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Transpalpebral Corrugator Resection: 25-Year Experience, Refinements and Additional Indications

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Abstract The senior author introduced the transpalpebral approach for the first time during the ASPS meeting in 1993. He has made some refinements in the technique and has developed newer indications for this procedure. These refinements, indications and the related new video are the subject of this report. The modifications in the technique are as follows: After elevation of the skin and the orbicularis muscle and dissection under the muscle, a thin layer of the depressor supercilii muscle overlying the darker and more friable corrugator supercilii muscle is removed. A fairly constant branch of the supraorbital nerve piercing this muscle medially is first identified on the surface and followed deep in the muscle using a mosquito hemostat. The muscle is then lifted, and then, the same nerve branch is identified above the periosteum. The segment of the muscle lateral to this nerve is then isolated and removed by first transecting it medially and then lateral to the nerve. A cephalic segment is isolated and removed using the coagulation power of the cautery to minimize the postoperative bleeding. The rest of the muscle is then removed in a piecemeal fashion as thoroughly as possible, including a lateral segment of the procerus muscle, the end point being visualization of the subcutaneous fat. If the intention of the surgery is to treat frontal migraine headaches, the supratrochlear and supraorbital arteries are also removed. If the nerve and vessel pass through a foramen, a foraminotomy is carried out on patients with migraine headaches. Two to three cc of fat is injected in the glabellar and corrugator sites in most patients to avoid any depression and to restore the lost glabellar volume. Beyond patients with male pattern baldness, those with a long forehead and those with overactive frown muscles but optimal eyebrow positions, this technique is now being used for those with proptosis, exophthalmos and those with eyelid ptosis who would not undergo ptosis correction to prevent elevation of the eyebrows, which exaggerates the proptosis or makes the eyelid ptosis more discernible. Additionally, a common indication for this surgery is in patients with frontal migraine headaches. This report highlights the refinements in the transpalpebral corrugator resection that have been implemented over the last 25 years and offers additional indications for its utilization.
Level of Evidence V This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Corrugator supercilii muscle · Transpalpebral

Introduction

Glabellar frown lines develop as a result of the contraction of the corrugator supercilii muscles and the thinning of the overlying skin. Resection of these muscles corrects deep furrowing and is usually accomplished through upper blepharoplasty incisions. This was first described at the American Society of Plastic and Reconstructive Surgery's 62nd Annual Scientific Meeting in New Orleans, Louisiana, on September 20, 1993, by Guyuron et al. It was subsequently described in an article by Knize [1] and then

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Fig. 1 The incision is designed as the inner half of the conventional blepharoplasty incision in the supratarsal crease

Fig. 2 The eyelid skin incision is made and extended through the orbicularis muscle

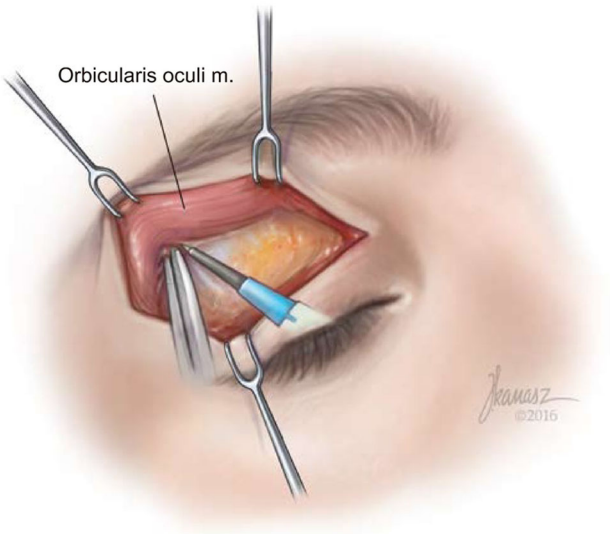

Fig. 3 The easily identifiable plane between these two anatomic structures is entered, and the dissection is continued toward the superior orbital rim using the cautery initially

