



Implant Dacryocystorhinostomy (DCR) using Modified Pawar Implant

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Abstract

Dacryocystorhinostomy (DCR) is an operative procedure performed for obstructed nasolacrimal passage. The procedure has a failure rate of 10% due to postoperative infection, granulation tissue formation and inadequate closure of anastomosis ostium in conventional DCR. Author has developed Pawar Implant - a silicon implant in 1985^{1,2} which has undergone some modifications over the years. The new modified Implant has no chances of getting expelled post operatively due to haptics of the collar. Implant DCR is indicated in the patients complaining of epiphora due to the obstruction in nasolacrimal duct due to Chronic Dacryocystitis; Mucocoele / Pyocoele; Lacrimal-fistula; failed cases of conventional and other varieties of DCR.

Keywords: *Dacryocystitis, dacryocystorhinostomy (DCR), dacryocystectomy (DCT), nasolacrimal duct, lacrimal gland, congenital dacryocystitis, nasolacrimal implant; mucocoele, pyocoele, Pawar Implant*

INTRODUCTION

Conventional DCR is most commonly performed surgery for obstruction in the nasolacrimal duct. Apart from having 10% failure rate, this procedure has disadvantages like ; it is the time consuming procedure, nasal packing is necessary to prevent the operative and post-operative bleeding, requires large size of ostium of 12-14 mm in diameter, bleeding and tissue handling is more. Also the procedure is contra-indicated in children and old patients, because the bones are thin, fragile before the age of 3 years and mucous membrane is atrophic due to the senile changes in old age. To overcome these difficulties various

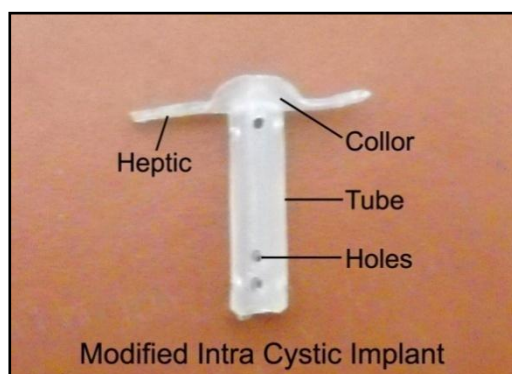
procedures have come into existence like Implant DCR, Endonasal DCR , Laser DCR, Conjunctival DCR, Canalicular DCR, Balloon Dacryoplasty etc. Author has developed Pawar - implant for DCR. The main aim of Implant DCR is to obtain and maintain a patent passage in between the lacrimal sac and middle meatus of the nose. The initial implant was made in 1985 out of the silicone pieces left over from Denver's Hydrocephalic shunts after hydrocephalous operation. In 1987 the device was modified and a collar was introduced. In 1995 the implant underwent second modification and the haptic was introduced. Modified collar with haptics of 3 mm

has overcome the problems like expulsion of the implant through the nasal cavity. The modified device now works well for Chronic Dacryocystitis, Mucocele / Pyocele, Lacrimal-fistula, failed cases of Conventional DCR and other varieties of DCR. The present study includes report of 12 operated cases. Due approval of ethics committee was obtained.

MATERIALS AND METHODS

Modified Pawar intra-cystic implant is made up of silicone providing maximum tissue compatibility and less thrombogenicity. The implant is available in three sizes – having length 13mm, 15mm, and 17mm. it has tubular shape with the collar at the distal end. The diameter of the collar is 2x5x8 mm with the haptic of 3 mm on either side as shown in the Fig.1. Outer diameter of the implant's tube is 3.5 mm and the inner diameter 3.0 mm. The diameter of the implant's hole at the proximal and the distal end is 1.0. The haptics are stiff but flexible so that there is no chance of the expulsion of the implant from its original position.

Figure 1



Preoperative investigations for evaluation of status of nasolacrimal apparatus included following tests.

