Endoscopic Brow Lift Fixation With Mitek Suture Anchors: A 9-Year Experience of a New “Ideal” Technique

La fixation du redrapage endoscopique des sourcils par ancre Mitek : neuf ans d'expérience à l'aide d'une nouvelle technique « idéale »

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Abstract

Purpose: In recent years, the endoscopic technique has emerged as a minimally invasive approach to forehead rejuvenation, although the specific need for and mode of brow fixation for endoscopic brow lifts remain under considerable debate. An ideal fixation device should provide non-palpable long-lasting fixation and allow retention of the device post-operatively without the need for removal. It should also allow precise intraoperative adjustment for symmetry and correction of brow ptosis.

Methods: The authors describe an endoscopic brow lift technique using an absorbable bone anchor, Mitek Microfix. A retrospective chart review was conducted in patients who underwent endoscopic brow lift procedures utilizing this fixation method at an academic practice. Outcomes evaluated included operative times, reoperation rates, palpability, fixation device permanence, incremental costs comparisons to conventional methods, efficacy, and technical learning curve. Complication rates were evaluated and the economic, incremental cost analysis of current fixation methods was reviewed. **Results:** Eighty-two patients underwent single-procedure endoscopic brow fixation using the Mitek anchor over a 9-year period (2005-2014). The mean operative time was 100 minutes. There were no cases of implant palpability, alopecia, or other postoperative complications. Two patients underwent revision secondary lifts after an average of 5.5 months for temporal ptosis. **Conclusion:** The Mitek Microfix QuickAnchor provides durable, long-lasting fixation without device palpability. Its technical ease of use is demonstrated by the reasonable mean operative time achieved with the active involvement of resident surgeons. This device is operator-friendly, easy to use, fully indwelling, and provides lasting fixation without the development of palpability or alopecia.

Résumé

Objectifs : Ces dernières années, la technique endoscopique est devenue une approche peu invasive du rajeunissement du front, mais la nécessité et le moyen de fixer les sourcils font l'objet de vifs débats. Le dispositif de fixation idéal doit être non palpable, durable et demeurer en place sans devoir être retiré. Il doit également assurer le rajustement intraopératoire précis de la symétrie et de la correction de la ptose des sourcils. **Méthodologie :** Les auteurs décrivent une technique de redrapage endoscopique des sourcils à l'aide de l'ancre osseuse absorbable Mitek Microfix. Ils ont procédé à une analyse rétrospective des dossiers des patients qui avaient subi un redrapage endoscopique des sourcils à l'aide de cette méthode de fixation dans un cabinet universitaire. Ils ont évalué la durée de l'opération, le taux de réopérations, la palpabilité, la permanence du dispositif de fixation, les comparaisons des coûts différentiels par rapport aux méthodes traditionnelles, l'efficacité et la courbe d'apprentissage technique. Ils ont également évalué le taux de complications et examiné l'analyse des coûts différentiels des méthodes de fixation.

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Résultats : Sur une période de neuf ans (de 2005 à 2014), 82 patients ont subi une seule intervention de fixation endoscopique des sourcils à l'aide de l'ancre Mitek. L'opération durait 100 minutes en moyenne. Il n'y a eu aucun cas de palpabilité de l'implant, d'alopécie ou d'autres complications postopératoires. Deux patients ont subi un redrapage secondaire après une ptose temporale au bout d'une période moyenne de 5,5 mois. **Conclusion :** L'ancre Mitek Microfix QuickAnchor procure une fixation durable sans palpabilité du dispositif. La simplicité de la technique est démontrée par le temps moyen raisonnable de l'opération obtenu avec la participation active de résidents en chirurgie. Ce dispositif à demeure est facile à utiliser pour l'opérateur et procure une fixation durable sans apparition de palpabilité ou d'alopécie.

