Knowledge of patient-reported outcomes is a benefit in presurgical counseling. Yet, the actual data available about patient-reported outcomes after cosmetic procedures, such as brow-lifts, done to lessen the visible signs of aging, and improve temporal hooding and brow ptosis, is lacking. Improving communication by giving accurate perioperative expectations can lead to improved perioperative satisfaction by realistically describing expected outcomes and recovery.

In 2010 the American Society of Plastic Surgeons reported 42,433 brow-lift procedures were performed, 100 years after Lexer performed the first forehead-lift. Passot first published an article about forehead-lift surgery in 1919. Later an endoscopic approach was developed by Isse and Vasconez in the early 1990s. This endoscopic brow-lift (EBL) approach was refined by Daniels and Tirkanits using small incisions within the scalp. The EBL is less invasive than the traditional frontal or coronal lift and involves no excision of hair-bearing skin. Studies have shown the endoscopic approach to have reliable results but with lower morbidity and postoperative recovery time compared with open techniques. The review of 400 EBLs by De Cordier et al listed some complications that were experienced by a small percentage of patients and included the following: scalp numbness and paresthesia, itching or dysesthesia, frontal nerve weakness, difficulty closing the eyes, eye irritation, eyelid asymmetry, eyebrow malposi-
tion, and hematoma.\textsuperscript{11} Despite this, a recent article by Guillot et al\textsuperscript{12} compared forehead and scalp sensation among patients undergoing EBLs and open brow-lifts and found that the open technique showed a significant decrease in sensation compared with the endoscopic technique. Arneja et al described some additional limitations of the technique: “relapse of brow ptosis, steep learning curve for the surgeon, expensive instrumentation, and limited efficacy in cases of severe brow ptosis.”\textsuperscript{13,14,17}

Elkwood et al\textsuperscript{14} conducted a survey of 570 members of the American Society of Plastic Surgeons. The results indicated that there is a significant difference in opinion among surgeons as to which method they prefer. Training and comfort level with various techniques are likely a leading cause but some uncertainty remains about limitations and complications of EBL.

What has been omitted from these previous writing on brow-lifts has been a comprehensive outcomes interpretation as defined not by the surgeon’s review of his or her notes but rather, a patient’s perspective. The primary objective of our study is to discover what benefits, potential complications, and perioperative limitations should be expected with EBL. Quality measures, including patient level of satisfaction, postoperative scarring, change in headaches, timing of recovery, and visual changes, will be assessed. Secondarily, we sought to verify and compare existing data using a single surgeon’s (N.D.G.) experience regarding complication rates of bleeding, infection, swelling, numbness, pain, and alopecia near the surgical sites. A better understanding of patient satisfaction will help surgeons choose the best procedure for each patient, and help the patient prepare adequately for their procedure, thus improving patient satisfaction.

Methods

This retrospective study assessed data from telephone questionnaires completed by patients who had an EBL by the senior author (N.D.G.) between January 2004 and January 2010. Participants were males or females aged 35 through 75 years identified using Current Procedural Terminology (CPT) codes through clinic databases as having had a brow-lift by one of us (N.D.G.). Participants were excluded if they did not agree to participate or if they could not be contacted. Institutional review board approval was obtained and protection of patient privacy was ensured. Informed consent was given orally by each study participant. The questionnaire was administered by a single member (N.J.P.) of the study staff who had no previous contact with the participants. A predetermined telephone script was used for internal consistency.

The participants were asked about scarring, pain, numbness, asymmetry, vision, recovery time complications, degree of satisfaction, hair loss, and improvement in headaches. Many questions required a simple “yes” or “no” answer, while others required participants to rate the test variable on a scale of 1 through 10. In total, the instrument contained 47 separate questions.

Statistical analysis was accomplished using descriptive statistics, the Fisher Exact $t$ test, Mann-Whitney tests, and Pearson $\chi^2$ test wherever appropriate.

