Lipofilling of the Upper Eyelid for Patients Affected by Facial Nerve Palsy

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AIM: The use of upper eyelid lipofilling to prevent ocular complications in patients affected by facial nerve palsy is compared to other treatment options.
CASE PRESENTATION: Ten patients treated with lipofilling of the upper eyelid, who were indicated for facial rehabilitation were identified from the Maxillo-facial Surgery Unit, Policlinico Umberto I. For all patients, fat harvested from the abdomen was processed with soft and short centrifugation.
RESULTS: Satisfactory aesthetical and functional results were obtained in most cases. All patients reported a considerable reduction in the use of artificial tear drops and ointment for corneal lubrication. A second procedure was needed in one case to refill the eyelid, and in another one to correct poor aesthetical results. No patients developed postoperative ocular surface disorders.
CONCLUSIONS: The lipofilling of the upper eyelid procedure was easy to perform, leading to minimal complications rate. Given the small sample size and variability of samples collected in the current study, future studies involving larger cohorts are required to validate the efficacy of upper eyelid lipofilling in comparison to other treatments.

Keywords: lipofilling; facial palsy; upper eyelid

Introduction

Persistent exposure of the cornea in patients affected by facial nerve palsy to the external environment can lead to the development of exposure keratitis, conjunctivitis, corneal ulcer and perforation, and blindness. In order to prevent these complications, nonsurgical treatments are useful in cases of temporary paresis but are insufficient in cases of permanent palsy [1–5]. In fact, several treatments for temporary paresis and permanent palsy have been described, including eyelid filling with platinum, which is the widely used method, lipofilling of the upper eyelid described by Biglioli *et al.* [4]. In this paper, we report our preliminary experience in applying the surgical technique of upper eyelid lipofilling.

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Materials and Methods

Patients

In this retrospective analysis, we identified 12 patients who underwent lipofilling of the upper eyelid for the purpose of facial rehabilitation in the Maxillo-facial Surgery Unit, Policlinico Umberto I from February 2018 to December 2019. Patients with permanent frontal facial nerve palsy and paralytic lagophthalmos, who underwent the eyelid lipofilling procedure and followed up for >4 months after the procedure, were included. Having prior surgical history or having been operated on with another surgical procedure at the same time was not used as an exclusion criterion in this study. Since general anaesthesia was not strictly necessary in the lipofilling procedure, patients with equivalent medical conditions but who were treated with lipofilling without general anaesthesia were not specifically excluded from the study. No lipofilling contraindication signs were detected from the sample collected. Two patients were excluded from the study because centrifugation was not used to processing their fat specimens, thereby reducing the total number of included patients to 10. Patient data are illustrated in Table 1.

Table 1. Patient data.

Patient (Sex, age)	Facial palsy etiology	PORT	Volume of fat injected	Need for eye taping and/or lubrification	Patient satisfaction score [a]	Need for other procedure
M, 54 [b]	Parotid gland mucoepidermoid carcinoma pT4aN0	Yes	3.5 cc	Yes	5	Yes
M, 56	Acoustic neurinoma	No	2.5 cc	No	9	No
F, 66	Acoustic neurinoma resection	No	3.5 cc	No	10	No
M, 51	Acoustic neurinoma resection	No	3 cc	No	8	No
M, 60	Parotid gland SCC pT4aN2b	Yes	4 cc	No	8	No
F, 70	Temporal bone meningioma resection	No	2.5 cc	Yes	6	No
M, 60	Acoustic neurinoma resection	No	2 cc	Yes	7	Yes
M, 44	Congenital	No	2 cc	No	9	No
M, 51	Acoustic neurinoma resection	No	3 cc	Yes	7	No
M, 52 [c]	Acoustic neurinoma resection	No	2.5 cc	No	10	No

Notes: [a] Patients were asked to rate their satisfaction from the angles of aesthetics and functions following the procedure from 0 to 10; [b] Representative images shown in Fig. 1; [c] Representative images shown in Fig. 2.

PORT, Post-operative radiation therapy; F, female; M, male; SCC, Squamous cell carcinoma.

