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Patient and Surgeon Experience With the Endotine Forehead Device for Brow and Forehead Lift

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Purpose: To report our experience with the Endotine forehead fixation device (Coapt Systems, Palo Alto, CA, U.S.A.), a bioabsorbable fixation method for forehead and brow lift.

Methods: Retrospective noncomparative case series of 31 patients who underwent forehead and brow lift surgery using the Endotine device in a single center during a 12-month period from 2004 to 2005.

Results A mean brow lift of 2.8 mm (SD, 0.2–7.1 mm) was achieved. There were no cases of recurrence during the follow-up period of 4 months to 22 months. Problems encountered included palpability, tenderness, and numbness. In the majority of cases, these symptoms resolved within a few months and were not troublesome to the patient. Other problems included visible lumps, device mobility, and exacerbation of a high hairline. Patient satisfaction was high, with 95.3% of patients saying they were either happy or very happy with the results; 81% of patients said they would recommend the Endotine as a method of fixation. All surgeons were pleased by the lift achieved and felt the device was easy to use. Problems reported by the surgeons included 1 dislocated device, discomfort, palpability beyond 15 months, a lack of lateral compared with central lift, and cost. Two of the 3 surgeons are still using the Endotine device as the preferred method of fixation.

Conclusions: The Endotine device is effective, safe, and easy to use, and has high patient satisfaction. Problems included numbness, tenderness, and palpability. A preference for other fixation methods was indicated by some because of cost, length of surgery, and the amount of lift achieved.

Various techniques have been described for forehead and brow elevation. Small-incision endoscopic brow lift methods are generally favored because of the lack of facial scarring, faster wound healing, and reduced problems of postoperative alopecia or sensory loss when compared with the coronal approach.

The Endotine forehead device (Coapt Systems, Palo Alto, CA, U.S.A.) is a recently developed bioabsorbable device that was approved for use in brow and forehead lift surgery by the U.S. Food and Drug Administration in March 2002.[1,2] It was designed to provide balanced distribution of tension to reduce tissue deformation, which can lead to failure of fixation and forehead redescent. Its design is intended to reduce tension on the incision and therefore minimize damage to overlying hair follicles and maximize fixation strength compared with single-point fixation. The device is completely absorbed 1 year following fixation.

The Endotine consists of a triangular platform with a dowel on the undersurface, which acts as a peg that is inserted in a hole drilled in the skull. The upper surface bears a number of projections or tines that grasp and fix the overlying soft tissue (Fig. 1). The original device consisted of a 1-mm-thick platform with 3.5-mm-long tines. The second-generation product, introduced in January 2003, has a 0.5-mm-thick platform and 3-mm tines,[2] which is better for thinner scalps and also reduces the palpability of the device. The second-generation device also is made from a different polymer than the original device, and contains both lactic and glycolic acids (82:18) that enable bioabsorption at a faster rate than for the original. A new, third-generation product is currently available; it has a smaller platform that is useful for patients with high or receding hairlines or thin scalps. All of the patients in this study underwent fixation with the second-generation product.

The device has been designed to provide predictable lift and optimal control of brow height and shape through its adjustability. Benefits described by the manufacturer include its ease of use, and as each device takes a few

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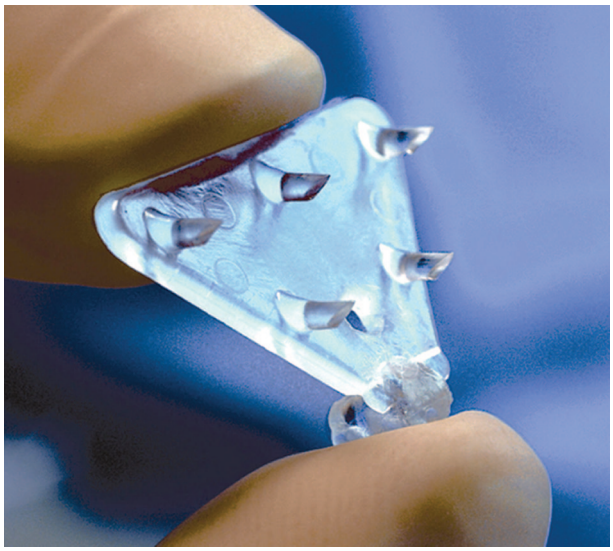

FIG. 1. Endotine forehead device.

minutes to insert, reduced operating time required to perform a forehead or brow lift. The amount of lift produced can be adjusted both intraoperatively and postoperatively by lifting and reattaching the scalp onto the tines. In addition, because of its bioabsorbable nature, further surgery to remove the fixation device is not needed. We report our experience with this product, which to our knowledge, includes the largest series to date in the United Kingdom.

