postoperative events including associated surgeries done if any, use of STI, and complications if any, questionnaires related to any complaints by patient, were noted down in a common spreadsheet (Table 1). The choice of type of surgery (Ex-DCR or En-DCR), was based on surgeon's as well as patient's preference. Primary outcome measures were surgical success and failure, secondary outcome measure was surgical complication (such as, hemorrhage, infection, eyelid, orbit or STI-related complications, rhinostomy granuloma, fibrosis or scarring, external scarring).

'Success' was defined as, subjective resolution of epiphora, and/or discharge, and objective evidence of patent naso-lacrimal passage as suggested by syringing and nasal endoscopy, till up to the end of 6 months follow up. 'Failure' was defined as, persistence of epiphora and/or discharge, with evidence of blocked syringing, and/or closed rhinostomy opening.

Technique of surgery

Most of the surgeries in both the types were performed under local anesthesia (LA) and sedation, except in bilateral NLDO, and apprehensive patients, where general anesthesia (GA) was required. All Ex-DCR surgeries were done by principal ophthalmic surgeon (SDG) in company with assistant ophthalmic surgeon (VV), whereas, all En-DCR surgeries were done by principal ENT-surgeon (AV) in company with any of the ophthalmic surgeon. Preoperatively, all the patients were screened for systemic disorders (such as, diabetes, hypertension, bleeding disorders, HIV, Hepatitis B and C, etc), and blood thinners (anticoagulants, low dose aspirin) were discontinued 5 days before surgery for patients taking such medicines.

Ex-DCR: Routine standard Ex-DCR surgery was performed in all the cases. During surgery special attention was given on adequate hemostasis, minimal use of sharp instrument, careful blunt dissection respecting the anatomical planes with least disruption of anatomical structure(s), and creation of at least 1.5 cm x1.5 cm bony ostium was targeted. In all the cases, medial canthal tendon (MCT) was not severed, posterior flaps were excised, and anterior flaps were sutured.

Wherever excess intraoperative bleed was observed or anticipated, the rhinostomy was packed with MEROCEL nasal tampon (MEROCEL® Nasal Dressings, Medtronic Xomed, Inc, USA), for that to be removed later endoscopically in the OPD. We did not use any surgical adjunct such as, Trypan blue dye, Viscoelastics, Mitomycin-C, etc.

En-DCR: 4% xylocaine with adrenaline 1:100000, was used for nasal packing. Standard rigid Sinus Endoscope (0˚) was used, to identify the attachment of the anterior end of the middle turbinate. The nasal mucosa over the septum, the inferior turbinate, the middle turbinate, andthe area in front of the uncinate process, was infiltrated with xylocaine 2% with adrenaline 1:200000, using long lumbar puncture needle.

A bony ostium of about the size of the mucosal window was made initially over the lacrimal fossa using a burr/chisel and hammer, which was subsequently enlarged to approx 1.5 cm x 1.5cm by using Kerrison punch. The medial wall of the lacrimal sac was then tented by using lacrimal probe inserted through the inferior punctum, while it was visualized simultaneously intranasally using Sinus endoscope, and it was then excised using sickle knife to make a large opening.

The rhinostomy was packed with MEROCEL- nasal tampon, for that to be removed later endoscopically in the OPD. Patients in both the groups were routinely put on oral tab Amoxicillin+Clavulinic acid 625 mg, 12 hourly for 7 days. In addition, oral NSAID's were continued for initial 3-5 days, antibiotic eye drops, and saline nasal

douche for next 15 days. The cases were followed up at postoperative day one, one week, one month, three month, and six months. Saline syringing and endonasal suction clearance/ alkaline nasal douche was done at all follow up visits, in both the groups. Stitches were removed at 1week after Ex-DCR surgery. Statistical analysis was performed using IBM SSPS software version 23.0 (IBM, USA), to compare the numerical variables. Chi-square ($\chi 2$) and Fisher's exact test (FT) was performed wherever applicable. P value <0.05, were considered statistically significant.

RESULTS

A total of 111 surgeries were performed on 106 patients enrolled in the study. Females (F): Males (M) ratio was found to be=77:29. In Ex-DCR group, there were total 55 patients (F: M=41:14), in En-DCR group total 46 patients (F: M=32:14). This intergroup gender ratio difference , was statistically insignificant (p=0.66; $\chi 2$).Mean age for Ex-DCR was 52±17 (SD) years, range 18 to 88years, whilst mean age for En-DCR was 36±18(SD) years, range 10 to 73 years. This difference was found to be statistically significant (p<0.0001; $\chi 2$) (Figure 1).

