32 Dacryoendoscopic Guided Canalicular and Nasolacrimal Duct Recanalization

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Introduction

Dacryoendoscopy is a procedure utilizing microendoscopic techniques to visualize the entire lacrimal system from the puncta to the inferior meatus [1–10]. It is gaining firm ground and increasing in popularity for expanding indications in lacrimal disorders, thus having many diagnostic and potential therapeutic implications [1–10]. Till the late 1990s, the microendoscopic systems were not well-developed; however, with the advancement in other specialties like endoscopic retrograde cholangiopancreatography (ERCP), numerous microendoscopes with a good image quality were designed. Dacryoendoscopes used in the past include the Junemann probe and the vitroptic. Additional channels were added, for example, for laser delivery of KTP-YAG or Erbium-YAG laser for laser dacryoplasty and micropunches for sample collection [8]. The author performs it using a 0.6-mm microendoscope (Karl Storz, Tuttlingen, Germany), which was adapted and partly modified from the original sialoendoscope (Figs. 32.1 and 32.2). The current chapter will discuss the instruments, indications, and techniques of lacrimal passage recanalizations.

Canalicular obstructions and NLDO are therapeutic challenges. Most of the lacrimal obstructions are known to follow the common final pathway of inflammation and fibrosis, even if there is a wide range of etiological factors. Canalicular obstructions can occur following

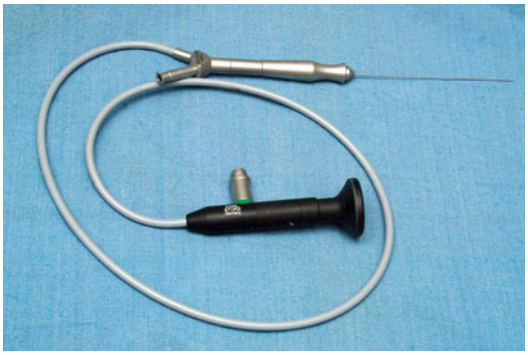

Fig. 32.1 Dacryoendoscope with rigid telescope and black eye piece

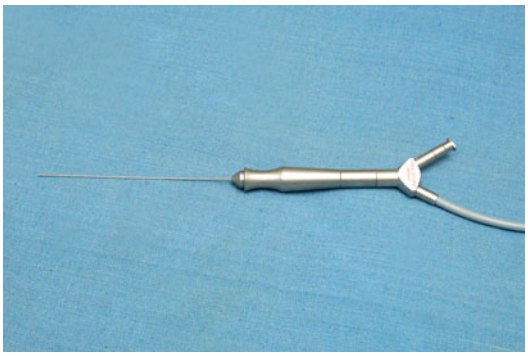

Fig. 32.2 A closer view of side port

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infections, inflammations like Stevens-Johnson's and lichen planus, posttraumatic and post-topical ocular medications and systemic chemotherapy [11–13]. Numerous modalities with variable success rates have been described for canalicular obstructions and include retrograde intubation dacryocystorhinostomy, membranectomy, endocanalicular laser surgery, canalicular trephination, and balloon canaliculoplasty [14–18]. For nasolacrimal duct obstructions (mostly partial), alternative options to a DCR described include therapeutic trephination and intubation, silicone intubation alone and anterograde balloon dacryoplasty, electrocauterization or diathermy-assisted recanalization of NLDO (RC-NLDO), radiofrequency recanalization, and microsurgical NLD rhinostomy with eversion technique [19–26].

Instruments and Techniques

1. Dacryoendoscope
2. 1-ml syringe with saline
3. Camera head
4. Endoscopic viewing system
5. Antifog solutions (ex-diluted chlorhexidine)
6. Sisler's trephines
7. Huco trephines
8. Additional instruments based on the technique like Microdrill or laser or balloon dacryoplasty

The dacryoendoscope has a thin, rigid fiber endoscope and a side port on the hand piece (Figs. 32.1 and 32.2). The rigid fiber endoscope is attached to the eyepiece through a fiber-optic cable (Fig. 32.1). The eyepiece of the dacryoendoscope is connected to the camera head and secured. The camera head is then connected to the endoscopic viewing system (Fig. 32.3), and the tip of the scope is gently cleaned with antifog solution and image quality is assessed.

The dacryoendoscopy can be performed in an anterograde or a retrograde manner. For the recanalizations procedures, the anterograde approach is used. It is important to know that illumination may need to vary in different parts of the lacrimal system, especially when there are obstructions.