Results

Of the 107 patients who were eligible for the study, 57 agreed to participate and willing to respond to the questions in the instrument. Only 7 refused to participate in the study and the remaining patients were unreachable by telephone. Of the 97% female ($n = 55$) population with a mean (SD) age of 49.5 (6.6) years, 43 participants (75%) had concurrent blepharoplasty, 8 participants (14%) had concurrent rhytidectomy, and 40 participants (70%) had functional noncosmetic goals.

Patient satisfaction with appearance was assessed with several different questions. The first asked how satisfied the patient is with the current appearance of scars. In all, 50 participants (89%) reported satisfaction of 7 of 10 or higher and the mean of all responses was 9.12. Patients were also asked how noticeable scars were on a scale of 1 to 10 with 10 being completely unnoticeable. The mean of these responses was 9.21. Additionally, patients were asked how often their scars were noticed by others. In our patients, 3 (5%) believed scars were noticed rarely, and 54 (95%) believed that scars were never noticed by others.

Participants were asked how long the bleeding lasted after the surgery. Thirty-seven could remember no bleeding at all. In all, 51 (89%) of 57 responders reported bleeding that lasted 1 day or less, and none required an additional procedure to assist in hemostasis.

Forty-nine patients (86%) reported edema that lasted 2 weeks or less. No surgical site infections were reported, but 1 patient did report a suspected Clostridium difficile infection after hospitalization likely due to postoperative antibiotic use. Time until return to work is an important indicator of recovery after surgery. Of the total responders, 54 patients (95%) returned to work within 2 to 3 weeks.

A minority, 16 patients (28%), said there was some alopecia after surgery. Five had alopecia at 1 incision site, 3 reported alopecia at 2 incision sites, 3 had alopecia at 3 or more incision sites, and 3 said hair loss was diffuse or away from the incision sites. Ten patients with alopecia reported that the total area (diameter) was the size of a dime or smaller, 2 said quarter sized, and 1 said 2 inches or more. The areas of alopecia took 1 to 2 weeks to regrow in 3 patients, 3 patients reported 1 to 2 months, 1 said 6 months, and 6 had permanent alopecia.

Among those surveyed, 43 patients (75%) experienced some pain, while 14 patients (25%) did not report any pain. When asked how long pain endured after the operation, 50 patients (88%) had no pain or pain that lasted 1 week or less. Graphic representation of pain scales from 1 to 10 can be seen in Figure 1. This was consistent with analgesic use as well. Analgesic was needed in 46 patients (81%) to control the pain after surgery, and when looking at the length of use, 51 patients (89%) did not require analgesic, prescribed or over-the-counter, for longer than 1 week. Thirty-six patients (63%)}
scribed some numbness after surgery, while 25 patients (44%) experienced some degree of numbness for 3 months or longer (Figure 2).

In the group surveyed, 16 (28%) of 57 reported regular headaches prior to their EBL. Of these 16 patients, 2 patients (13%) had complete resolution of regular headaches after the surgery, 7 patients (44%) did not experience any change in headache frequency or intensity, 1 patient (6%) did not respond to further questions regarding headache, and 6 patients (28%) had improvement in either headache frequency or intensity. Among the 16 responders, the average patient had 8.5 headaches per month and a mean headache intensity of 3.4 of 10 before the surgery. After the procedure, the mean amount of headaches per month for these 16 patients was 3.4 fewer and the headaches were 0.80 points less severe on a scale of 1 to 10. Thus, the patients reported significantly fewer headaches ($P = .01$) and less severe headaches ($P = .03$) after having undergone the surgery.

After EBL, patients were asked if they had received comments about their appearance from people who were unaware of the surgery and who were not prompted to give feedback. Forty-two patients (74%) reported that they had been told that they looked younger, 37 patients (65%) said that they had been told they looked more rested or less tired. Only 3 patients had been asked if they had plastic surgery by someone who did not previously know. No patients had been told that they looked worse.