Out of 55 Ex-DCR surgeries, 29 were performed in the right side, and 26 in the left side. 3 patients in this group (5.45%) required GA. Though nobody in this group required repeat Ex-DCR surgery. Two patients in this group (3.64%), underwent revision Ex-DCR for previously failed En-DCR (Table 2), and 5patients (9.09%) in this group required STI intraoperatively, depending upon the status of the sac, revision surgeries, and adequacy of the bony ostium and middle meatus space. All STI's were removed endoscopically at 3 months post-op visit. 2 patients (3.64%) in this group experienced excess intraop bleed, which was managed well.

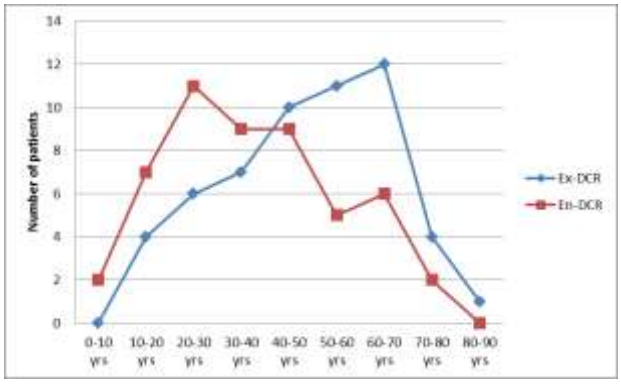

Figure 1: Age-wise distribution of patients.

Table 1: Spreadsheet used in our study.

SL No.	Age Sex	Symptom. Duration.	Assoc disease /Trauma/ Assoc. Fistula mucocele. HO failed surgery.	Eye / nasal evaluation. Syringing /probing.	Assoc surgery (Nasal/sac).	Date of surgery/ Surgeon /STI/ Right-left	LA/GA	Rhinostomy status/ complication/ patency						End result. Success/fail . Remarks. Name/phone
								Intra - OP	POD 1D	POD 7D	POD 1M	POD 3M	POD 6M	
1														
2														

Table 2: Surgical details.

	UL	BL	Eye (s)				STI	Associated surgery(s)
			R	L	LA	GA		
Ex-DCR (total No=55)								Fistulectomy=5
Primary Ex-DCR	53	0	28	25				Septoplasty=4
Repeat Ex-DCR	0	0	0	0	52	03	05	Polypectomy/
Ex-DCR Revision of En-DCR	02	0	01	01				turbinectomy=3
En-DCR (total No=56)								Septoplasty=12
Primary En-DCR	40	05	19	31				Polypectomy/
Repeat En-DCR	03	0	01	02	50	06	11	turbinectomy=5
En-DCR Revision of Ex-DCR	03	0	03	00				Ant. Ethmoidectomy=1
Total surgeries = 111	101	05	52	59	102	09	16	30

Out of 56 En-DCR surgeries, 23 were performed in the right side and 33 in the left side.6 patients (10.71%), required GA. 6 patients (10.71%) underwent further surgeries, that included 3 repeat En-DCR and 3 revisions En-DCR for previously failed Ex-DCR. In 11 En-DCR (19.64%), STI was implanted, that was removed at 3 months post-op. Other than hemorrhage, no other intra or

early post-op complication was seen in this group. In 1 patient, STI had fallen out prematurely at 7th post op day. Surgical success was achieved in 51 En-DCR (91.07%), whereas, in 5 (8.92%) surgical failure was declared. Apart from excess rhinostomy scarring which was the leading cause, ostium-septum or osteum-turbinate synechea, and ostial granulation tissue, were other causes of failure in this group. 100% success was achieved on all such 5 primarily unsuccessful En-DCR patient after repeat/revision surgeries, at the end of 6 months follow up.

There was significantly higher number (p=0.0022; FT) of associated intranasal disease (such as DNS, antrochoanal polyp, lacrimal sac mucocele etc) found in En-DCR group (n=26), as compared to those in Ex-DCR(n=10), that resulted in higher number of associated surgeries in the former group (En-DCR,n=18; Ex-DCR,n=12), although this difference was statistically insignificant (p=0.2860; FT) (Table 2 and 6).

Table 3: Surgical complications.