METHODS

This is a retrospective, noncomparative case series of 31 patients who underwent forehead and brow lift surgery using the Endotine device as the method of fixation. Inclusion criteria were the presence of brow ptosis at or below the level of the superior orbital rim and availability of follow-up data. Four patients were excluded because of lack of follow-up data. Surgery was performed on the remaining 27 cases from 2004 to 2005 by 3 surgeons (RM, PA, RS) at a single center (McIndoe Surgical Centre, East Grinstead, United Kingdom). Twenty-six patients were female and 1 was male. The mean age was 50.3 years (SD 9.7; range, 26.2–66 years). Twenty-two patients underwent additional surgery to the eyelids, face, and/or neck at the time of forehead or brow lift surgery, with 20 patients undergoing more than 1 additional procedure (Table 1).

TABLE 1. *Additional surgery performed at the time of forehead and brow lift surgery*

Area of surgery	Operation	Number
Eyelid	Bilateral upper and lower blepharoplasty	13
	Bilateral upper blepharoplasty	3
	Bilateral lower blepharoplasty	5
	Bilateral ptosis surgery	2
Face and neck	Face lift	11
	Neck lift	6
	Rhinoplasty	4
	Lip lift	1

After completion of ptosis surgery under local anesthesia (2 cases), all forehead and brow-lift surgeries were performed under general anesthesia using a standard endoscopic approach. The brow is elevated to the desired position and a site located at the anterior apex of the elevated incision is identified for insertion of the Endotine. A manual or power drill with an Endotine drill bit is then used to drill a hole at this position. This hole should be medial to the temporal fusion line and anterior to the coronal suture, where the cranium is thickest. A hole is drilled, using low speed and high torque, to avoid inadvertent enlargement of the hole, down to the drill-bit sleeve. Suction is applied to remove any debris from the hole. This ensures stable insertion of the device.

An insertion tool is used to grasp the Endotine. A needle-like tip fits in a hole on the platform of the device. The device is inserted in the drilled hole and forcefully pushed until a click is heard and the platform is flush with the cranium. The tool is then disengaged from the Endotine.

Brow tissue is elevated to the desired position and the scalp is then applied with digital pressure onto the tines projecting from the platform of the Endotine to achieve multipoint fixation. The scalp can be lifted off the tines and readjusted intraoperatively until the desired lift and contour are achieved. At the end of the procedure, incisions are closed with sutures or staples that are removed 2 weeks later. Temporal incisions were often combined with skin excision or Y-V flap closure and were closed in 2 layers with fixation deep to temporalis fascia.

The results of the surgery were evaluated both quantitatively and qualitatively. The amount of elevation produced was assessed by comparison of the preoperative and postoperative vertical height from the mid-pupil to the base of the brow. Measurements also were calculated from photographs taken before and after surgery. The magnification of preoperative and postoperative images was matched by adjusting the size of the horizontal corneal diameter of the right eye to 12 mm using Photoshop 7.0 (Adobe Systems, San Jose, CA, U.S.A.) (Fig. 2). This allowed an accurate comparison of the vertical height between the mid-pupil and the base of the brow. Only photographs without any obvious head tilt or frontalis overaction that could influence the vertical pupil-to-brow measurement were used in this study. Figure 3 shows the preoperative, 3-month, and 22-month postoperative photographs from a representative patient. Patient experience was assessed by means of a telephone survey. Overall satisfaction was scored, specific questions were asked regarding postoperative problems, and patients were asked if they would be prepared to recommend the device to other patients undergoing forehead and brow lift surgery.