Fig. 32.3 Endoscopic viewing system

Indications

The indications for the recanalizations procedures are as follows:

1. Complete canalicular obstructions
2. Complete nasolacrimal duct (NLD) obstructions
3. Symptomatic partial obstructions.
4. Patchy or multifocal canalicular or NLD strictures
5. Obstructive dacryolithiasis
6. Obstructive foreign bodies, for example, migrated punctal plugs
7. Membranous canalicular obstructions following a DCR

Contraindications

1. Acute canaliculitis
2. Acute dacryocystitis
3. Posttraumatic obstructions following gross fractures

4. Misaligned canaliculi
5. Acute infective rhinitis (for nasolacrimal recanalizations)

Techniques

1. Dacryoendoscopic guided canalicular and NLD trephination
2. Laser dacryoplasty
3. Microdrill canaliculoplasty
4. Balloon canaliculoplasty
5. Diathermy-based recanalizations

Canalicular Recanalization Techniques

Canalicular trephination can be carried out using laser, microdrills, or balloons under dacryoendoscopic visualization or, alternatively, using trephines under similar guidance. Sisler's trephines were described in the year 1990 as specialized microtrephines designed for the canaliculi [14]. The trephine is 16 mm in length and 0.81 mm wide with a plastic hub behind for a syringe or simply to hold during the boring movements. It is accompanied by an intraluminal stylet or guide (Fig. 32.4). Dacyroendoscope is used to assess the type of obstruction (partial or complete), its distance, and its appearance. It is important to differentiate stenosis from various degrees of obstructions (Figs. 32.5, 32.6, 32.7, and 32.8). Lubricated trephine is inserted to the point of obstruction with its accompanying stylet in place to minimize trauma to the proximal, patent canaliculus. The syringe is then affixed to the trephine's luer-lock hub and trephination is carried