Keywords

brow fixation, brow lift, endoscopic brow lift, Mitek suture anchor

Introduction

The brow lift is an important technique in aesthetic surgery that addresses the stigmata of aging of the upper face. First described by Passot in 1919,¹ this technique has since undergone numerous refinements. The modern coronal approach was described by Gonzalez-Ulloa in 1962,² and in 1992, the endoscopic approach was described independently by Vasconez et al³ and Isse.⁴ The endoscopic approach was further validated in the ensuing years, and several modifications, including a variety of surgical techniques, devices, and approaches, have been subsequently described.⁵⁻¹⁹ To date, no studies have demonstrated that the coronal approach is inferior to the endoscopic approach.²⁰ However, the coronal approach has fallen out of favor in recent years as this approach is significantly more invasive than its endoscopic counterpart and thus less desirable to patients.²¹ While the endoscopic approach has gained significant popularity since its original description in 1992, the superior endoscopic technique is still debated with various fixation techniques being the recent focus.^{12-19,22-31}

Endoscopic brow internal fixation techniques provide long-lasting support for the maintenance of lifted brow and soft tissue position during the wound healing phase.³² The indications for fixation are chiefly determined by the plastic surgeon intraoperatively, depending on their assessment of the muscle and periosteal release. These internal fixation techniques typically use either implant-based fixation or bone tunnel fixation. The various characteristics, advantages, and disadvantages of each are outlined in Table 1. Bone tunnel fixation techniques are durable, have high surgeon and patient satisfaction, and have a low implant profile and minimal palpability.^{26,28,31} Despite these benefits, these techniques have a higher learning curve. Drilling bone canals and threading sutures may be less efficient and technically more difficult and may thus contribute to longer operative times compared to placing an implant.²¹ In addition, newer, resorbable implants do not require a second procedure to remove temporary, indwelling screws.

Numerous implants have been described, including absorbable and non-resorbable screws, tacks, and plates that are implanted in the outer cortex of the skull.³³ Resorbable implants are most desirable, as these do not require a secondary procedure for implant removal. The most commonly reported implant is the tined, multi-point fixation plate, Endotine (MicroAire, Charlottesville, Virginia).^{15,22-25,27,29,30} Reported

advantages of this resorbable plate include reduced operative time, reduced complications in postoperative care, and relatively straightforward application.^{15,22-25,27,29,30} However, its residual palpability and expensive cost are significant limitations to be considered.^{15,22-25,27,29,30} In one study, as many as 7 of 27 Endotine anchors were surgically removed as they persisted beyond the 8 months established by the manufacturer.³⁴ This device is also recommended in patients with thicker scalps, and it is thus not appropriate for all patients.³⁰ Studies have also reported some success with the resorbable LactoSorb Endobrow Fixation System (Biomet Microfixation, Jacksonville, Florida).^{10,35,36} This device requires a suture to be threaded through the eyelet of a resorbable "push screw," anchoring the periosteum in place. A polylactic acid tack (Macropore, San Diego, California) has also been described.³⁷ However, this device does not contain an eyelet through which suture can be threaded, and suture needs to be "looped" under the head of the tack to achieve fixation of the brow.

In search of the ideal implant fixation device, we identified 4 characteristics that are critical to obtaining a desirable outcome: aesthetic satisfaction, patient comfort, intraoperative ease of use, and uncomplicated postoperative care (Table 2). For a pleasing and long-lasting aesthetic result, the device should be durable. A low-profile implant that lies flush with the calvarium translates to a lack of palpability and improved patient comfort. Intraoperative ease of use with the device allows the surgeon to dynamically adjust for symmetry and tailor the lift to the patient's desired outcome. A reasonable learning curve associated with such a device contributes to shorter operating times and lower overall operating room cost. Lastly, the device should have a low-risk profile and be indwelling and resorbable so as not to require subsequent removal, while persisting long enough to allow for device-tissue interface incorporation. A minimum of 6 to 12 weeks of persistence is required for the periosteum to become adherent to the calvarium.¹²

The Mitek Microfix QuickAnchor (DePuy Synthes, Raynham, Massachusetts) is a small, resorbable suture anchor threaded with a 3-0 or 4-0 Ethibond (Ethicon Inc, Somerville, New Jersey) suture that offers precise soft tissue to bone fixation. The ability to completely insert this implant into bone lends it an extremely low profile. As it remains within the bone, this device is absorbed and integrated within 3 to 6 months.