1. Syringing – to know the patency of NLD. If saline comes into patient's throat through the nose, it means that the NLD is patent and there is no obstruction. If no saline comes into throat and reflux regurgitation comes from the upper punctum then there is obstruction either in sac or in duct. If reflux regurgitation comes from same canaliculus then obstruction is in the canalicular system.
2. Modified Syringing – is indicated to clear the mucoid plug from already introduced implant.
3. Fluorescein Dye Test – is done in doubtful cases of watering. There are two types – Jone's Test 1 and 2. It is done in sitting position. Fluorescein 2% two drops are instilled into conjunctival sac and tip of the cotton is applied beneath the inferior turbinate. After 2 to 5 minutes if the dye is recovered at the tip of the cotton then the test is considered to be positive and indicates patent NLD and normal physiological function of lacrimal passage, If the dye is not recovered then try for Jone's Dye test 2 :- It is done after washing residual fluorescein from conjunctival sac. Syringing is done under local anaesthesia with normal saline and patient is instructed to blow. Recovery of the dye stained saline indicate normal punctal and canalicular anatomy with partial block at the lower level of the sac or duct, otherwise test is considered to be negative.

4. Schirmer's Test: This test is performed by measuring the wetting of special filter paper (Whatman no. 44 – size 5mm X 35 mm). The test gives guidelines, whether to go ahead with Dacryocystectomy or Dacryocystorhinostomy operation. It also distinguishes between hyper secretion and epiphora in confusing cases. Post operativeschirmer's test is helpful to note the desired success of the various anastomosing surgical procedures.
5. Dacryocystography: Involves visualization of lacrimal drainage system by injecting a radio opaque contrast dye and is done under local anesthesia.
6. Lacrimal Scintigraphy: It is indicated only in doubtful cases. A minute quantity of radioactive tracer (Sodium pertechnetate Tc 99 m) is instilled into the eye as drop and the progression of the radioactive fluid is followed through the drainage system using gamma camera.
7. Fluorescein Dye disappearance test: A single drop of 2% fluorescein solution is instilled into the inferior conjunctival sac. The colour intensity remaining after 5 minutes can be graded on a scale of 0 to +4. In normal excretion the retained fluorescein will be 0 to +1. Any greater residual is indicative of impaired out flow. This test may be complimentary to the Jone's test and dacryocystography in the diagnosis.
8. Saccharin test: In this test a strip of saccharin is instilled into the conjunctival sac. If the passage is normal, Patient will report the bitter sweet solution in his mouth within 20 to 30 minutes of instillation.
9. ENT check up
10. Bleeding and clotting time
11. Blood grouping and cross matching
12. Blood sugar – Fasting and postmeal

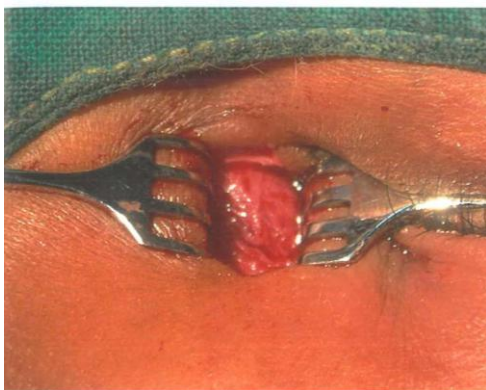
METHOD – (OPERATIVE-STEPS)

Anaesthesia– Local anaesthesia for adults and general anaesthesia for children. Local anaesthesia, surface anaesthesia of conjunctival sac by instilling 4% xylocaine with adrenaline 1: 10,000 solution or Paracaine eye drops 2-3 times. Infiltration anaesthesia by Stallard technique. It is done by injecting 2% xylocaine with adrenaline 1: 10,000 solution as follows.

- 1) Skin over the anterior lacrimal crest is infiltrated with anaesthetic along the line of incision, needle is then directed posteriorly downwards and medially to infiltrate the entrance of NLD.
- 2) Blocking the nasociliary nerve around the anterior ethmoid foramina. Needle enters the orbit a little below the trochlea and is passed backwards along the junction of roof and medial wall for 3cms. Care is to be taken to avoid injury to angular vein. About 1ml xylocaine with adrenaline is injected before the needle is withdrawn. It

is directly medial for injection along the orbital margin and around the fundus of the sac.