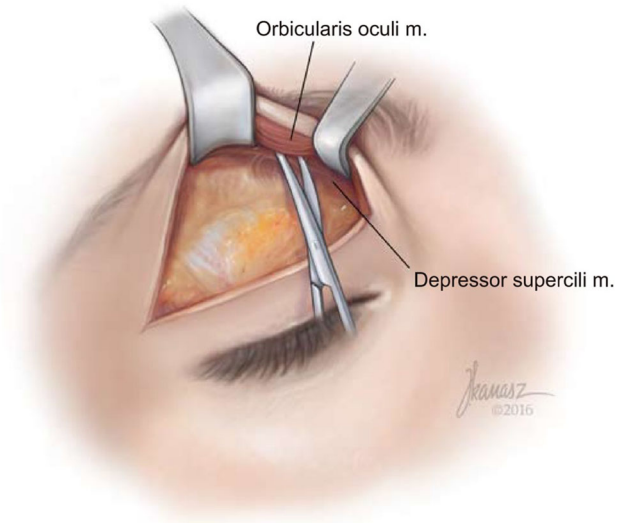

Fig. 4 The dissection is continued with a pair of baby Metzenbaum scissors, spreading the tissues parallel to the muscle fibers

Guyuron et al. [2], both articles published in *Plastic and Reconstructive Surgery*. This article outlines some refinements from the technique originally described in 1993, as well as updated indications for the procedure.

Patient Selection

Good candidates for transpalpebral corrugator resection (TPCR) include: (1) patients who have proper lateral eyebrow position or exhibit minimal eyebrow ptosis with hyperactive corrugator muscles, (2) patients who are undergoing endoscopic forehead rejuvenation and blepharoplasty concomitantly, (3) patients with male pattern baldness, on whom one needs to avoid visible scars in the forehead area, (4) patients who have a long forehead but do not wish to have a forehead shortening procedure [3], (5) patients with proptosis or exophthalmos and overactive glabellar muscles where elevation of the eyebrows should be avoided, which otherwise would expose the proptosis more and would have an adverse effect on the patient's face, (6) patients with documented frontal migraine headaches and (7) those with upper eyelid ptosis who decline its correction. Correcting will result in more disharmony, since the distance between the eyebrow and the eyelid, which is usually too great in this group of patients, will increase.

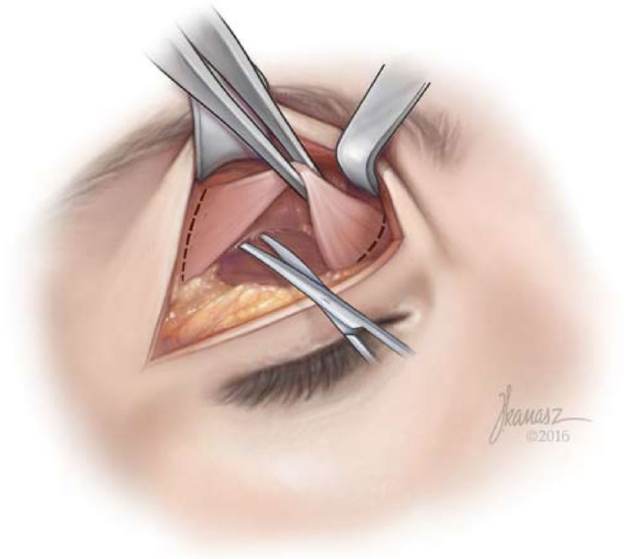

Fig. 5 The depressor supercilii muscle is exposed and dissected adequately

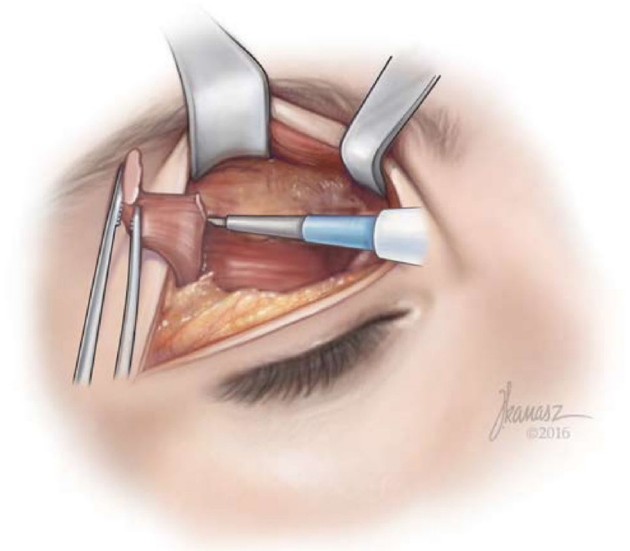

Fig. 6 The depressor supercilii muscle is removed using the coagulation power of the electrocautery