	EX-DCR Total=55	En-DCR (Total=56)	Remark(s)
Intra op:			
Unsual hge	2	0	Well managed.
Unsual pain	0	0	
Injury to orbital sturctures	0	0	
Injury to nasal structures	0	0	
Immediate post-op			
Epistaxis	1	1	Well managed.
Subconjunctival Hge	2	5	Spontaneously resolved soon.
Subcutaneous emphysema	0	0	
Preseptal/orbital cellulitis	0	1	Preseptal. Managed easily.
Periocular eccymosis	1	2	Spontaneously resolved soon.
Visual disturbance	0	0	
Lid Edema	4	1	Spontaneously resolved soon.
CSF-Rhinorrhea	0	0	
Early post-op			
STI migration/loss	0	1	At 1 month. Needed repeat En-DCR +STI.
Wound infection	0	0	
Late post-op			
STI migration/loss	0	0	-At 1 month. Needed repeat En-DCR+STI.
Septo-osteal synechea	0	1	
Ostium granulation	3	5	-Excised, as minor OPD-procedure.
Ostial closure/fibrosis	3	3	
Hypertrophied bad scar	3	0	-En-DCR revision of Ex-DCR.
Nasal deformity	0	0	Repeat En-DCR.
Lacrimal pump failure	0	0	-Steroid. Massage. Scar revision. Rectified.
Total	19 (34.55%)	20 (35.71%)	P= 1.00; Not significant. Fisher's exact test

Table 4: Surgical Success and Failure.

	Success (=103)	Failure (=8)	Total (=111)
Ex-DCR	52 (94.54 %)	3 (5.45 %)	55 (100 %)
En-DCR	51 (91.07 %)	5 (8.92 %)	56 (100 %)
Test of significance	P=1.00	P=0.717	(Not significant; fisher's exact test)

Commonest perioperative complication seen in our study, was hemorrhage (28.20%; 11 out of 39 complications), followed by lid edema/eccymosis (20.51%, 8 out of 39 complications), and the commonest late complication seen were rhinostomy fibrosis/granulation (38.46%, 15 out of 39) followed by external scarring (7.69%, 3out of 39). The intergroup difference in surgical complication rate was statistically insignificant (Ex-DCR-19cases, 34.55%; En-DCR-20cases, 35.71%; p=1.00, FT) (Table 3). Overall success rate of DCR surgery was 92.80 %(n=103 out of 111). The intergroup difference of success

rate, was insignificant (Ex-DCR-94.54%, En-DCR-91.07%; p=1.00, FT). Overall failure rate of DCR surgery was 7.20% (n=8 out of 111). The intergroup failure rate difference, was too insignificant (Ex-DCR-5.45%, En-DCR-8.92%; p=0.717, FT). Most common cause of DCR surgery failure (75%; n=6 out of 8), was found to be rhinostomy closure from fibrosis and scarring (Table 5).

Table 5: Analysis of failure cases.

		Observation	Time	Managed as	Final result
Ex-DCR	Patient-1	Excess ostial scar.	1Mth after	En-DCR + STI	Patent syringing
	Patient-2	Excess ostial scar.	1Mth after	En-DCR + STI	Patent syringing
	Patient-3	Excess ostial scar. Far anterior ostiotomy.	1Mth after	En-DCR + STI	Patent syringing
En-DCR	Patient-1	Excess ostial scar.	3Mth after	Ex-DCR + STI	Patent syringing
	Patient-2	Septo-lateral synechea. Inadequate bone excision	1Mth after	Repeat En-DCR+STI	Patent syringing
	Patient-3	Excess ostial scar.	3Mth after	Ex-DCR + STI	Patent syringing
	Patient-4	STI-migration & loss. Excess granulation.	7Days after	Repeat En-DCR+STI	Patent syringing
	Patient-5	Excess ostial scar.	3Mth after	Repeat En-DCR+STI	Patent syringing

Table 6: Associated lacrimal passage and intranasal disease/abnormalities.

Associated disorders	Ex-DCR (55=100%)	En-DCR (56=100%)
Mucocele	6	2
Sac Fistula	5	1
DNS (mild to high)	5	15
ITH/Polyp	3	5
Nasal spur	1	2
Enlarged Bulla ethmoid	1	3
Septal perforation	0	1
Total	21 (38.18 %)	29 (51.78 %)

DISCUSSION

Although Ex-DCR has been considered as the gold standard surgery for the primary NLDO, En-DCR has gained popularity in the recent years, even by the ophthalmologists, because of tremendous improvements in instrumentations, such as sophisticated endoscopes, improvised surgical techniques, accelerated success rate, and minimization of complications.[4-6]

Majority (n=77; 70%) of our study population were female which conforms to the other studies, as well.4,8 We observed majority of the younger population preferring En-DCR over Ex-DCR (Figure 1). This was possibly because of the comfort of surgery, lesser hours of stay at the hospital, and devoid of ugly scar formation, as similarly observed by Indian author Col K N Jha et al.[8]

