Feasibility of Parotid Duct Transposition for the Treatment of Dry Eye: A Cadaveric Study

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Abstract Total dry eye is encountered less frequently, but it may lead to blindness. Transposition of parotid duct to the conjunctival cul-de-sac is a method of treatment for advanced cases of xerophthalmia to prevent blindness. Tears and parotid secretions have similar composition; therefore saliva provides an excellent replacement for tears. Limitation of this procedure is that the length of the parotid duct may not be adequate to reach the conjunctival cul-de-sac. This study was conducted in 30 fresh cadavers to assess the length of parotid duct and technical feasibility of parotid duct transposition for the treatment of dry eye. The parotid duct was dissected and resting length of parotid duct was measured on both sides without stretching. The distance between ear lobule to lateral canthus was also measured on both sides in each cadaver. The length of parotid duct ranges from 4.5 to 7 cm with average length was 5.8 cm. The majority of the cadavers had parotid duct length of 6 cm. Length of the right and left parotid duct was found to be equal in all cadavers. Parotid duct reached comfortably in 24 cadavers (80%) while it was short in 6 cadavers (20%) by 1–1.50 cm in length. Parotid duct can be transposed easily to the lower conjunctival cul-de-sac in majority of the cases. If the parotid duct is falling short than a cuff of the buccal mucosa can be taken in order to gain length.

Keywords Dry eye · Parotid duct · Xerophthalmia · Tear production

Introduction

Dry eye afflicted mankind since ancient time. Mild dryness of eye is very common and causes just discomfort while total dry eye is encountered much less frequently, but may produces blindness due to keratitis with ulceration and opacification. The most common causes of dry eye are trachoma, avitaminosis, Stevens–Johnson’s syndrome, chemical burns, pemphigus, severe conjunctival infections, Bell’s palsy and removal of posterior fossa neoplasm [1].

The primary factor in total dry eye is the lack of moisture which interferes with corneal transparency and may leads to loss of vision therefore; it is logical to provide continuous moisture to replace the deficient or absent lacrimal secretions. Transposition of the parotid duct to the conjunctival cul-de-sac can be done to provide moisture in cases of xerophthalmia. One limitation of this procedure is the length of the duct may not be adequate to reach the conjunctival cul-de-sac [2]. The present study was conducted in fresh cadavers to assess the feasibility of parotid duct transposition for treatment of dry eye.

Materials and Methods

This study was carried out in 30 fresh cadavers in Department of Surgery and Department of Forensic Medicine, in a tertiary referral centre over a period of 18 months. Institutional ethical committee clearance was taken before starting the study. Cadavers were placed in supine position. A line was drawn from the base of the ear

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lobule to the ala of the nose. The parotid duct lies along this line. A vertical line was dropped from the lateral canthus of the eye to intersect the horizontal line. At this point that the parotid duct turns deep over the anterior border of the masseter muscle into the buccal fat pad and pierces the buccinator muscle to enter the mouth opposite the second upper molar. The parotid duct was exposed through an incision along the middle segment of the horizontal line. The parotid duct was most readily identified as it passes over the anterior surface of the masseter muscle and can then be followed both anteriorly and posteriorly. An external skin incision was made and the flap elevated. The parotid duct, which runs about 1.5 cm below the Zygomatic arch, was identified. Its course is deep to the superficial musculo-aponeurotic fascia that lies over the masseter muscle. The buccal branch of facial nerve is in close proximity and crosses over the lateral aspect of the parotid duct. The duct was freed from facial nerve branches. The orifice of the parotid duct was identified intraorally in the buccal mucosa just lateral to the second upper molar tooth. The duct was first followed anteriorly down to the buccinator muscle. Then, by working through both the mouth and the skin incision, the parotid duct was freed from the mouth. The parotid duct was dissected away from the surrounding soft tissues. The resting length of parotid duct was measured and no stretching was done while measuring the length of duct. The distance between ear lobule to lateral canthus was also measures on both sides in each cadaver. The parotid duct was lay without stretching up to the lower conjunctival cul-de-sac near lateral canthus. The same procedure was repeated on the other side. Photographs were taken.

Results

We dissected 60 parotid ducts in 30 fresh cadavers. Out of 30 cadavers 27 were male and 3 were female. The length of parotid duct ranges from 4.5 to 7 cm with average length was 5.8 cm. The majority of patients had parotid duct length of 6 cm. Length of the right and left parotid duct was found to be equal in all cadavers. Parotid duct reached comfortably in 24 cadavers (80%) (Figs. 1, 2). Length of parotid duct fell short in 6 cadavers (20%) (Figs. 3, 4). Out of 6 cadavers the parotid ducts was short by 1–1.50 cm in length (Tables 1, 2). Out of 3 female cadavers one female cadaver was having adequate length of parotid duct to reach to lower conjunctival cul-de-sac and in remaining 2 female cadavers the parotid duct was short to reach to lower conjunctival cul-de-sac. Out of 27 male cadavers parotid ducts reached comfortably in 23 cadavers and remained short in 4 cadavers.