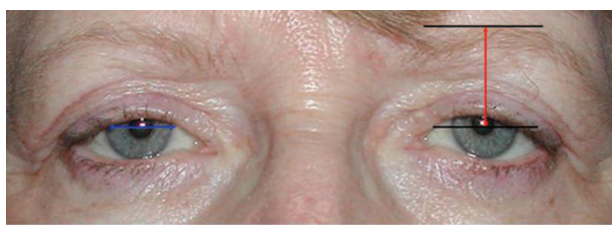

FIG. 2. Horizontal corneal diameter of right eye *(blue line)*, adjusted to 12 mm using Photoshop on both preoperative and postoperative photographs. Vertical pupil-to-brow (VPTB) measurement *(red line)*.

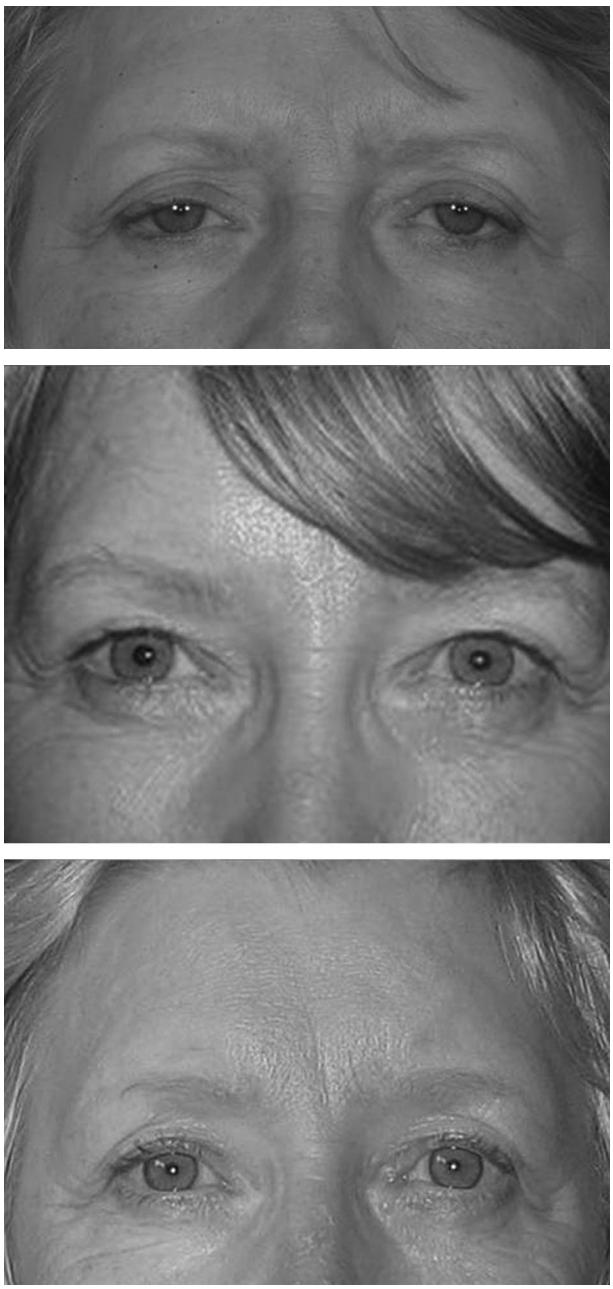

FIG. 3. Brow and forehead lift with Endotine forehead device, ptosis repair, and upper blepharoplasties. **Top,** Preoperative, **middle,** 3 months postoperative, and **bottom,** 22 months postoperative.

Any complications were noted perioperatively. Each surgeon was interviewed to obtain information relating to their views on the following aspects of the device: cost, ease of use, outcome of surgery, and any problems or complications encountered.