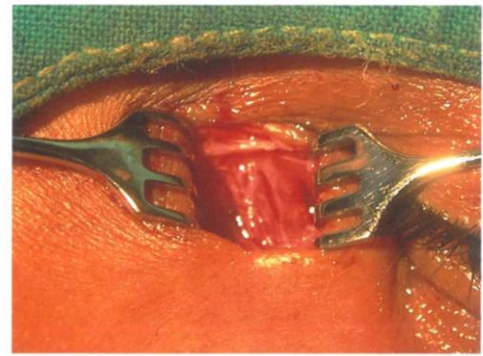
- 3) Superior alveolar nerve is blocked as it leaves the infra-orbital margin to enter an osseous canal proximal to infra-orbital foramina about 7-9 cms below the infra-orbital margin.
- **INCISION** - Straight or curved incision 3mm medial and near about 5mm in length along the anterior lacrimal crest is taken on the skin and deepen up to the bone level to expose the lacrimal sac. The injury is avoided to the angular vein.
 - **EXPOSURE OF SAC** – Lacrymal sac gets exposed with the blunt dissector separating the fibres of orbicularis muscle and cutting the lachrymal fascia.



Dissection of lacrimal sac

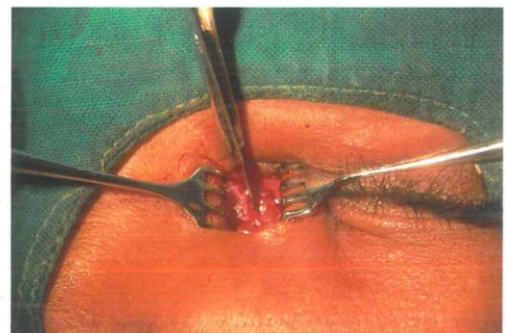
- **INCISION OVER LACRYMAL SAC** - Antero-lateral incision of 3.5mm long is made on the anterior surface of the lacrimal sac. The cavity of the sac is irrigated with saline containing beta-iodine and adrenaline in strength of 1: 10,000 to remove the mucus contents from it. Beta-

iodine acts as antiseptic and irrigating solution acts as hemostatic.



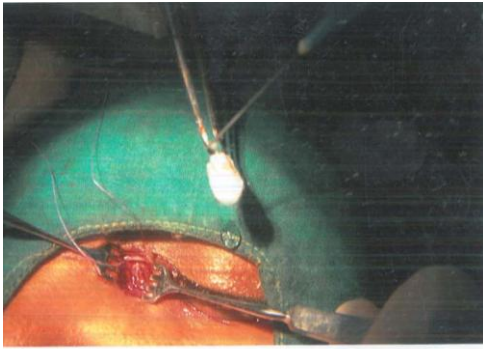
3.5 mm incision over anterolateral wall of sac

- **MAKING NASAL OSTIUM** – Mastoid gouge of 3mm diameter is passed obliquely down-ward through antero-lateral opening of the sac to perforate the postero-medial wall of the lachrymal sac along with the lachrymal bone and nasal mucous membrane. The mastoid gouge is passed in NLD when it is planned to keep the implant at that site.



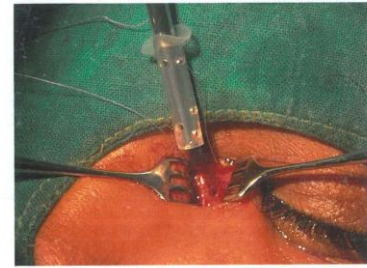
Making of bony ostium by mastoid gouge

- **PAINTING NEWLY FASHIONED OSTIUM WITH MITOMYCIN 'C' 0.04%** - The sterile cotton bud contain Mitomycin 'C' 0.04% is kept for 3 minutes in the newly fashioned ostium and then again the sac irrigated with normal saline.

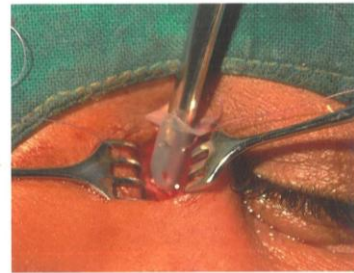


Cotton swab is wetted with
Mitomycin – C (0.04%)