Table 1. Comparison of Implant-Based Fixation, Mitek Microfix QuickAnchor Plus Implant-Based Fixation, and Bone Tunnel Fixation Methods in Endoscopic Brow Lift Operations.^a

Characteristics	Implant	Mitek	Tunnel
Durability	+	++	++
Palpability	-	++	++
Operative time	++	++	-
Post-operative care	++	++	-
Outcome efficacy	+	++	++
Technical difficulty	++	+	-
Economic cost	-	-	+

^a, disadvantage; -, strong disadvantage; +, advantage, ++, strong advantage.

Table 2. Ideal Characteristics of Brow Fixation Methods.

- Durable
- Lack of palpability (indwelling)
- Provides patient comfort
- Intraoperative ease of use
- Allow dynamic adjustment for symmetry
- Reasonable learning curve
- Short operating time
- Cost-efficient
- Low-risk profile

These unique qualities lend the Mitek anchor to a variety of applications in the fixation of soft tissue to bone in hand³⁸ and craniofacial surgery,³⁹ where its high tensile strength and low complication rates have been well described. To date, however, this device has not been described for fixation of the brow in brow lift procedures. We present the first clinical series describing the use of the Mitek Microfix QuickAnchor for endoscopic brow lift fixation, with a special focus on this device's safety, cost-effectiveness, ease of use, and patient outcomes.

Methods

Surgical Technique

The patient's hair is organized with elastics and 7 proposed scalp incisions are marked (Figure 1). Four anterior incisions are placed just posterior (approximately 3 mm) to the anterior hairline, aligned with the midpupillary and lateral canthi bilaterally. Two posterior incisions are designed in line with the midpupil, 5 cm posterior to the corresponding anterior incision. An additional midline incision is marked in line with the anterior incisions to allow entry of the endoscope. Each anterior incision is approximately 8 mm in length. The 2 posterior incisions are stab incisions to allow for placement of the bone anchors.

Approximately 20 mL of 0.5% lidocaine with epinephrine 1:100 000 is injected into each incision site and in the subperiosteal plane of the forehead. Hydrodissection in the subperiosteal plane with the local anesthetic creates a relatively bloodless plane. The 2 anterolateral incisions are made and

Figure 1. Preoperative incision markings. Anterior incisions are highlighted in green, posterior incisions in red, and camera port in blue.

dissected to the temporoparietal fascia (TPF). The TPF and superficial layer of the deep temporal fascia (DTF) are incised. A Freer elevator is inserted beneath the superficial layer of the DTF and directed posteriorly toward the occiput. In a sweeping motion, the freer releases the periosteum overlying the temporal crest line to the level of the supraorbital rim. The midline port incision is then made, dissected to the subperiosteal plane, and the endoscope is introduced. Subperiosteal dissection is then performed under endoscopic vision over the frontal bone to the level of the supraorbital rim. The fascia is incised and the retaining ligaments released, taking care to preserve the supra-trochlear and supraorbital neurovascular bundles. In order to transit the periosteum and release the fascia, a curved, back-cutting periosteal elevator is utilized (Hönig recommended set for endoscopic brow lift, Raspatory 58210 LGA; Karl Storz, Tuttlingen, Germany). Dissection continues laterally so that it is in continuity with the dissected area lateral to the superficial temporal crest line. At this point, the forehead is freely mobile.