RESULTS

All patients achieved a desirable brow lift and contour. Both preoperative and postoperative photographs with similar views were available for 17 patients. The vertical pupil-to brow height was measured and the amount of lift achieved was calculated for these cases. The measurements for patient No. 4 in Table 2 show a reduction of the vertical pupil-to-brow measurement following surgery. On inspection of the photographs, the explanation for this appears to be frontalis overaction, elevating the brow, which is clearly present preoperatively but not postoperatively. The measurements for this patient have therefore been excluded from the following results. A mean lift of 2.7 mm (SD 1.9; range, 0.2–7.1 mm) was achieved on the right side and a mean lift of 2.9 mm (SD 1.8; range, 0.3–5.8 mm) was achieved on the left side. Follow-up ranged from 4 months to 22 months (mean, 8.5 months; SD 4.2). There were no cases of recurrence of brow ptosis during the follow-up period.

Twenty-one patients were available for the telephone survey. Postoperative sensory loss (6 patients), tenderness (8 patients), and palpability (8 patients) were common symptoms reported. The majority of patients were not troubled by these symptoms, which resolved within 3 months to 5 months. One patient, who was not troubled by her symptoms, commented that her tenderness was worse premenstrually. One patient was troubled by all 3 symptoms. Two other patients were troubled by persistent tenderness at 4 months and 8 months, respectively. One patient was aware of persistent palpability 15 months after surgery. One patient felt the surgery had exacerbated a high hairline. Two patients reported that the device was visible through the skin; this troubled 1 of them, while the other concealed it with her hair. One patient felt the device was mobile. Two patients complained of an asymmetric brow lift. This could not be assessed quantitatively because neither patient had provided postoperative photographs and lived too far away to return for a clinical examination.

Patient satisfaction was assessed using a 5-point scoring scheme: 5 indicating very happy, 4 happy, 3 neither happy nor unhappy, 2 unhappy, or 1 very unhappy. Nine patients (42.8%) were very happy, 4 (52.4%) were happy, and 1 (5%) was neither happy nor unhappy. No patients were unhappy with their surgery.

Patients were asked if they would recommend the Endotine device for patients undergoing forehead and brow lift surgery in the future. Seventeen patients (81%) said they would definitely recommend the Endotine device. One patient was unsure if she would recommend the Endotine device, because she was experiencing mobility of the device. Two patients said they would recommend the device depending on the patient: 1 of the patients said she would not recommend the Endotine device for patients with high hairlines—because the surgery had exacerbated her high hairline—while the other patient said she would only recommend the Endotine device to patients who were prepared to tolerate the side effects of numbness, palpability, and tenderness. One patient said she would not recommend the Endotine device. She was interviewed 4 months postoperatively and was troubled by numbness.

All 3 surgeons whose patients were included in this study were interviewed to discuss their views. Two of the 3 surgeons felt that the device was expensive. All 3 surgeons felt the device was easy to use. All surgeons were pleased by the contour achieved and with the amount of lift attained. All 3 surgeons felt that although the amount of central lift achieved was satisfactory, lateral brow lift was not addressed by the Endotine device.

There was only 1 complication affecting the forehead and brow lift surgery. This was a dislocation of the Endotine device

TABLE 2. *Preoperative and postoperative vertical pupil to brow (VPTB) measurements and amount of lift achieved in each case*

Patient	Pre-operative VPTB right side (mm)	Post-operative VPTB right side (mm)	Amount of lift right side (mm)	Pre-operative VPTB left side (mm)	Post-operative VPTB left side (mm)	Amount of lift left side (mm)
1	21.2	26.5	5.3	19.7	24.1	4.4
2	19.9	22.7	2.8	20.7	21.7	1
3	18.2	20.8	2.6	19.4	22.6	3.2
4	25.4	21.8	−3.6	26	24	−2
5	24.1	25.5	1.4	21.9	25.8	3.9
6	21.2	21.3	0.1	19.7	20	0.3
7	26.7	30	3.3	24.5	30.3	5.8
8	21.8	24.5	2.7	19.6	24	4.4
9	17.2	21.5	4.3	17.2	22.6	5.4
10	22.6	22.9	0.3	22.4	23.4	1
11	23.1	30.2	7.1	23	26.7	3.7
12	24.4	26.2	1.8	25	26.2	1.2
13	16	18.5	2.5	18	18.8	0.8
14	22.6	25	2.4	22.6	25.7	3.1
15	15.4	19.8	4.6	13.7	15	4.3
16	17.3	18.5	1.2	17.5	19.5	2
17	17	17.5	0.5	18.5	20.1	1.6

that required further surgery for reinsertion. The surgeon encountering this problem felt this was due to inadequate insertion of the device. He recalled that at the time of surgery he did not hear a click before releasing the Endotine from the insertion tool during this particular case. Palpability was reported by 2 of the surgeons. Discomfort was mentioned by 1 surgeon. One surgeon reported persistence of the device beyond 15 months. No cases resulted in alopecia or necessitated removal of device.