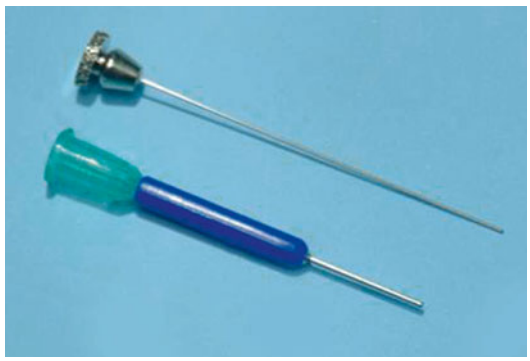

Fig. 32.4 Sisler's canalicular trephine with intraluminal stylet

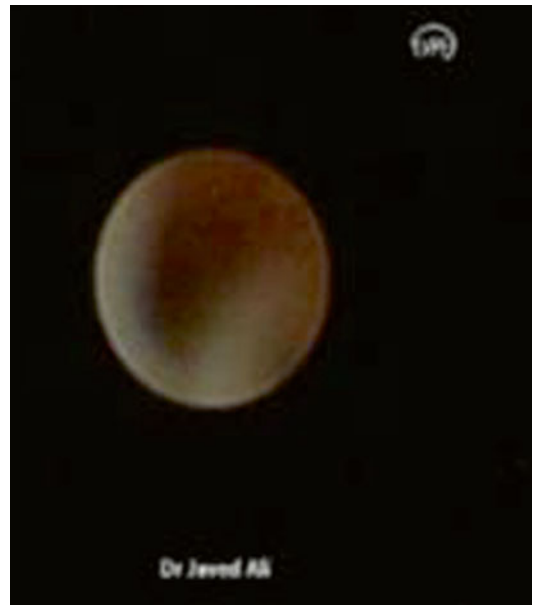

Fig. 32.5 Canalicular stenosis

Fig. 32.6 Partial canalicular obstruction

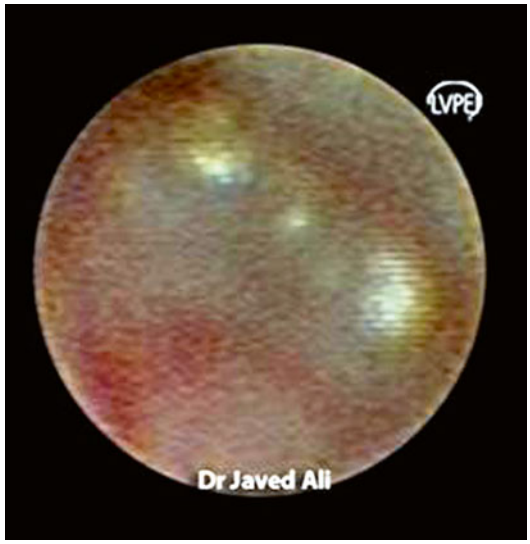

Fig. 32.7 Complete canalicular obstruction

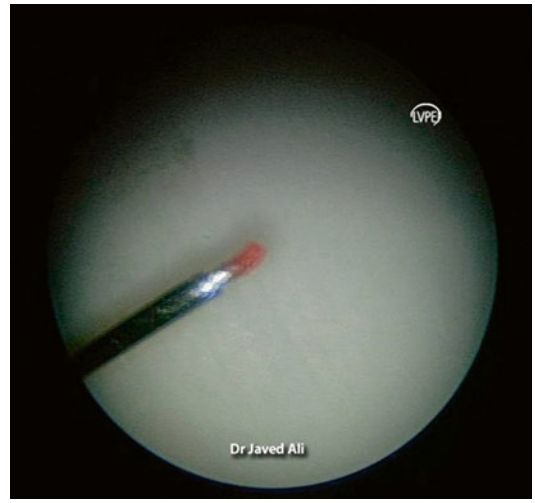

Fig. 32.9 Obstructed sculpted segment in trephine barrel

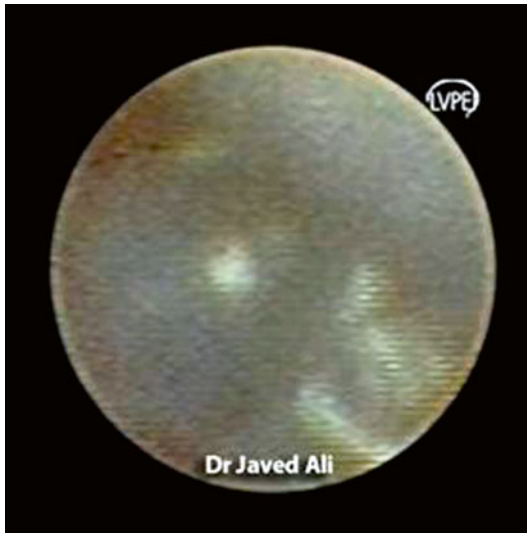

Fig. 32.8 Complete canalicular obstruction

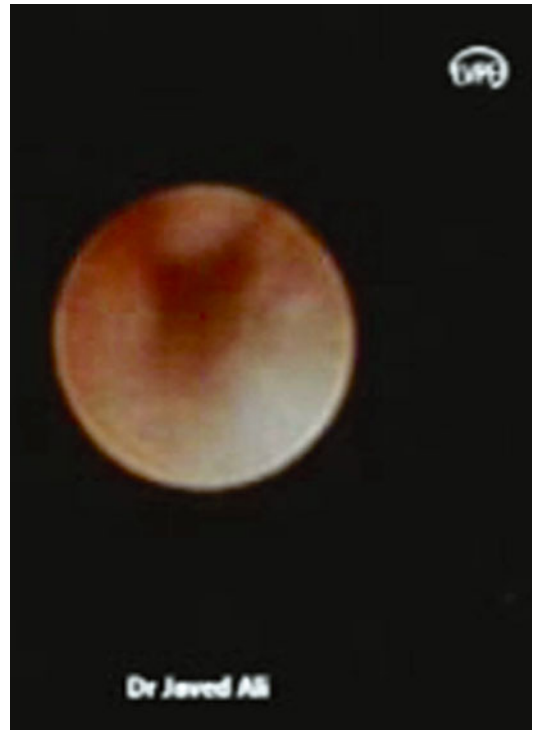

Fig. 32.10 Complete canalicular recanalization

out by gentle rotation of the assembly. After each millimeter boring, dacryoendoscope is used to assess the extent of clearance, assess further passage, and obstruction. Bleeding is usual since the obstruction is a fibrovascular tissue and it should be simultaneously cleared by irrigating the canaliculus with saline from the side port. The trephination is continued and when the sac is entered, the syringe will pop indicating achievement of the desired passage and a plug of scar tissue is seen either within the lumen of trephine or barrel of the syringe (Fig. 32.9). Dacryoendoscope is inserted to ascertain completer recanalization (Fig. 32.10). This is followed by stenting of the new passage with mono- or bicanalicular stents. Postoperatively, a combination of topical antibiotic and steroid is

continued in a tapering fashion for 4 weeks. The author retains the tubes for 3 months in recanalizations cases.