Surgical success in our study was 94.54% in Ex-DCR (n=52), and 91.07% in En-DCR (n=51), which correlates well with reported studies where success rate in Ex-DCR ranging from 80-100% and 74-100% in En-DCR.[5-7]

It is heartening that, surgical success after revision DCR surgeries following failed primary surgeries (total n=8; Ex-DCR n=3, En-DCR n=5) in our series was 100% in both the groups, although reported success rates varies into a large extent in this regard, ranging from 75 to 97%.[9,10] The reason for such discrepancy may be because of larger cohort of revision cases and differing study design, as compared to us.

Major reason for failure of 8 DCR surgeries in our study (Ex-DCR n=3; 5.45%, En-DCR n=5; 8.92%) was detected at the level of bony ostium, mostly because of premature closure down of the rhinostomy opening resulting from scarring (Figure 2). Classic teaching on DCR advises creation of atleast 15x15 mm bony opening. However, there is no agreed dimension in this regard, as the final healed ostium size narrows down to nearly 2% of the iatrogenic opening created and no statistical correlation found between the initial and final ostium size (Figure 3).[11,12]

Obviously we find here En-DCR technically more advantageous in all the revision cases, as approach to this occluded rhinostomy site was much easier endoscopically, the finding which is supported by several authors in reported studies.[9,13] We kept our maximum follow up time up to 6 months, as literature reports most

of the surgical failure takes place within the first 3 months following surgery.[3]

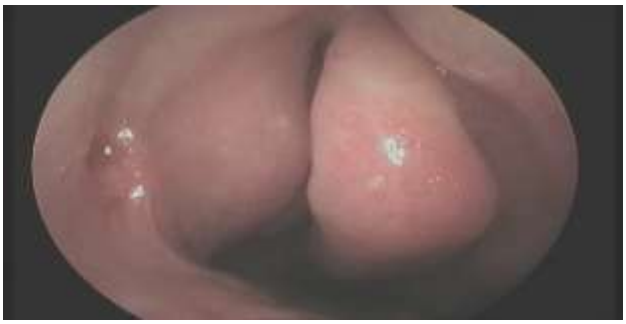

Figure 2: Ex-DCR: anteriorly placed scarred rhinostomy site, at 6 months follow up.

While performing En-DCR, along with additional surgeries in patients with additional intranasal disease (n=18) or in the opposite side in patients with bilateral NLDO (n=5), simultaneously in the same sitting, we had a feeling of its advantage over Ex-DCR in reducing the cost, duration of hospital stay, risk of anesthesia, and saving the time for the patient by minimizing follow up visits, as agreed by several authors.[8,14]

Special operative steps adopted by us during Ex-DCR by preserving MCT and suturing of anterior flaps alone, which were aimed to prevent iatrogenic telecanthus and to save the total operative time, respectively does not have any impact in attainment of final reasonably good surgical success (94.54%), which is corroborative to the findings by several authors.[15]

Other distinct advantages of Ex-DCR as experienced by us were, wider operative field, easy accessibility to the bleeding vessels, and control over MCT.

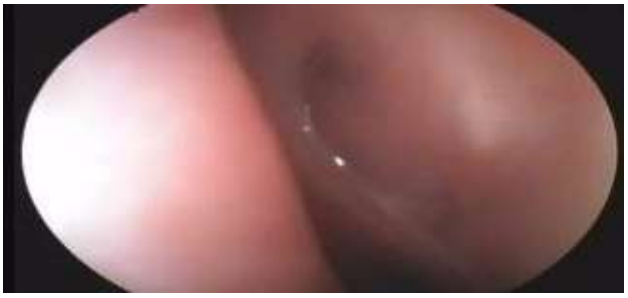

Figure 3: En-DCR: same patient at 3 months follow up following removal of STI, showing patent intranasal rhinostomy site.

Use of STI during DCR surgeries, still remains controversial. Some authors are against its use, whereas, some authors believes in its usefulness, because of several reasons.[16,17] In our study, 16 out of 111 surgeries required STI (8 in primary NLDO, 8 in revision surgery) (Figure 4). Out of them, in 1 En-DCR case STI extruded prematurely within 1 week of surgery which required reimplantation later, and in 2 cases (1 En-DCR ,1 Ex-DCR) granulation tissue was found around the ostium which required curettage later, although all 3 cases attained good surgical end result.