Two surgeons are still using the Endotine device as their preferred method of fixation for forehead and brow lift surgery. One surgeon no longer uses the device because he felt it was too expensive and takes longer than periosteal fixation, his recent preferred method for endoscopic brow lift surgery.

DISCUSSION

In this study we looked at the results achieved in forehead and brow lift surgery with the use of the Endotine forehead fixation device. Results were assessed objectively by measuring the amount of brow lift obtained, and subjectively by interviewing patients to assess their satisfaction with the procedure. The majority of patients achieved a satisfactory amount of lift, both objectively and subjectively. Patient satisfaction was high, with the majority of patients willing to recommend the Endotine device as a fixation method for other patients undergoing forehead and brow lift surgery.

We also looked at problems and complications encountered by the patients and surgeons. The most frequent problems reported by patients were tenderness, numbness, and palpability. These symptoms were not troublesome in most cases and lasted a few months. Only 1 complication was reported, a dislodged device that required further surgery for reinsertion.

Surgeon satisfaction also was assessed. Most surgeons felt the device was easy to use and achieved a satisfactory contour and central but not lateral brow lift. One of the surgeons would not use the device as the preferred fixation technique because of cost and length of operating time compared with other fixation methods.

Endoscopic brow lifts were first described by Isse[3] in the 1990s. Endoscopic brow lifts have been found to be effective, achieving lasting and predictable results with an acceptable complication rate.[4] Small-incision, nonendoscopic brow lift[5] and endoscopic brow lift are emerging as the procedures of choice, presumably because smaller incisions have greater patient acceptance and a lower risk of postoperative problems such as alopecia and sensory loss.

Techniques used to achieve bone fixation include suspension sutures through bone tunnels,[3,6] Kirschner wires for direct fixation of the brow to the supraorbital rim,[7] and fibrin glue fixation.[8] Jones and Grover[9] compared fibrin glue fixation with vicryl sutures through bone tunnels. The results were not significantly different at 1 month. At 3 months, there was a significant difference with bone tunnel/vicryl suture fixation remaining stable and fibrin glue fixation resulting in some relapse.

Troilius[10] performed endoscopic brow lifts on 20 patients without using scalp fixation. He relied instead on changing the balance of muscle vectors around the eyebrows to achieve brow lift. He concluded scalp fixation was not necessary for cases where no more than 4 mm increased vertical brow height was needed.

Biodegradable fixation methods described in the literature include a variety of polylactide devices: pericranial pins with long-acting polylactide sutures,[11] tacks,[12] and screws.[13] Fixation during the critical healing period is a key factor in the success of endoscopic brow lifts. In animal studies of fixation of bone to periosteum, investigators concluded that periosteal adherence to calvarium takes at least 6 weeks, with adherence being completed

by 12 weeks.[14] Biodegradable implants are designed to provide fixation until biologic fixation occurs. The Endotine forehead device is biodegradable and is absorbed by 1 year after fixation. It is currently recommended for relatively thick scalps because of problems of visibility of the device through the skin.[1]

There are few studies on the efficacy and safety of the second-generation Endotine forehead device. Stevens et al.[15] followed 9 patients with the first-generation device over a 6- to 8-month period. Palpability was a reported problem. Berkowitz et al.[16] studied 21 patients, 15 of whom had received the first-generation device, and 6 who received the second-generation device. The follow-up period ranged from 54 days to 174 days. A mean mid-pupil to superior brow lift of 4.3 mm to 4.8 mm (range, 1–13 mm) was obtained in the first-generation group, while the mean mid-pupil to superior brow lift in the second-generation group was 4.2 mm to 4.8 mm (range, 1–13 mm). Both devices were found to be well tolerated. Holzapfel et al.[17] studied 53 patients undergoing brow lift surgery with the second-generation device. All patients in their study had midline rather than lateral fixation with the Endotine device. The brow was fixed laterally to temporal fascia with a 2-0 braided polyester suture. No measurements of the amount of brow lift were provided. One case of recurrent lateral brow ptosis occurred that required further temporal refixation. Expense of the device adding to the cost of the procedure was mentioned by these authors.