Surgical Technique

(a) Fat harvesting: Fat was most commonly harvested from the abdomen, followed by the trochanteric region inner thighs, and knees. We used the "wet" method, which involves the injection of the donor with a modified Klein's solution containing 500 mL Ringer's solution, 1 mg/1mL epinephrine and 50 mg/5 mL lidocaine (only if the procedure is performed under local anaesthesia), using a 2.1 mm cannula. Fat aspiration was performed using a 1.5-mm, blunt-edged, 8-hole cannula connected to a 10-mL Luer Lock syringe. The fat was manually drawn by pulling the plunger. The cannula was pushed through the fat harvest site as the surgeon pulled the plunger of the syringe by means of a digital maneuver in order to create a gentle negative pressure.

(b) Fat processing: The aspirated fat was left to settle. Afterward, we performed three rounds of consecutive soft (maximum 400 $\times g$) and short ($<$60 sec) centrifugation coupled with washing using 0.9% NaCl solution.

(c) Fat injection: If the procedure is performed under local anaesthesia, it is recommended to inject the recipient at the selected site at the outset of the procedure. Using an 18G needle, a skin incision was made adjacent to the lateral cantus. Subsequently, the harvested fat was injected in a subcutaneous, pretarsal plane using a 17G $\times$ 100 mm cannula connected to a 1 mL syringe. Due to fat resorption, it is advisable to "overfill" the recipient sites with, usually, up to 2.5–3 mL of fatty tissue, as long as the injected fat does not exceed above the tarsal plane, in order to avoid graft displacement that can result in poor cosmesis and uncompleted closure (Fig. 1, Ref. [5]).

Results

Consisting of a big portion of male subjects at 80%, the sample of this study had a mean age of 56.4 years (range 44–70 years). The most frequent etiology of facial palsy was acoustic neurinoma resection (60%), followed by parotid gland cancer (20%), temporal meningioma (10%) resections, and congenital facial palsy in one case (10%). Clinical evaluation was performed 4 months after grafting. Most patients expressed satisfaction with the aesthetic and functional results following the procedure, with a mean self-rated score of 7.9; from the score range of 0 to 10, 20% of the cases rated 10 points, which represents the highest score, whereas 10% of them rated 5 points (Table 1). While 80% of patients did not require a second surgery, surgical repositioning of the graft was indicated in one case (Fig. 1), while another procedure was required in another to remove fat excess.

On average, 2.85 $\pm$ 0.669 cc of fat (range of 2 to 4 cc) was injected into the subjects. Upon stratification based on intervention outcome, we found that 2.88 $\pm$ 0.641 cc of fat was injected into cases showcasing good outcomes, whereas 2.75 $\pm$ 1.06 cc of fat was administered to cases re-

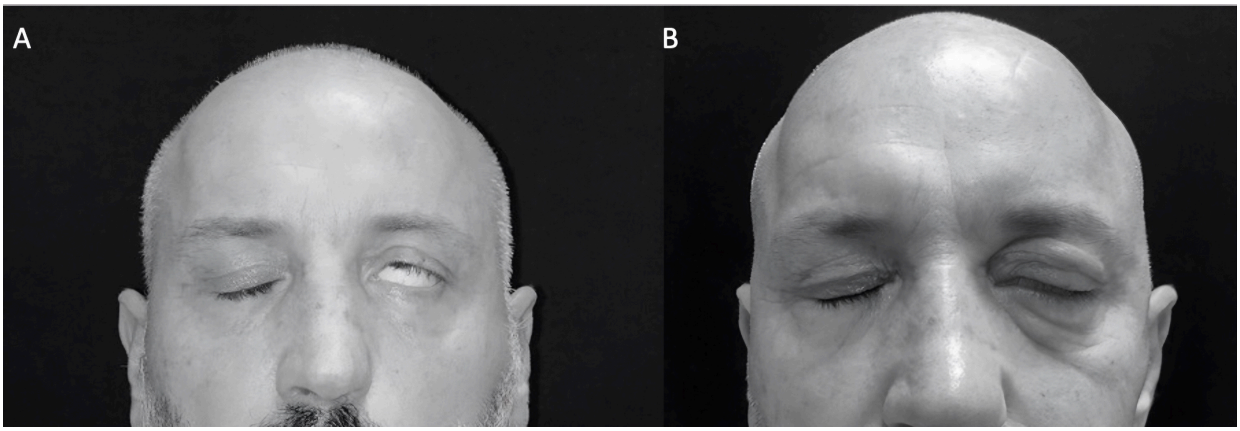

Fig. 1. Case 1. (A) A 54-year-old man affected by a parotid gland carcinoma underwent radical parotidectomy, ipsilateral neck dissection, and contemporary reinnervation using a combination of split hypoglossal nerve and masseteric nerve neurorrhaphy via interpositional nerve graft [5]. (B) Upper displacement of the graft, probably due to overfilling, resulted in poor cosmesis despite even good functional results.