When asked if EBL had changed patient confidence or self-image, 42 patients (74%) said that they feel better about themselves. Fifty-three patients (93%) felt that the surgery was an overall success. When asked whether they would be willing to have the surgery again, 37 patients (65%) said they would be very willing, and 12 patients (21%) said they would be somewhat willing. One patient reported being very unwilling to undergo EBL again, and 7 patients (12%) reported being somewhat unwilling. Finally, patients were asked if they would recommend the EBL surgery to a friend or relative and almost all, 54 (96%) of 56 responders, were willing to recommend it.

Within the group of patients surveyed, there was a subset that had undergone concurrent rhytidectomy with EBL. Eight participants in this subgroup were compared with the remaining 49 who had EBL alone in their responses to several questions (Table). There was not a statistically significant difference in satisfaction with scar appearance ($P = .44$), noticeable of scars ($P = .42$), alopecia ($P = .42$), or numbness ($P = .70$). Adding a concurrent rhytidectomy did not change the patient’s opinion about whether he or she thought the surgery was an overall success ($P > .99$) or if he or she would recommend the surgery to a friend ($P > .99$). Overall, pain was not found to differ after surgery ($P = .57$), including postoperative day 1 ($P = .97$) or day 3 ($P = .12$). This trend did not continue to postoperative day 7 where concurrent rhytidectomy patients actually reported a significant decrease in pain with a mean of 0.38 compared with EBLs alone patients’ mean of 1.59 ($P = .008$). Despite reporting less pain, patients were slower to return to work or normal daily activities when having a concurrent rhytidectomy. Thirty-nine percent of these patients were able to return to work within 2 weeks, while 7 of 8 (87%) had EBLs alone were back in the same period ($P = .02$).

**Discussion**

Despite the understood importance of patient satisfaction, especially in cosmetic surgery, no published instruments to determine satisfaction exist within the English literature for EBLs.
Furthermore, other large studies are retrospective reviews of surgeon’s notes evaluating complications and few focus on patient satisfaction. Alsarraf et al15 established that surveys could be used for outcomes measurement in several different cosmetic facial procedures. They found that the results from such surveys were reliable and consistent and provided surgeons with quantitative tools to assess surgical outcomes. Research that relies on the patient’s viewpoint in an unbiased format is important to understand what surgery entails to properly inform patients of complications and expected outcomes.

De Cordier et al16 described the outcomes of 400 EBLs performed by various surgeons. They found that scalp numbness and paresthesias were common with most patients reporting it to some degree. Only 2% had lasting itching of dysesthesia. They also found that 2% of the patients experienced temporary frontal nerve paresis, 7% had limitations with full eye closure, 8% experienced eye irritation, 8% experienced upper eyelid asymmetry, and 3% experienced eyebrow malposition.16 The study by Jones and Grover15 compared fixation techniques of EBL in 538 patients with the following findings: 1 patient experienced frontal nerve paresis, 1 had a postoperative infection, 5 patients experienced alopecia, and 1 patient experienced severe pain for longer than 1 year. In their study, 80% of patients also had a concurrent rhytidectomy with their brow-lift.15 Our results differed, with no facial paralysis, paresis, infections, or lagophthalmos, and higher rates of persistent alopecia in 12% and persistent anesthesia in 44%. This discrepancy could be the result of an actual difference in complication rates due perhaps to surgical technique or extent of subperiosteal release, or perhaps, what we believe to be more accurate surveying as a result of direct patient feedback. Surgeons in a postoperative visit are unlikely to miss a brow paralysis or paralysis but may not accurately reflect as well alopecia and anesthesia. In this same light, we believe that the data about patient satisfaction on appearance (93%) and willingness to recommend to a friend (96%) are better understood from this perspective. It must be recognized, especially in the case in which surgical procedures are done with primarily cosmetic goals, that what a surgeon may call an expected outcome may actually be a disappointing outcome in the patient’s eyes.