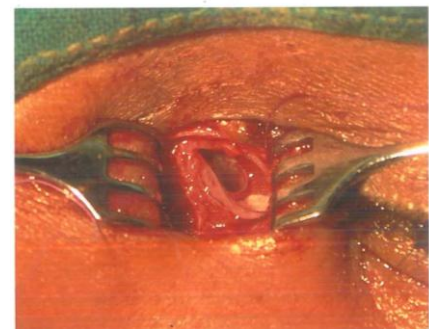
- INTRODUCTION OF IMPLANT** - A sterile intracystic Implant is mounted on mastoid gouge of 3mm diameter, which acts as an introducer. So the implant is introduced through the antero-lateral opening of the sac in the nasal cavity negotiating the posterior-medial opening wall of the lachrymal sac and newly fashioned ostium which was painted with 0.04% Mitomycin 'C' for 3 minutes. The sterilized Implant is placed in such way that the wider collar portion of the implant lies in the cavity of the sac and other distal portion of the sac open either in the middle meatus or inferior meatus of the nasal cavity. The intracystic implant without haptic is anchored to the wall of sac with non absorbable suture material e.g. Prolene 6/0, so that it should not expelled out post operatively. This step is not required for the implant having heptics on either side.



Needle is passed through proximal hole of implant and then through anterolateral wall of sac



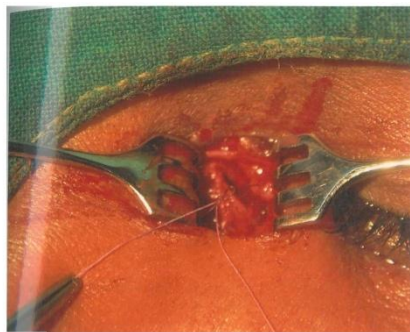
Implant is implanted in the sac and the newly fashioned bony ostium



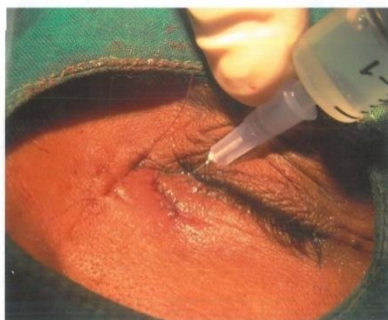
Collar of the implant in the cavity of the sac

- CHECKING THE POSITION OF IMPLANT** - Saline is irrigated in the cavity of the sac and through the proximal opening of the introduced implant and observed so that it will come in the patient throat indicate the patency of the nasolacrimal duct through the introduced implant. Air bubble will be seen from the nostril at the site of surgical wound.
- CLOSURE OF SURGICAL WOUND**- The antero-lateral opening of the sac is

closed with 1-2 stitches with 6/0 absorbable or non absorbable suture material. The other surgical wound layers are closed one after another. Skin is closed by giving the subcuticular stitches for thin scar. Syringing is done on operation table to confirm the patency of the NLD through the introduced implant. Pad and bandage is given after applying the antibiotics drops and ointment at the operative site and in the eye. The patient can discharge on OPD basis as there is no need of admission.



Closure of lacrimal sac opening



Closure of wound by subcuticular stitches and on table syringing is done

POST-OPERATIVE TREATMENT –

- Systemic oral antibiotics and anti inflammatory drugs for 3 days.
- Local antibiotic drops 3-4 times for 4 weeks.
- Decongestive nasal drops 2-3 times a day in the nostril of operated site.

- Remove the non absorbable skin stitches after 7 days.
- Instruction is given to the patient not to blow nose or sneeze forcefully of operated site for 6-8 wks.

Patient is asked to review weekly for 1st month and then once in a month for 1st three months and then every three month for 1 year. If there is doubt about the patency of NLD through the introduced implant – Syringing is done to confirm it.

MODIFIED SYRINGING

This is indicated to clear the mucoid plug formation as late complication of Implant DCR. A straight blunt canula is attached to the 5 ml syringing containing saline + beta iodine is forward in the canaliculi after dilating puncti and proceed further in the cavity of the sac toward the introduced implant and then irrigated forcefully as shown in figs. This procedure is performed under the local anaesthesia.

POST-OPERATIVE SYRINGING

First syringing is done on operative table immediately after the closure the surgical wound. Second syringing is done at end of 1stwk and then there-after if required.

OBSERVATIONS

The procedure was done in 24 patients. None of the patients had any complications on the operating table. One patient had infection of wound. It was treated by systemic antibiotics and local povidone iodine application. The suture was removed one day earlier. It subsided completely.

No expulsion of implant was noted. There were complaints of watering in 2 patients after a month. Modified syringing was done. This dislodged the mucoid plug and patency was established. Patients

were advised Mucomist or acetyl cystane eye drops for 10 days. Patients thereafter did not complain of watering.