quiring a second procedure. To ascertain whether the volume of fat injected was associated with the intervention outcome, we performed the Mann–Whitney *U* test but found no statistically significant association ($p = 0.9$). By analyzing other variables the same way, we notice that the age did not appear to be significantly correlated with the success of the intervention ($p = 0.79$), so did the patient's biological sex ($p = 1$). No patients developed postoperative ocular surface disorders (e.g., punctate keratitis, exposure keratitis, conjunctival infection). In addition, after the lipofilling procedure, 60% of the patients claimed that artificial tear drops and ointment for corneal lubrication were no longer necessary, and the remaining 40% still used them but less frequently (half of the patients in this category underwent the second intervention).

Discussion

Facial nerve palsy can lead to severe ocular complications. To prevent the occurrence of these events, conservative and surgical options are described [6]. Initial management for ocular complications caused by facial nerve palsy generally includes artificial tear drops and ointment for corneal lubrication and strategies to protect the ocular surface (taping of the upper eyelid overnight, therapeutic contact lens), but these methods are not sufficient in the case of permanent palsy [1–4,6]. Dynamic reanimation of eyelid blinking is the best option, but success is not always guaranteed, and in the case of "cross-facing", two operations are required so that in the prevision of the second surgical the ocular surface has to be protected [7]. The advantages and disadvantages of these methods are listed in Table 2.

The classical surgical approach typically includes a temporary or permanent tarsorrhaphy, which is useful for patients with significant corneal thinning, individuals at increased risk of corneal perforation, and people who are not recommended for more aggressive or staged therapies due to poor cosmesis, mechanical keratopathy (due to lashes) and reduction of the temporal visual field [8]. Additionally, chemical tarsorrhaphy entailing botulinum injection into the levator palpebrae superioris represents another canonical approach, but unlike the approach utilizing toxin to correct asymmetry or synkinesis, its outcomes are largely unpredictable even when operated by expert physicians [3].

Another way to re-establish a functional eye closure is lid loading, through which the ideal weight of the lid should be achieved to enhance the relaxation of the levator muscle so that the eyelids cannot close completely. In addition, it should can be modifiable, in case of patient discomfort. In the 1950s, the use of a gold weight was introduced to assist the eyelid in closing using only weight and gravity, but it causes complications such as exposure keratitis, infection and poor aesthetics, which warrant removal in many cases. The revelation of the shortcomings of the gold weight has led to the discovery of more versatile materials, and in the 2000s, platinum weight was introduced to assist the eyelid in closing using only weight and gravity. Owing to the smaller weight due to lower density, as well as relative safety in terms of complication occurrences, this material stands as the most used method to correct paralytic lagophthalmos nowadays [9].

Lid loading is easy to perform and has long-standing beneficial outcomes, but in some cases, surgical removal is required because of infection, extrusion, or ptosis (Fig. 1). The use of external weight has been proposed too, but it is a temporary solution, characterized by multiple disadvantages [3]. Lipofilling has recently been proposed to treat paralytic lagophthalmos, owing to the ease of operation, minimal rate of complications triggered, and satisfactory aesthetic and functional results [2]. The only but prominent disadvantage of this procedure is that multiple interventions are required in certain individuals due to the inherent variability in fat resorption, in order to obtain the best optimal

Table 2. Advantages and disadvantages of procedures used to prevent corneal complications in patients with facial nerve palsy.