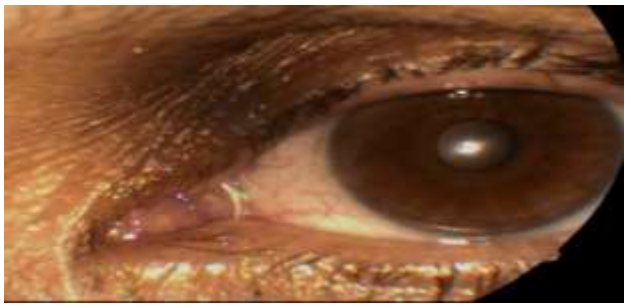

Figure 4: En-DCR: sti-in situ joining puncta; At 3 months follow up.

No other STI-related complication was observed in our study. Premature spontaneous tube extrusion, and granulation tissue formation around the ostium is a common phenomenon following STI-implantation, as reported by several studies, and believed to be one of the major reason of failure in DCR surgeries.[9] In our study, mean duration of STI removal in all cases was 3.4±0.2 months, which corresponds to the other studies as well, where authors reported that, STI placement for more or less than 3 months, can act as either nidus for infection and granuloma formation, or may lead to failure of surgery, respectively.[18] Although, we have found STI an exceptionally valuable tool especially in revision cases, but simultaneously we believe that it adds extra cost to the surgery and increases surgical failure chance by of forming granulation tissue around the rhinostomy site, hence we emphasize this should be used judiciously in selected cases only.

We did not find any major intra or postoperative complications (such as CSF-rhinorrhea, emphysema, visual disturbance, orbital hemorrhage, scar infection, etc) in both type of surgeries. Most common complication noted was hemorrhage, which conforms to the other reported studies, and has been managed well by us.[3,8] Cosmetically visible scar formation following Ex-DCR was reasonably low in our study (3/55 Ex-DCR; 5.45%, $\chi 2=1.263$) as compared to the published reports where visible scar formation ranges from 9-26%, hence this should not become a major issue and lone decisive factor while choosing for particular type of surgery (Figure 5,6).[19,20]

It is now an established fact that, surgical expertise in the field of DCR surgery may dramatically affect the surgical outcome.[21] Both the primary ophthalmic and ENT surgeon in our study are well versed in the nasolacrimal anatomy and in performing high volume DCR surgeries. Thus, accountability of their surgical skill cannot become a questionable issue. Limitations of our study were, its retrospective nature, small sample size, limited follow up

time, limited cohort of bilateral and STI-cases, and there was no attempt to evaluate duration of surgery, effect of adjuvant (Mitomycin-C), or socioeconomic impact on surgery.

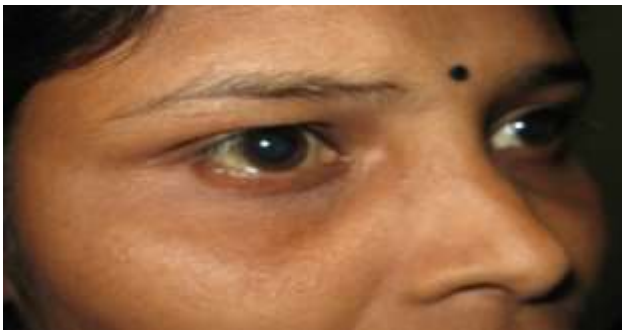

Figure 5: Ex-DCR: right side; Acceptable scar, at 6 months post-op visit.

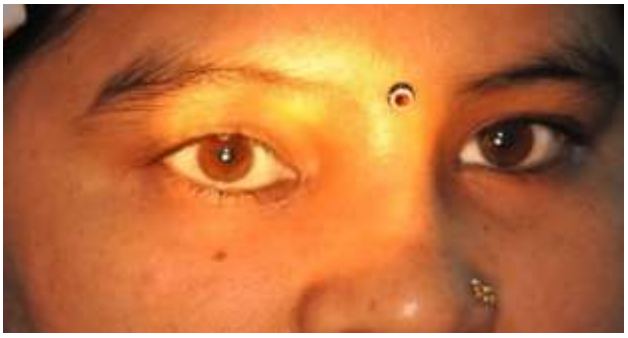

Figure 6: Ex-DCR: right side; hypertrophied ugly scar, at 6 months follow-up.

CONCLUSION

Success rate and complications of En-DCR is comparable with the gold standard Ex-DCR surgery, by experienced hands. En-DCR surgery may be preferable over Ex-DCR for all revision and bilateral cases, cases with additional intranasal pathologies, and cosmetically conscious persons, for its inherent advantages. However, large scale, multicenter, prospective, randomized study is required to substantiate our findings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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