The posterior stab incisions are then made and the dissection is carried down to the outer table of cranial bone. A trough

Figure 2. Placement of the Mitek Microfix QuickAnchor into the previously drilled hole in the outer table of the cranial bone is demonstrated in the upper left photograph. A tendon passer is placed from the anterior incision to the corresponding posterior incision (upper right). One of the needles of the Mitek Microfix is captured in the tendon passer and pulled out to exit from the anterior incision. The periosteum and subcutaneous tissue sutured and the needle passed back to the posterior incision (lower left). The same procedure is repeated for the contralateral side. Both anchors are retracted and symmetry of the eyebrows are adjusted (lower right) prior to securing sutures in place.

measuring 1.3-mm wide and 3-mm deep is drilled into the bone and a Mitek Microfix QuickAnchor is applied so that it is completely embedded within the bone. A tendon passer is placed from the corresponding anterior incision to the posterior incision. One of the needles of the Mitek Microfix QuickAnchor is captured in the tendon passer and pulled to exit out from the anterior incision. The 3-0 Ethibond suture is passed through the periosteum and subcutaneous tissue and the needle is then passed back to the posterior incision to complete a mattress suture. The same procedure is repeated for the contralateral side. With retraction on the anchors, the brow height and symmetry is adjusted prior to securing sutures in place (Figure 2). Through the lateral incisions, a bilateral temporal lift is performed. The TPF is re-approximated to the superficial layer of the DTF with a 3-0 polydioxanone suture. A small strip of excess skin is excised. Since the patient's hair is not shaved, all incisions must be carefully approximated, taking care to not

include any hair in the incision closures. The patient's hair is washed and a light head wrap dressing applied.

Chart Review

The charts of all patients undergoing the described endoscopic brow lift technique were retrospectively reviewed over a 9-year period (2005-2014). All operations were performed at an academic teaching institution (Loma Linda University Medical Center, Loma Linda, California). Evaluated metrics included operative time, complication rates, and reoperation rates. Specific complication rates that were assessed included wound dehiscence, infection, hematoma, seroma, dural injury, nerve injury, alopecia, device palpability, and need for surgical revision. A cost analysis comparing the Mitek Microfix QuickAnchor and other implant fixation devices (Endotine, Lactosorb) was performed. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study. The International Review Board at Loma Linda University Medical Center approved this study.

Results

In the 9-year study period, 82 patients underwent the described endoscopic brow lift technique using the Mitek Microfix QuickAnchor by the senior author (S.C.G.). This study included patients who desired aesthetic rejuvenation or desired improvement in facial asymmetry induced by facial nerve palsies. Plastic surgery residents actively participated in each case. The mean age of patients undergoing this operation was 57.6 years (range: 15-87 years). All patients were Caucasian, Hispanic, or Asian.

The mean operative time was 100 minutes (range: 74-133 minutes) and the average follow-up time was 3.95 years. There were no postoperative complications. None of the patients had evidence of implant palpability or alopecia. All patients were pleased with the improvement in their brow ptosis and correction of any preoperative asymmetry (Figure 3). Long-lasting results (ranging from 10 months to 9 years postoperatively) were observed in the overwhelming majority of patients. Only 2 patients required revision endoscopic brow lifts at an average of 5.5 months postoperatively (range: 3-8 months) for recurrence of brow ptosis.

Discussion

The brow lift has emerged as an integral operation in the plastic surgeon's armamentarium. Although the advent of neuromodulators has impacted the number of brow lifts performed, there are still over 50 000 brow lifts performed annually by members of the American Society of Plastic Surgeons (ASPS) and the American Society for Aesthetic Plastic Surgery (Figure 4).^{40,41} The endoscopic-assisted approach has

Figure 3. A 55-year-old female presented with static transverse forehead rhytids and asymmetric bilateral brow ptosis. She underwent an endoscopic brow lift with the Mitek Microfix QuickAnchor implant-based technique. Her preoperative presentation (left) and 9-month postoperative result (right) are shown.

Figure 4. Forehead lifts performed by ASPS and ASAPS plastic surgeons from 1997 to 2013. ASPS indicates American Society of Plastic Surgeons; ASAPS, The American Society for Aesthetic Plastic Surgery.

revolutionized brow lift techniques as a minimally invasive option for patients who do not wish to undergo the morbidity of the traditional coronal approach. The search for the ideal technique remains ongoing, with a variety of different methods available. The Mitek Microfix QuickAnchor presents a novel method for fixation of the brow in endoscopic brow lift procedures that satisfies the majority of the criteria for an ideal implant fixation device.