Laser dacryoplasty is performed using Erbium:YAG laser or KTP:YAG laser [8, 17]. For this purpose the dacryoendoscope needs to have an additional channel for the passage of laser fiber. Laser delivery using a sapphire fiber of 375 μm, and energy of 50 mJ with 1–3 Hz frequencies have been described. The procedure is the same as described earlier but instead of a mechanical trephine, laser is used to lyse the fibrous tissues, followed by irrigation and intubation [8, 17].

Microdrill dacryoplasty was introduced by Busse [6]. The additional channel on dacryoendoscope is designed to carry a battery-operated 0.3-mm stainless steel microdrill shaft. The frequency to begin was 50 Hz but now powerful drills up to 3,000 Hz are available. The microdrill is best suited for partial obstructions, where the drill starts from the edge of the patent lumen to recanalize it further. It is very important to have a continuous irrigation and suction with a clear visualization and utmost control on the instruments, since the possibility of canalicular lacerations can be high if the shaft is not accurately positioned [6].

Balloon canaliculoplasty is sparsely reported in the literature [16]. It uses a 2-mm balloon for recanalizations following probing just like in balloon dacryoplasty. The inflation–deflation cycles at 8 atm of pressure is followed by intubation. It was found to be more effective in common canalicular obstruction as compared to isolated canalicular obstructions.

Nasolacrimal Duct Recanalizations Techniques

Nasolacrimal duct obstructions are an enigma. Recanalization approaches used include dacryoendoscopic guided Huco trephination and intubation, anterograde balloon dacryoplasty, electricity-assisted recanalization of NLDO (RC-NLDO), and Javate's mechanical recanalizations under simultaneous guidance [19–25]. Trephination is usually done using the Huco trephine (Fig. 32.11). Lubricated trephine is inserted to the point of obstruction with its accompanying stylet in place to minimize trauma to the proximal, structures. The trephination is carried out by gentle rotation of the assembly. After each millimeter boring, dacryoendoscope is used to assess the extent of clearance, assess further passage and obstruction, modify the course, and confirm complete recanalizations (Figs. 32.12, 32.13, 32.14, and 32.15). Bleeding is usual since the obstruction is a fibrovascular tissue and this needs to be cleared simultaneously with saline irrigation of the NLD from the irrigation port (Fig. 32.2). Crawford silicone intubation was performed and retrieved through the NLD and secured in the inferior meatus (Fig. 32.16), following the recanalization procedure.

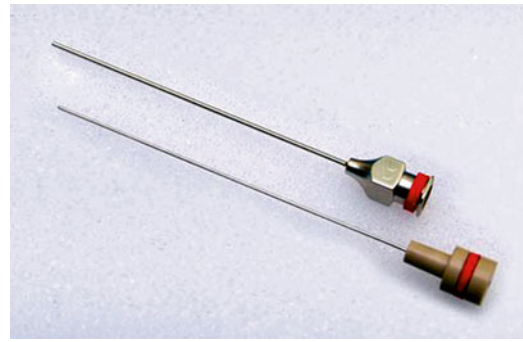

Fig. 32.11 Huco trephine

Fig. 32.12 Obstructed nasolacrimal duct

Fig. 32.13 Following early trephination

Fig. 32.14 Residual tissue in lumen following recanalization

Fig. 32.15 Complete recanalization

Fig. 32.16 Crawford intubation secured in inferior meatus

Anterograde balloon dacryoplasty is usually used for recanalizing partially obstructed nasolacrimal ducts [19]. The ducts are initially probed and the probe confirmed with an endoscope in the inferior meatus. A 3-mm lubricated balloon is then passed into the distal portions of the nasolacrimal ducts and inflated to 8 atm for 90 s, deflated, and reinflated to 8 atm for 60 s. The same procedure is repeated for the proximal portion of the nasolacrimal duct. This is followed by stenting of ducts with Crawford bicanalicular tubes [19].

Electrocautery or diathermy-based NLD recanalizations have also been described and claimed to be effective. The electrocautery-based recanalizations with bicanalicular intubation (RC-BCI) have shown efficacy for overcoming both the canalicular obstructions and NLDO [18, 21]. The instrument consists of a lacrimal canalizer (Tonxing Co, Changyi, China), whose console can discharge current between 50 and 150 W at a frequency of 500 KHz. The hand piece is a high-frequency lacrimal probe made of copper–silver alloy with 2-mm blunt, smooth but naked tip for electrocauterization. Another variant of this in a more practical setting has been described by Agarwal et al. [24], where a 20 gague, 7-W, endodiathermy probe connected to phaco machine has been used and recommended this as an alternative to DCR.