In conclusion, our experience indicates the Endotine forehead device is an effective method of fixation, with all patients achieving a desirable amount of lift and contour. Lateral lift was not addressed by the Endotine device. Use of this device was acceptable to the majority of patients, despite the commonly encountered side effects of numbness, tenderness, and palpability that resolved after a few months in most cases. The surgeons participating in this study found the device easy to use and few problems were encountered. However, most surgeons felt that cost was an issue. Two of the 3 surgeons in this study expressed a preference for the Endotine device over other fixation methods.

REFERENCES

1. Evans GR, Kelishadi SS, Ho KU. Plastic Surgery Educational Foundation DATA Committee. “Heads up” on brow lift with Coapt Systems’ Endotine Forehead technology. *Plast Reconstr Surg* 2004;113:1504–5.
2. Apfelberg DB, Jacobs D. Coapt Systems Endotine technology for brow lift. *Plast Reconstr Surg* 2005;116:336–7.
3. Isse NG. Endoscopic facial rejuvenation: endoforehead, the functional lift. *Aesthetic Plast Surg* 1994;18:21–9.
4. De Cordier BC, de la Torre JI, Al-Hakeem MS, et al. Endoscopic forehead lift: review of technique, cases, and complications. *Plast Reconstr Surg.* 2002;110:1558–70.
5. Kikkawa DO, Miller SR, Batra MK, Lee AC. Small incision nonendoscopic browlift. *Ophthal Plast Reconstr Surg* 2000;16:28–33.
6. McKinney P, Celetti S, Sweis I. An accurate technique for fixation in endoscopic brow lift. *Plast Reconstr Surg* 1996;97:824–7.
7. Chasan PE, Kupfer DM. Direct K-wire fixation technique during endoscopic brow lift. *Aesthetic Plast Surg* 1998;22:338–40.
8. Marchac D, Ascherman J, Arnaud E. Fibrin glue fixation in forehead endoscopy: evaluation of our experience with 206 cases. *Plast Reconstr Surg.* 1997;100:704–14.
9. Jones BM, Grover R. Endoscopic brow lift: a personal review of 538 patients and comparison of fixation techniques. *Plast Reconstr Surg.* 2004;113:1242–52.
10. Troilius C. Subperiosteal brow lifts without fixation. *Plast Reconstr Surg.* 2004;114:1595–605.
11. Pakkanen M, Salisbury AV, Ersek RA. Biodegradable positive fixation for the endoscopic brow lift. *Plast Reconstr Surg* 1996;98:1087–91.
12. Landacker A, Buck JB, Grotting JC. A new resorbable tack fixation technique for endoscopic brow lifts. *Plast Reconstr Surg.* 2003;111:880–90.
13. Benito JD, Camargo VJ, Torres A. Absorbable screws in endoscope-assisted forehead lifting. *Aesthetic Plast Surg* 2003;27:63–7.
14. Romo T 3rd, Sclafani AP, Yung RT, et al. Endoscopic foreheadplasty: a histologic comparison of periosteal refixation after endoscopic versus bicoronal lift. *Plast Reconstr Surg.* 2000;105:1111–9.
15. Stevens WG, Apfelberg DB, Stoker DA, Schantz SA. The Endotine: a new biodegradable fixation device for endoscopic forehead lifts. *Aesthetic Surg J* 2003;23:103–7.
16. Berkowitz RL, Jacobs DI, Gorman PJ. Brow fixation with the Endotine forehead device in endoscopic brow lift. *Plast Reconstr Surg* 2005;116:1761–70.
17. Holzapfel AM, Devinder S, Mangat MD. Endoscopic forehead-lift using a bioabsorbable fixation device. *Arch Facial Plast Surg* 2004;6:389–93.