Other studies have reported favorable outcomes of headaches after EBL in a similar manner to our study that showed 50% (8 of 16 patients) experienced a decrease in frequency and intensity after surgery.17,18 Similarly, botulinum toxin injections of the corrugator, procerus, and frontalis muscles have been shown to improve migraine and other types of headaches in some patients.19,20 While causation cannot be shown with our study, these data give credence to the theory that a relaxation of the frontal musculature or manipulation of the tissues near the peristeum or supratrochlear and supraorbital neurovascular structures might reduce the frequency and severity of headaches.

Our study found that adding a concurrent rhytidectomy did not seem to ensure additional morbidity; however, patients should expect to take longer to return to work or normal activities after a combined surgery. Patients who underwent surgery for functional reasons might return faster to work compared with those who had a concurrent rhytidectomy, because they are possibly more likely to not care if other people would suspect their recent intervention. Because there is no difference in patient satisfaction or complications, we believe that it is appropriate to conclude that adding a concurrent rhytidectomy with EBL is well tolerated and that a patient should expect this portion of the surgery to have no significant impact on their postoperative course compared with EBL alone or EBL with blepharoplasty.

While this study offers new information about EBL, there are limitations to the information gathered. This small study included 57 patients and is limited in power especially when comparing concurrent rhytidectomy and headaches. It is also important to recognize the potential for selection bias in this study. Because the study required willing cooperation from the participant, it is possible that the least satisfied patients would choose not to participate in the study. The vast majority of those who did not participate were unable to be reached in 3 daytime telephone calls. We believe that there were few patients who chose to avoid the study; however, we must acknowledge the potential for that particular bias in the data. The retrospective nature of the study also presented a recall bias in the data collected. Although patients were told that they should not answer questions if they did not have a reasonably accu-

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**Table. Responses From 57 Patients Undergoing EBL Alone Compared With EBL and Rhytidectomy**

<table>
<thead>
<tr>
<th>Category</th>
<th>EBL Alone (n = 49)</th>
<th>EBL With Rhytidectomy (n = 8)</th>
<th>P Value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was surgery a success, % yes</td>
<td>91.8</td>
<td>100</td>
<td>&gt;.99</td>
</tr>
<tr>
<td>Time required to return to work in &gt;14 d, %</td>
<td>39.6</td>
<td>87.5</td>
<td>.02</td>
</tr>
<tr>
<td>Satisfaction with scars, scale 1-10&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.0</td>
<td>9.9</td>
<td>.44</td>
</tr>
<tr>
<td>Noticeability of scars&lt;sup&gt;c&lt;/sup&gt;</td>
<td>9.1</td>
<td>9.8</td>
<td>.97</td>
</tr>
<tr>
<td>Experienced hair loss, %</td>
<td>30.6</td>
<td>12.5</td>
<td>.42</td>
</tr>
<tr>
<td>Pain duration postoperatively &gt;7 d, %</td>
<td>42.9</td>
<td>12.5</td>
<td>.22</td>
</tr>
<tr>
<td>Postoperative pain score&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>4.7</td>
<td>4.7</td>
<td>.97</td>
</tr>
<tr>
<td>Day 3</td>
<td>2.9</td>
<td>1.5</td>
<td>.12</td>
</tr>
<tr>
<td>Day 7</td>
<td>1.6</td>
<td>0.4</td>
<td>.008</td>
</tr>
</tbody>
</table>

Abbreviation: EBL, endoscopic brow-lift.

<sup>a</sup> Data are given as mean unless otherwise stated.

<sup>b</sup> Bolded P value represents P < .05.

<sup>c</sup> 1 indicates noticeable; 10, completely unnoticeable.
rate answer, one could expect that the data are affected by the inaccuracy of memory. We did attempt to remove the tendency of patients to seek physician approval by not having the senior author and primary surgeon (N.D.G.) involved in data collection.

Overall, patients undergoing EBL are satisfied with their outcomes. Studies that aim to understand the patient’s perspective should aim to decrease data collection biases that might exist limiting the usefulness of the data. These results are most relevant to a patient seeking consultation and considering EBL. We hope to see further progress in the area of patient-reported outcomes and strongly believe that this area represents many opportunities for further research.

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REFERENCES