Journal of Plastic, Reconstructive & Aesthetic Surgery (2016) **69**, 679—686

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

Levator lengthening technique using cartilage or fascia graft for paralytic lagophthalmos in facial paralysis

Ayato Hayashi*, Hidekazu Yoshizawa, Yuhei Natori [a], Daiki Senda, Rica Tanaka, Hiroshi Mizuno

Department of Plastic and Reconstructive Surgery, Juntendo University School of Medicine, 2-1-1 Hongo Bunkyo-ku, Tokyo 113-8421, Japan

Received 9 October 2015; accepted 9 January 2016

KEYWORDS
Facial paralysis;
Paralytic lagophthalmos;
Fascia graft;
Cartilage graft;
Keratitis;
Lid loading

Summary *Introduction:* Lid loading using gold weights has been commonly used to treat paralytic lagophthalmos (PL); however, the procedure has a relatively high complication rate and the availability of these plates varies among social circumstances. We used a levator lengthening (LL) technique, which originally elongated the levator aponeurosis by inserting a fascia graft between the edge of the levator aponeurosis and the tarsal plate. However, because this procedure tends to result in a wide residual lagophthalmos, we changed the graft material from fascia to conchal cartilage. In this study, we describe in detail our experience with LL using the cartilage graft.
Methods: LL was performed in 18 patients with PL. Fascia grafts were used in seven patients and cartilage grafts in 11. Static reconstructions of the lower eyelid and eyebrow were also performed in most patients. Efficacy was evaluated from patient reports of ocular symptoms and by measuring the palpebral fissure width at opening and closing for both eyes.
Results: All patients experienced improved ophthalmological symptoms, which were more apparent in cartilage cases. The average palpebral fissure at eyelid closure was 1.8 mm in cartilage cases and 4.0 mm in fascia cases. In cases where an eyebrow lift was concurrently performed, the residual lagophthalmos became wider in fascia grafting but remained acceptable in cartilage grafting.
Discussion: LL is a simple and useful procedure for treating PL with higher efficacy when a cartilage graft is used. However, the level of the upper eyelid can be easily adjusted by changing the fixation position of the cartilage. Additional experience is required to obtain more consistent outcomes.

* Corresponding author. Tel.: +81 3 3813 3111; fax: +81 3 5802 1225.
E-mail address: ayhayasi@juntendo.ac.jp (A. Hayashi).
[a] Department of Plastic and Reconstructive Surgery, AOI Universal Hospital, Kanagawa, Japan.

http://dx.doi.org/10.1016/j.bjps.2016.01.010

Introduction

Lagophthalmos in facial paralysis requires prompt and appropriate treatment to prevent the development of keratopathy and ulceration of the cornea, which eventually results in blindness.[1] The upper eyelid is responsible for 85% of lid closure,[2] and there are several techniques for improving the protective function of the upper eyelid, such as lid loading,[1,3–5] use of a palpebral spring,[6,7] or a lid magnet,[8,9] and muscle transfer.[10,11] Among these surgical options, lid loading using gold weights has been commonly used for achieving upper eyelid closure because the surgical procedure is simple and minimally invasive and gold has a high density and is nonallergic.[3] Henstorm et al. reported that lid loading is a major contributor in improving the quality of life.[12] Harrisberg et al. reported that lid loading should be indicated for high-risk patients, such as those with combined ipsilateral fifth and seventh nerve palsy, those with signs of exposure keratopathy despite conservative treatment modalities, and any patient whose paralytic lagophthalmos (PL) is expected to persist beyond 3 months.[13] However, the rate of complications, such as migration, extrusion, discomfort, bulging, and pseudoptosis, are relatively high,[14–16] and it has been reported that 25% of patients required compulsory removal of the implants.[17] In addition, gold is not covered by social insurance in our country and has recently been subject to heightened restrictions. Therefore, an alternative method of surgical intervention to the upper eyelid in PL is required.

Levator lengthening (LL) as developed by Paul Tessier is a unique procedure for treating paralytic lagophthalmous.[18,19] It elongates the levator aponeurosis by introducing an interpositional fascia graft between the tarsus and the edge of levator aponeurosis, thus enabling easier eyelid closure by weakening the effect of the levator muscle[18] (Figure 1a). We have been using this technique instead of gold weight lid loading since 2009; however, with this procedure, eyelid closure tends to be incomplete and the residual lagophthalmos tends to be wide, especially with cases where an eyebrow lift was concurrently performed. To solve this problem, we changed the grafted material from the fascia to the auricular cartilage, which seemed to provide more steady elongation of the levator.

In this study, we provide a detailed description of our experiences with LL using a cartilage graft and evaluate its efficacy by comparing outcomes against the conventional method using a fascia graft.

Materials and methods

We performed LL using a fascia graft in seven patients (two men and five women) and LL using an ear cartilage graft in 11 patients (four men and seven women). These patients had developed facial paralysis either due to brain ($n = 8$) or parotid gland tumor ($n = 6$) resection or due to Bell's palsy, Hunt syndrome, trauma, or neurofibromatosis II ($n = 4$). The duration of paralysis was <1 year (acute or subacute) in six patients and >1 year (established) in 12 patients. Among the established cases, six patients had undergone gold weight implantation previously, which required removal. The mean patient age at the time of surgery was 58.4 years (range, 18—78 years), and the mean postoperative follow-up period was 21.5 months (range, 9—60 months).

Surgical methods

An incision was made at the superior palpebral fold and superior edge of the tarsal plate was identified (Supplemental Video 1). After exposing the tarsal plate, the levator aponeurosis and Müller's muscles were dissected off from the whole tarsal plate. The conjunctiva was exposed and kept intact, and the levator aponeurosis together with Müller's muscles was elevated fully around Whitnall's ligament (Figure 1b).

Supplementary video related to this article can be found at http://dx.doi.org/10.1016/j.bjps.2016.01.010.

The ipsilateral temporal or thigh fascia or the auricular conchal cartilage was harvested as a graft (Figure 1c). The graft, either fascia or cartilage, was inserted and fixed between the edge of elevated levator aponeurosis and the superior edge of the tarsal plate.

The width of the fascial graft was determined as previously described,[18] and it is one of the most important determinants of the efficacy of this procedure. We chose the width of aponeurosis lengthening by doubling the distance resulting from the difference between the superior edge of the contracted pupil and the free edge of the upper eyelid on the paralytic and healthy side. The length of the fascia was 20 mm (Figure 1d). The width of the cartilage was also determined as the fascia in most of the initial cases; however, we set it at 7 mm in later cases because the level of the upper eyelid can be easily changed by fixing the cartilage graft to the tarsal plate. In the case of severe lagophthalmos, we attached the edge of the graft cartilage to the superior edge of the tarsal plate and attempted to caudally push down the tarsal plate by the cartilage graft (Figure 1e). The width of cartilage graft was standardized at 7 mm, and we rectified the height of the upper eyelid intraoperatively by adjusting the procedure for fixing the inferior edge of the cartilage graft to the superior edge of the tarsal plate (Supplemental Video).

Operations were performed using either local or general anesthesia, and general anesthesia was used for cases where the procedure was combined with other reconstructive methods. For cases where surgery was performed