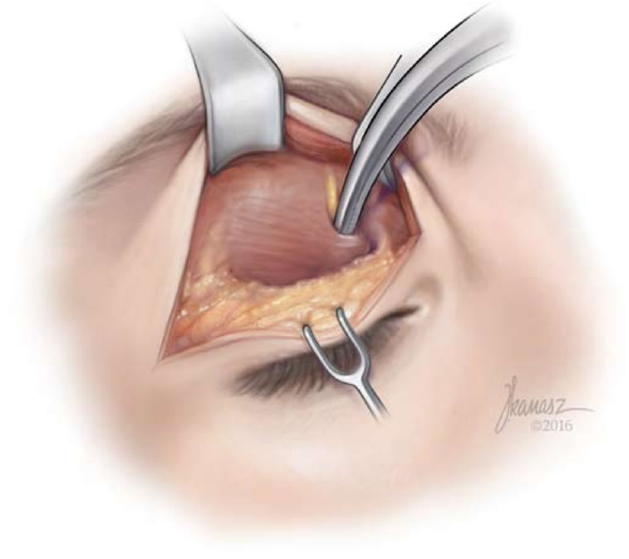

Fig. 7 The consistent large branch of the supratrochlear nerve emerging from the corrugator supercilii muscle is identified

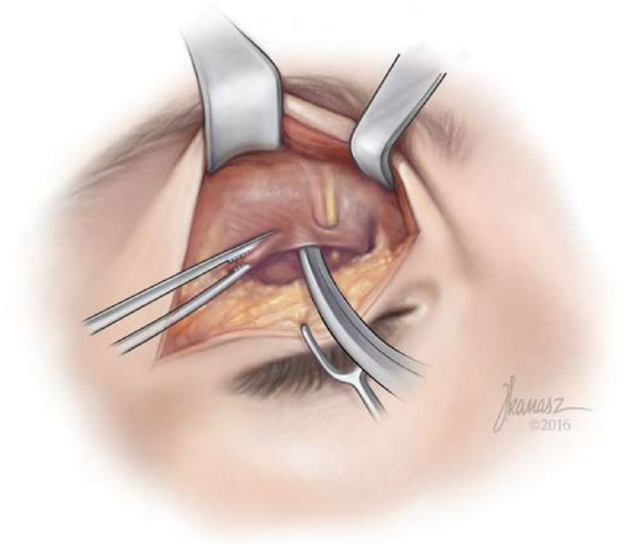

Fig. 8 The nerve branch is followed deeper in the muscle with a mosquito hemostat. The corrugator supercilii muscle is then lifted to locate the point of entrance of the nerve to the muscle

Technique

The procedure is carried out under general anesthesia or deep sedation. An upper blepharoplasty incision is used if a blepharoplasty is intended concomitantly (Fig. 1). Otherwise, only the medial half of the conventional blepharoplasty incision is utilized and is placed in the most caudal crease above the tarsus. The upper eyelid is infiltrated with lidocaine containing 1:200,000 epinephrine. The incision is made and taken through the orbicularis muscle (Fig. 2). Skin hooks are placed in position, and the skin and muscle are retracted cephalically. The dissection is continued toward the supraorbital rim in the plane between the orbicularis muscle and the orbital septum, while staying immediately under the orbicularis muscle using the needle tip cautery for an extent of 5–8 mm (Fig. 3). The dissection is continued with a pair of baby Metzenbaum scissors, using mostly the spreading technique (Fig. 4). After elevation of the skin and the orbicularis muscle, a thin layer of the depressor supercilii muscle overlying the darker and