Complications

1. Bleeding
2. Proximal healthy structure trauma
3. Punctal trauma
4. Canalicular or NLD lacerations (rare)
5. False passage (rare)
6. Aggressive reocclusion
7. Tube-related complications

Prevention of Complications

1. Prior proximal dilatation
2. Lubrication of trephines
3. Good knowledge of anatomical course and variations
4. Avoid forceful entries
5. Periodic blood and debris clearance
6. Always perform under visualization

Advantages of Recanalization Procedures

1. Minimally invasive procedure
2. Major surgical interventions can be avoided
3. Sculptured passage creation
4. Smooth edges and less reclosures
5. Minimal trauma
6. Quick recovery
7. Early rehabilitation

Outcomes

Canalicular Recanalization

Nathoo et al. [15] studied canalicular trephination and intubation in 45 eyes of 43 patients and at 1 year follow-up showed a success rate of 64 %. Khoubian et al. [27] studied the effects of trephination and intubation based on the level of canalicular obstructions in 41 eyes and found that 80 % of eyes had complete resolution from epiphora in lower distal canalicular obstructions, 66 % in distal bicanalicular obstructions, and 59 % in common canalicular obstruction. No cases of complete resolution were noted in the proximal group.

In the pilot study conducted by the author [28] on ten patients treated with dacryoendoscopic guided recanalizations, 40 % were mid and 60 % were distal obstructions; 40 % of these were partial, equally divided between the mid and distal groups. At 1 year follow-up, 70 % of these were patent. The author found that dacryoendoscopy helped in avoiding false passages, accurate assessment of the obstructions, as well as its complete clearance following trephination.

Laser dacryoplasty has been shown to be effective in 80 % of the patients with regard to relief from epiphora at a mean follow-up of 20.4 months [8, 17]. The success rate in canalicular stenosis was 67 %, whereas in isolated com-

mon canalicular stenosis it was as high as 86 %. Microdrill dacryoplasty showed a success of 78 % in reducing epiphora at 12 months follow-up [6]. Balloon dacryoplasty showed that an immediate success rate of 82 % was achieved but long-term follow-up success is only 57 % and not encouraging [16]. The outcomes of RC-BCI in canalicular obstructions in 32 eyes showed a complete resolution from epiphora in 81 % at a mean follow-up of 21.5 months [18].

Nasolacrimal Duct Recanalization

Ali et al. [19] performed anterograde balloon dacryoplasty in 21 partially obstructed NLD, followed by silicone intubation for 3 months. At a minimum follow-up of 6 months after tube removal, anatomical success was noticed in 71 % of the lacrimal passages. The use of silicone intubation along with a balloon dacryoplasty is not clear. Kashkouli et al. [20] retrospectively compared balloon dilatation with intubation versus intubation alone and reported no statistical difference between the groups (61 % vs. 54 %) in the outcomes at a mean follow-up of 14.60 months. However, it is important to note that this was not a randomized study. Bleyen et al. [23] conducted a similar study but it was a randomized control trial. They also did not find a significant difference between the groups (52 % vs. 57 %).

In a pilot study conducted by the author [28] on ten partially obstructed NLD with dacryoendoscopic guided recanalizations showed very good immediate success in all patients; however, the long-term outcomes were discouraging. There was a success rate of only 50 %, even though only partial obstructions were chosen for the procedures. An 80 % (4/5) of the failed NLD recanalization worsened symptomatically because of complete obstructions and needed dacryocystorhinostomy.

The outcome of diathermy recanalization has been reported to be 92.7 % at a 2 year follow-up. The surgical time taken was 21.3 ± 6.2 min with complications noted in 1.3 % and include punctal cheese wiring [24]. Javate et al. [25] performed a comparative trial between endocanalicular lacrimal duct recanalization (ELDR) and a standard external DCR and found that the anatomical and functional success rates were 93 and 85 %, respectively, as against 94 and 90 % in external DCR, and concluded that both are equal in efficacy without the major complications of external DCR.

Conclusion

In conclusion, for canalicular obstructions, the outcomes of various procedures are more convincing especially trephination and canaliculoplasty. Dacryoendoscopic guided recanalization in the author's experience is a useful and effective technique with a success rate of 70 %. However, the same was not found true for NLD recanalizations, which had a success rate of only 50 %, even though only partial NLDO were chosen for in their study. The fundamental block needed to make recanalizations a real alternative modality is accurate understanding of the etiopathogenesis, which is still elusive. Apart from this, modifications in instrumentation techniques with a larger sample size and longer follow-up are required and till then skepticism on NLD recanalizations is justified.

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