DISCUSSION

Following table is self – explanatory and confirms the usefulness of modified Pawar implant.

Differentiation of modified Pawar Implant DCR with Endonasal and Conventional DCRS

Sr. No.		Modified Pawar Implant DCR	Endonasal DCR	Conventional DCR
1.	Anaesthesia	Local	General/local	Local as well as general
2.	Nasal packing	Not necessary can be used	Required after operation	Required (pre + post operatively)
4.	A Dacryocystitis	Not indicated	Can be indicated	Not indicated
5.	Tissue handling	Less +	++	+++
6.	Bleeding	+	++	+++
7.	Implant left in situ	Permanently	No Implantation	No implant
8.	Closing of surgical wound	+ve	-ve	++ve
9.	Endoscopy + TV set	Not required	Required	Not Required
10.	Ostium + Flaps	3mm No Flaps	4-5 mm No Flaps	10-12mm, bigger With Flaps
11.	Hospital admission	Not required	Required for 2-3 days	Required for 2-3 days
12.	Post operative scar	+ve faintly	-ve	++ve thicker
13.	Operative time	20-30 minutes	45 - 60 minutes	60-90 Minutes
15.	children and very old patients	Indicated	Indicated	Not Indicated
16.	Success rate	100%	92%	90-92%

Implant DCR in our study were operated under the local anesthesia in adult. The children were operated under the general anesthesia. Mc Dongh M. et al 1989³ performed Endonasal DCR both under general and local anesthesia. Hartikainen J.

1998⁴, Lun Sham C. 2000⁵ preferred local anesthesia. Nussbaumer M. 2004⁶, Singh M. 2004⁷, Durcasula V. S. 2004⁸ and Farnandes S. V. 2005⁹ performed all cases of NLD obstruction by Endonasal DCR under local anesthesia.

While taking incision in the present study, precaution is taken of not to cut Medial palpebral ligament that helps in the pumping action of lacrimal sac it. Raynaldo M Javate¹⁰ mentions using Elima-Javate electrodes called as mini incision DCR. Awasthy and Agrawal 1962¹¹ made a straight incision 2 cms long 1mm above and 1cm nasal to medial palpebral ligament. I do not find any difference in between the straight and crescentic incision.

In Implant DCR making of nasal ostium is simple and quick by perforating nasal bone with the help of mastoid gouge having the diameter of 3mm equal to the intra-cystic Implant. It does not produce much bleeding because of less handling of the tissue and comparative small size of diameter. In conventional flap DCR it was very tedious job to make large ostium of 12 to 14 mm in size in the nasal bone with severe grade of bleeding.

Linberg J. V. 1982¹² showed that on approximately larger osteotomy made during surgery narrow down to final size of 2mm due to the tissue grown and scarring. To prevent this narrowing of the ostium, Mitomycin - C 0.4% was painted for 3 minutes. This is the modification in surgical procedure of Implant DCR with modified intra cystic Implant is introduced since 2009 by Pawar M.D.

Mc. Dongh M. and Meiring J. H. 1989 cut an interiorly based flap in the medial wall of sac fold it down and suture it on the interior turbinate. Lun Sham C et al 2002 made 'H' shaped incision at superior and inferior limit of sac, reflected over nasal mucosa. Wormald P.J. et al 2002¹³ matched

the 'U' shaped nasal mucosa flaps edges to the edges of lacrimal sac.

Various Implants have been tried in the past. Linnhares et al passed silk thread through the punctum, canaliculus, anastomotic opening nose and tied it on cheek. Summer skill W.H. 1952¹⁴ used polyethylene tube between the sac and middle meatus of the nose. The polyethylene tube could not be tolerated by tissue and so rejected. Abrahmson 1960 used steel wire to keep ostium open. Trivedi et al 1969¹⁵ used a rubber tube. Thomas et al 1965¹⁶ used silicone sponge and kept for 6 wks. However Pico G et al 1971 strongly opposed to use of any foreign material between the wall of new anastomosis as a preventive measure. In his opinion, this simply disrupts the suture line in the gap and may even stimulate the formation of obstructive granulation tissue by causing irritation in bony opening.