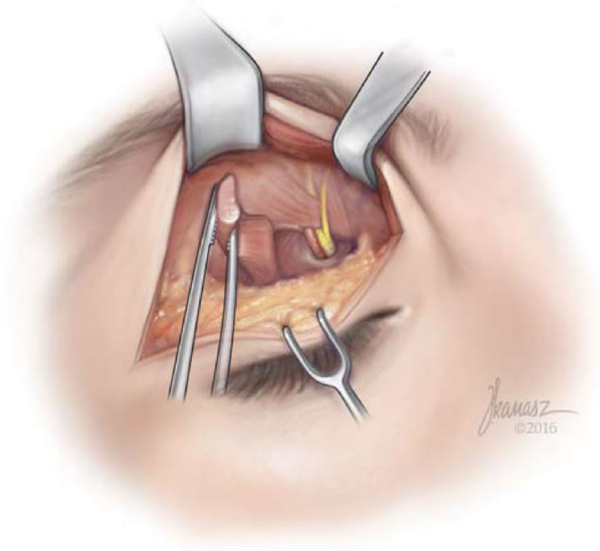

Fig. 9 The corrugator muscles and the medial fibers of the procerus muscles are removed as thoroughly as possible using the coagulation power of the electrocautery

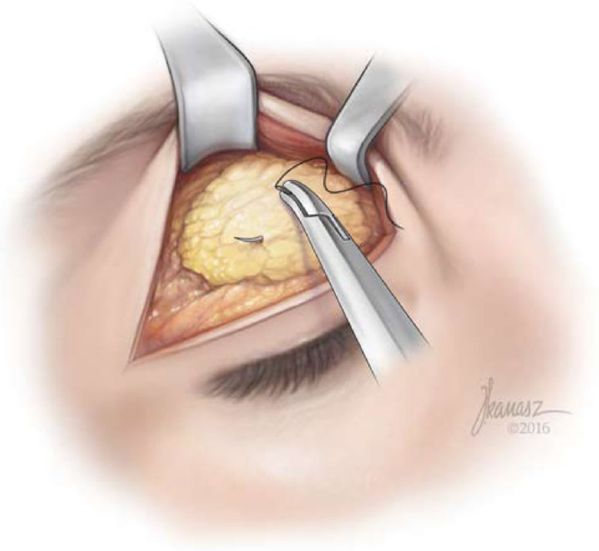

Fig. 11 The fat graft harvested from the medial compartment of the upper eyelid is fixed to the underlying periosteum using 6–0 Vicryl or Monocryl to prevent postoperative dislodgement of the fat caudally

more friable corrugator supercilii muscle is dissected (Fig. 5) and removed (Fig. 6). A fairly constant branch of the supraorbital nerve piercing this muscle medially is first identified on the surface and followed deep in the muscle using a mosquito hemostat (Fig. 7). The muscle is then lifted, and the same nerve branch is identified above the periosteum and protected (Fig. 8). The segment of the muscle caudal to the nerve is then isolated and removed using the coagulation power of the electrocautery, first medially and then (Fig. 9) laterally. The segment cephalad to the nerve is isolated and removed. The rest of the muscle is then removed in a piecemeal fashion as thoroughly as possible, including lateral fibers of the procerus muscle, the end point being exposure of the subcutaneous fat. If the intention of the surgery is to treat frontal migraine headaches, the supratrochlear and supraorbital arteries are removed due to their roles in compressing the nerve, and if the nerve and vessels pass through a foramen, a foraminotomy is carried out using a 2-mm osteotome or a rongeur while protecting the orbital content (Fig. 10).