Endoscopic brow lift operations using the Mitek Microfix QuickAnchor have several benefits. This versatile, durable, and lasting fixation technique can be performed for aesthetic rejuvenation and static correction of neuropathic, trauma, and senile asymmetry. Operative times were 100 minutes on average, well within the 1- to 2-hour range reported by ASPS members for their own procedure times.⁴⁰ The use of this implant is straightforward and is easily taught and learned. The combination of incisions required for the described endoscopic brow lift allows adequate visualization for dissection and subsequent forehead mobilization. We found no issues of tissue adherence

with this approach. No significant complications were exhibited in our patients. In addition, there were no reported cases of alopecia or implant palpability. Although patient perspective was not a focus of this study, we have noted that patient feedback in regard to their postoperative symmetry and overall improved appearance has been overwhelmingly positive (Figure 3).

When comparing the palpability of implant fixation devices, the Mitek Microfix QuickAnchor has superior results. Implant-based fixation techniques typically exhibit problems such as long-term persistence and palpability. This has been reported with the use of Endotine devices; Langsdon et al note that, “the Endotine was always palpable under the skin but visible in only roughly half of patients.”^{42(p.805)} The Mitek Microfix QuickAnchor provides a durable solution as it lies flush with the calvarium and completely resorbes within 6 months postoperatively. This device can be used with any degree of scalp thickness as it is embedded below the surface of the bone. The LactoSorb (Biomet Microfixation, Jacksonville, Florida) is another absorbable implant; however, it requires manual threading of the screw, which can be tedious through a small scalp incision. In contrast, the Mitek Microfix QuickAnchor is manufactured pre-threaded, with the suture and screw already integrated.

An economic and incremental cost analysis of the Mitek Microfix QuickAnchor and other available fixation methods was performed. Although there are multiple benefits to using the Mitek Microfix QuickAnchor in endoscopic brow lifts, its primary limitation is its cost (Table 1). Material costs for bone tunnel fixation methods are relatively inexpensive as no devices are required, other than a standard, gas-powered drill. However, the technical difficulty of creating bone tunnels and the additional operative time required indirectly increase the total operating room costs. While objective data are not currently available demonstrating that implant-based fixation techniques are technically more straightforward procedures, these procedures are intuitively simpler than drilling cortical bone tunnels. Implant-based fixation methods inherently require an implant, which adds to the cost of the operation. However, the cost of this implant is justified if its use directs efficiency in the operating room, thereby decreasing overall operating room cost. A price comparison between different implant types demonstrates the cost efficacy of the Mitek Microfix. The total cost for the Endotine is USD\$1224 (USD\$524 for a pair of screws, USD\$100 for the drill bit, USD\$600 for the instrument kit).³⁰ Thus, the necessary purchase of instrument kits and drills for application of Endotine implants drives up the total operating device cost. In contrast, the Mitek Microfix QuickAnchor includes a disposable applicator and drill bit and is less expensive as it does not require a special drill (\$453, including screw and drill bit). This device does not require additional equipment, other than a hand-held reusable and sterilizable drill.

The brow lift is a popular operation and an important component of a plastic surgeon’s skill set. Utilizing the Mitek Microfix QuickAnchor in endoscopic brow lifts is a viable

option, particularly for the young plastic surgeon. The use of this device not only offers consistent and pleasing aesthetic outcomes but is also easy to learn. As this device is absorbable, there is no need for a planned second procedure to adjust or remove hardware.

Conclusion

In the face of an as yet non-existent ideal, the Mitek Microfix QuickAnchor may be a promising new alternative to implant-based endoscopic brow lift techniques. It exhibits several ideal qualities for implant-based endoscopic brow lifts including durable fixation without the development of palpability or alopecia. Despite the active operative participation by plastic surgery residents at various levels of training, this device is efficient and easy to use. This method can easily be adopted by practicing plastic surgeons of any level. While it is too soon to predict its long-term viability beyond 9 years postoperatively, our experience with this device has been promising.

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Declaration of Conflicting Interests

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