There are two main sources of bleeding e.g. angular vein and nasal mucosa. One should take care not to damage the angular vein during the surgical procedure, if it is damaged or injured should be ligated with 6/0 cat gut suture. Nasal packing with 4% xylocaine with adrenaline helps to prevent bleeding when incision is given on nasal mucosa to make the flaps. Nasal packing is given 15 minutes before starting the operation. Ostachowacz 1961¹⁷ used suction pump to keep operation field clean. Cautery was used by Veir 1969. Sprekelsen M.B. et al 1966¹⁸ used monopolar cautery while performing endonasal DCR with concomitant anterior ethmoidectomy. In this procedure of Implant DCR amount of bleeding is significantly reduced to grade 1 as

there is less tissue handling and small size of ostium. In endonasal DCR bleeding was of grade +2 to +3. In conventional DCR bleeding is a significant problem mainly at preparing the flaps of nasal mucosa. It is reported +5 to +10 grade sometimes.

In Implant DCR newly fashioned ostium was painted with Mitomycin 'C' 0.4% for 3 minutes before introduction of the Intracystic Implant. Ugurbas S. H. et al 1997¹⁹ studied the histopathological effect of Mitomycin 'C' (0.5mg/ml) on osteotomy site. This prevents the compression of the introduced intracystic Implant and blocking of newly fashioned ostium. This factor help to increase success rate of Implant DCR. Liao S. L. et al 2000²⁰ showed that with intra-operative use of Mitomycin 'C' over osteotomy minimized the adhesion around the osteotomy area as well as the opening of common canaliculus. Camara J. G. et al 2000²¹ reported no complications of Mitomycin 'C' like delayed wound healing, infection or abnormal bleeding.

In present Implant DCR surgical wound is closed layer by layer with 6/0 absorbable or non - absorbable suture. Skin is closed by sub-cuticular stitches so that a fine scar is formed post-operatively. In Endonasal DCR, Laser DCR surgical approach is not through skin, so there is no need of skin stitches. In conventional Flaps DCR skin incision is longer and is thicker than the other type of DCRs.

Implant DCR requires 20 to 25 minutes. Endonasal DCR requires 45 to 60 minutes. Hartikainen J. et al 1998 mentioned average surgical time 38 minutes (range 30 to 79

minutes) for endonasal DCR. Cokkesar Y. et al 2000²² required mean 33 minutes (range 20 to 105 minutes) for endonasal DCR.

As far as hospitalization is concerned, there is less tissue handling and minimum bleeding, in this Implant DCR. No hospitalization is required. Endonasal DCR usually performed under general anesthesia. Also chances of post - operative bleeding might require hospitalization. In conventional flap DCR patient is kept hospitalized to observe for post-operative bleeding and other complications.

In the earlier implant by Pawar M.D. 1985 failure of Implant DCR was mainly due to the blockage of Implant by blood clot or mucoid plug and expulsion of the implant. The blockage of implant was taken care of by modifying syringing. The second factor responsible for the blockage of implant was compression in the newly fashioned ostium. This is now being managed by painting it with Mitomycin-C 0.04%. The expulsion of the implant was prevented by encoring implant to the sac by non-absorbable 6/0 suture. The Implant was modified with haptics on the opposite site of the collar. This prevents the expulsion of the implant in the present modified Implant DCR. Welham R.A. and Wulc A.E. et al 1987²³ found that problem with the location. Size of the internal lacrimal ostia was the cause of failure in 52% of cases in endonasal DCR. Metson R. et al 1990²⁴ Cokkesar Y. et al 2000 and Tsirbas A. et al 2000 reported the commonest cause of endonasal DCR failure as granulation tissue formation and scarring within the ostium. Mannor G.E. and Millman A.L. 1992²⁵ found endonasal DCR was

successful in 82% patients with the normal sized lacrimal sac but the success rate was only 29% in individuals with the small lacrimal sac. Sprekelsen M.B. et al 1996 reported the cause of failure due to synechia in 22.4%, granulation tissue in 6.6% and obliterative scarring in 3.3% of the cases. Hartikainen J. et al 1968 noted obstruction at the rhinostomy site causing failure in 7 out of 9 nine failures. Lun. Sham C et al 2000 found failure of one case due to canalicular obstruction and one case due to prolapsed of orbital fat hindering proper fashioning of mucosal flap.

CONCLUSION

In comparison to the other DCRS, modified Pawar Implant DCR is simple, quick and less complicated and more effective surgical procedure without disturbing the anatomical structure of NasoLacrimal Passage.

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