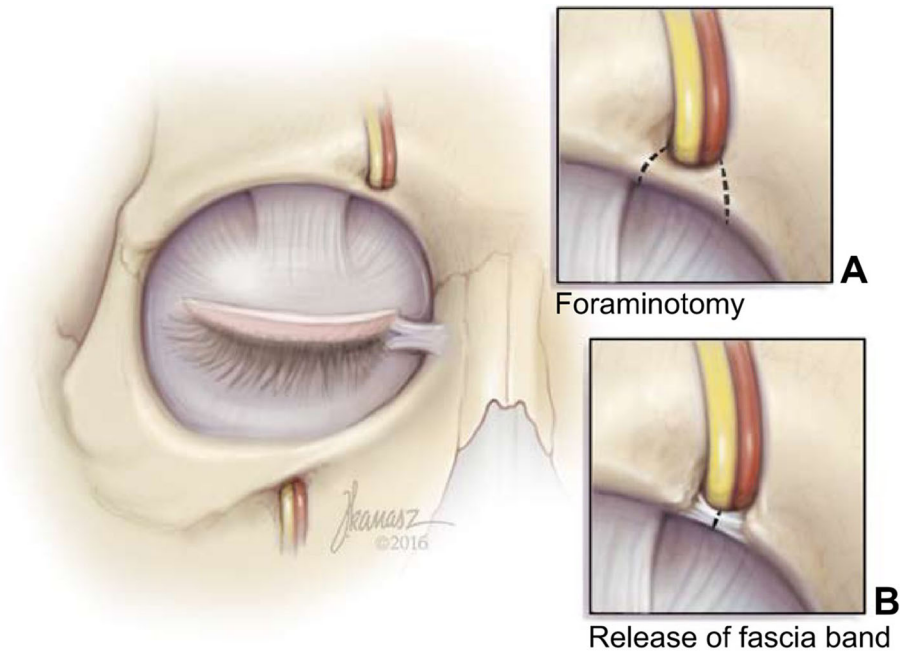

Fig. 10 If there is a supraorbital foramen, it is unroofed with an osteotome or rongeur for the patients suffering from the frontal migraine headaches

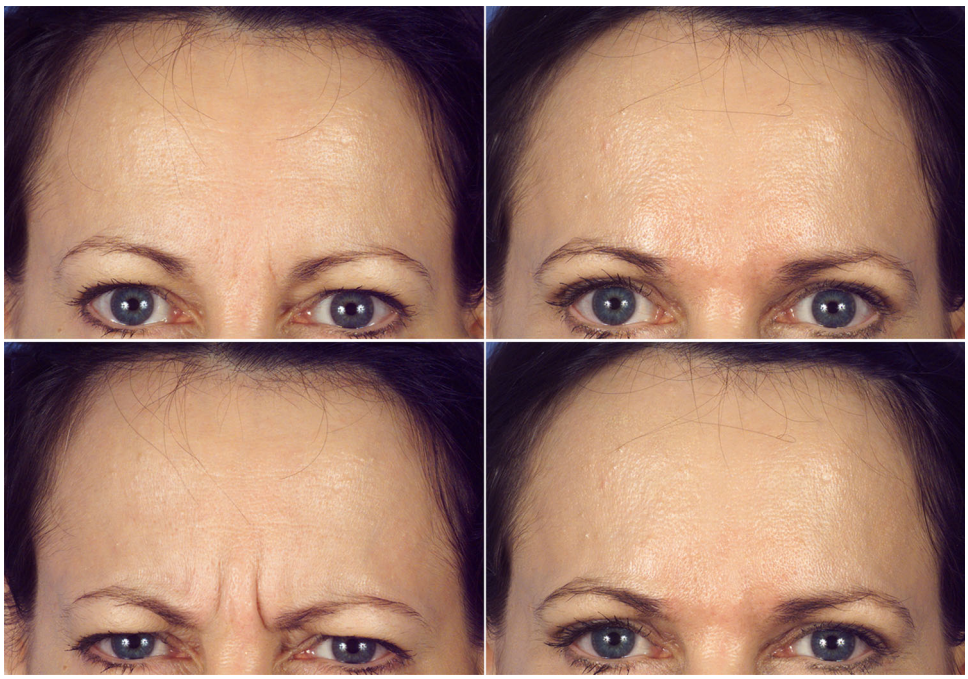

Fig. 12 A patient before (*above*, *left*) and after (*above*, *right*) in repose and before (*below*, *left*) and after (*below*, *right*) while attempting to frown

Fig. 13 Another patient before (*above*, *left*) and after (*above*, *right*) migraine surgery in repose and before (*below*, *left*) and after (*below*, *right*) while attempting to frown

Should the patient have protruding medial fat pads, this fat is gently isolated, injected with a small amount of lidocaine containing 1:100,000 epinephrine and then removed with cautery. The fat is flattened and placed in the corrugator site and fixed to the underlying periosteum using a 6–0 Vicryl suture (Fig. 11). The skin incision is repaired using 6–0 fat-absorbing plain catgut. On patients with glabellar aging or those who do not have protruding fat in the medial compartment of the upper eyelid, 2–3 cc of fat that have been aspirated from the abdomen and spun is injected in each side of the glabellar area and the corrugator sites to avoid any depression and to restore the lost glabellar volume to this site (Video).