Fig. 1 Parotid duct reaching to left lower conjunctival cul-de-sac

Fig. 2 Parotid duct reaching to right lower conjunctival cul-de-sac

Discussion

Conventional treatment of dry eye includes: methyl cellulose tear substitutes, topical cyclosporine, mucolytic and topical retinoid [3]. Evaporation can be decreased by decreasing room temperature, use of moist chambers, protective glasses and punctal occlusion. Transplantation of various tissues into the conjunctiva such as oral mucosa and placenta has been reported to be effective in some cases [4, 5]. These measures are helpful in mild cases, are not effective in total dry eye which results in blindness [2]. Tears and parotid secretions have similar composition;

Fig. 3 Parotid duct not reaching to left lower conjunctival cul-de-sac

Fig. 4 Parotid duct not reaching to right lower conjunctival cul-de-sac

therefore saliva can be used for replacement of tears [2, 5–7]. There are many experimental studies of salivary gland transfer in animals [8–11]. All these studies showed the reduction in development of corneal ulceration with significantly greater tear secretion and provide long-term

Table 1 Parotid duct reaching to lower conjunctival cul-de-sac

S. No.	Sex	Parotid duct length (cm)		Length between ear lobule to lower conjunctival sac (cm)
		Right	Left	
1	M	6.5	6.5	6.5
2	M	7	7	7
3	M	6	6	6
4	F	5	5	5
5	M	5.5	5.5	5.5
6	M	7	7	7
7	M	6.5	6.5	6.5
8	M	6	6	6
9	M	7	7	7
10	M	6	6	6
11	M	6	6	6
12	M	6.5	6.5	6.5
13	M	5.5	5.5	5.5
14	M	5	5	5
15	M	5	5	5
16	M	5.5	5.5	5.5
17	M	5.5	5.5	5.5
18	M	5.5	5.5	5.5
19	M	6	6	5.5
20	M	5	5	5
21	M	5.5	5.5	5.5
22	M	5	5	5
23	M	6	6	5.5
24	M	6	6	6

Table 2 Parotid duct falling short to lower conjunctival cul-de-sac

S. No.	Sex	Parotid duct length (cm)		Length between ear lobule to lower conjunctival sac (cm)	Parotid duct short by (cm)
		Right	Left		
1	M	6	6	7	1
2	M	6	6	7.5	1.5
3	F	6	6	7	1
4	M	6	6	7	1
5	M	4.5	4.5	6	1.5
6	F	4.5	4.5	6	1.5

relief from pain and reduce the need for frequent installation of lubricants.

The most important limitation of parotid duct transposition is the length of the duct may not be adequate to reach the conjunctival cul-de-sac. Tension at anastomosis may cause leaks or stenosis, leading to obstruction and ultimately a poor outcome.

The length of the parotid duct can be measured by sialography, ultrasound, MRI or by cadaveric dissection. In these studies the average length of parotid duct was 42–50 mm with internal diameter ranging from 1.6 to 2.5 mm [2, 5, 12–14]. Which is adequate in the majority of the cases to transpose to the conjunctival sac without tension. In our study of cadaveric dissection showed 80% of the parotids are having adequate length of duct to be transposed to the lower conjunctival cul-de-sac near lateral canthus. The length of the right and left parotid duct was equal in all the cadavers. In 3 female cadavers the parotid duct fell short in 2, while in 27 male cadavers only 4 had short parotid duct which was unable to reach the conjunctival cul-de-sac.

In cases of short parotid duct the length of duct can be increased taking a cuff of buccal mucosa, parotid gland mobilization and using the vein graft as extension [15]. The problem of epiphora following parotid-duct transplantation can be reduced by irradiation, partial resection, or denervation of the gland. Parasympatholytic, and periglandular injections of botulinum toxin may also help. Other method is Conjunctivo-antrorhinostomy which provides adequate drainage thus control epiphora [16–18]. Though transposition of parotid duct improve patient comfort, reduces corneal ulceration and prevent blindness but corneal transplant becomes difficult due to microcystic epithelial edema [19].

Conclusion

The parotid ducts can be transposed easily to the lower conjunctival cul-de-sac in majority of cases. If the parotid duct is falling short than a cuff of the buccal mucosa and/or parotid gland mobilisation can be done in order to gain length. Parotid duct transposition is technically feasible and can be used to treat the dry eye and prevent blindness.

Compliance with Ethical Standards

Conflict of interest All author declares that they have no conflict of interest.

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