	Advantages	Disadvantages
Lid loading using gold weight	• Less expensive than platinum weight • Easy to perform • Persistent results	• Bad aesthetics (the implant is visible in case of thin skin and bulkiness) • Ptosis • Exposure keratitis • Infection • Revision surgery in case of not functional closure
Lid loading using platinum weight	• Denser than gold weight • Reduced allergic response • Easy to perform • Persistent results	• Bad aesthetics (the implant is visible in case of thin skin and bulkiness) • Ptosis • Exposure keratitis • Infection • Revision surgery in case of not functional closure
Lid loading using external weight	• Easy administration • Low costs • Less invasive approach	• Temporary solution • Changeable adhesive • Contact dermatitis • Controindicated in case of dermatochalasis
Surgical tarsorrhaphy	• Low costs • Easy to perform • Useful for patients with significant corneal thinning or in those facing greater risk of perforation	• Poor cosmetics • Mechanical keratopathy • Poor cosmesis • Reduction of the temporal visual field
Chemical tarsorrhaphy	• Nonsurgical treatment	• Temporary solution • Unpredictable outcomes even if operated by expert physicians • Automatic eyelid elevation is not possible.
Lipofilling	• Low costs • Surgical procedure is eventually reproducible in case of no functional closure	• Repeated procedure is sometimes needed in case of fat resorption

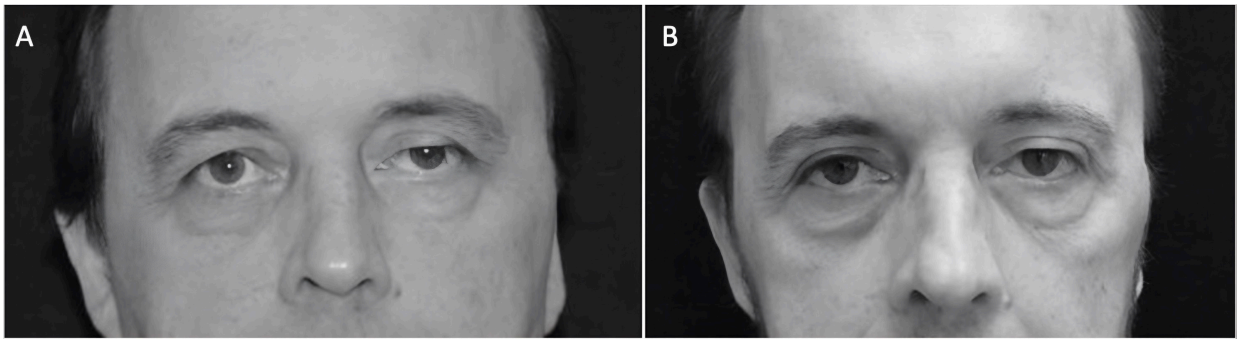

Fig. 2. Case 2. (A) A 52-year-old man underwent facial rehabilitation using masseteric-facial nerve neurorrhaphy and two-step cross-face grafting with sural nerve. Lid loading using a 1.4 gr platinum chain was performed, resulting in poor aesthetic and discomfort due to implant bulkiness. (B) Lipofilling of the upper eyelid was performed 1 month after implant removal.

results. Nevertheless, the flexibility in addressing an unsatisfactory result stemming from a minimal discomfort experienced by the patient is a strength of this procedure, that is not showcased by the gold or platinum weights applied in lid loading. To avoid the necessity of a second intervention, we performed a minimal traumatic harvesting, and a subsequent soft and short centrifugation of the harvested fat specimens, to ensure sufficient preservation of the extracted adipose lobules, with the intent of raising fat retention rates [10,11]. In addition, we reduced or eliminated the use of local anesthetics in order to preserve the viability of the adipose cells [9,12]. It should be noted that in cases needing

weight removal, lipofilling can be performed safely after wound healing, achieving good results from both functional and aesthetical points of view (Fig. 2).

Conclusions

Aside from the ease of operation, the lipofilling procedure for the upper eyelid has a minimal complication rate. However, the small size and variability of the sample included in this study are potential limitations to generalizing the findings to other populations. Future studies involving larger sample sizes are thus required to verify the efficacy of lipofilling procedures in comparison to other treatments.

Availability of Data and Materials

All data and materials sources described in this study are available from the corresponding author.

Author Contributions

VT, MDM, MM and AC: contributed to conception and design. VT and VV: contributed to acquisition of data. IR, DDC, DDG and FDC: analysis and interpretation of data. IR, DDG and FDC: draft the manuscript. All authors revised the manuscript critically for important intellectual content. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Policlinico Umberto I was exempted from ethical approval of this study because of the retrospective nature of the research. The study, including all the procedures, was conducted in the accordance with the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from each participant/patient prior to their participation and for approving the publication of their data and images.

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Conflict of Interest

The authors declare no conflict of interest.

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