Discussion

Since the first report of this operation by the senior author, it has become the workhorse of glabellar rejuvenation for many. Thorough removal of the corrugator and depressor

supercilii muscles is essential for the success of this operation. The procerus muscle is only partially removed to prevent excessive elevation of the medial eyebrows. This procedure, along with endoscopic lateral brow elevation, accomplishes all of the forehead rejuvenation goals expected from a full endoscopic forehead rejuvenation, with less invasiveness.

A few of our respected colleagues who have adopted this technique are recommending removal of only a segment of the muscle. While this limited procedure may induce some improvement in the static frown lines, it is fraught with animation flaws. First, undoubtedly, the partial removal of the muscle is going to result only in partial improvement of the lines. Second, if some of the muscle is left medially or laterally, it is likely to result in lateral and medial bulging, with or without animation [4]. Additionally, even with early elimination of the lines, they are likely to return, since the residual muscle fibers will hypertrophy over time. Finally, dimpling is common with incomplete removal of the muscle fibers.

A phenomenon that has not been given enough recognition is the major ill effect of elevation of the eyebrows on patients with exophthalmos or proptosis, by virtue of elimination of camouflage of the condition and by more exposure to this aesthetically displeasing condition. Since TPCR allows for only slight lateral migration of the eyebrows due to unleashing the tail of the eyebrow, and since it does not elevate the eyebrows as much as an endoscopic or an open forehead lift, it would have fewer adverse effects on this group of patients. The same would be true about the patients who have eyelid ptosis but would not wish eyelid ptosis correction.

The initial reports of cessation of migraine headaches by patients undergoing forehead lift, followed by our extensive retrospective [5], prospective pilot [6], prospective randomized [7], prospective randomized with sham surgery [8], five-year follow-up [9], other clinical studies from our group [10] and similar successful reports from the other centers [11–13], have all proven the efficacy and safety of migraine surgery. A very common site for this disabling condition is the forehead, and the direct approach for treatment of frontal migraine headaches is TPCR. Although our previous studies have demonstrated superior outcomes with the endoscopic approach, our conclusion was the ability to visualize and to deal with the supraorbital foramen, which resulted in more success with the endoscopic approach. With the use of perinasal sinus CT [14], detection and management of the supraorbital foramen have become feasible, which leads to decompression of this foramen through the transpalpebral approach, thus eliminating the superiority of the endoscopic over the TPCR technique for treatment of migraine headaches.

The rationale for removal of the arteries adjacent to the nerves on patients with migraine headaches is elimination of the irritation of the nerves by the pulsatile vessels. We have demonstrated through proteomic analysis and electron microscopy that the nerves of the patients who suffer from migraine head are deficient in myelin and the elements such as vessels and muscles that do not irritate the nerves the patient without migraine headaches would irritate the nerves of the patients with migraine headaches triggering an entire cascade of events leading the pain that the patients experience [15].

Postoperative recovery is uncomplicated, and patients report a high level of satisfaction after the procedure (Figs. 12, 13). Long-term follow-up is extremely encouraging.

The most common complication after the surgery is paresthesia of the forehead. This complication is generally temporary, but permanent paresthesia may occur on rare occasions. Early recurrence of glabellar furrowing may occur if the corrugator muscle is not adequately resected or is not replaced with a fat graft. The patients who undergo transpalpebral corrugator resection with blepharoplasty have more ecchymosis compared to those who have blepharoplasty alone. However, the advantages of fewer skin incisions, less tissue mobilization and a direct approach to the origin of the problem make this a valuable, effective technique, especially in properly selected cases. Intense itching may occur after this surgery. This condition usually responds to antihistamines and lidocaine topical creams.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

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