



# Eyebrow Asymmetry: Definition and Symmetrical Correction Using Botulinum Toxin A

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**Background:** Some degree of eyebrow asymmetry is present in many patients who request periorbital rejuvenation, although patients are often unaware of minor asymmetries. There are few parameters for defining eyebrow asymmetry and its incidence in otherwise healthy patients in the literature.

**Objective:** We investigated whether bilateral, symmetric chemodenervation of the primary depressors and elevators of the eyebrows results in a symmetrical standstill of the eyebrows in a neutral position.

**Methods:** Measurements of brow height taken in 683 patients who requested reduction of facial rhytids revealed that the minimal amount of asymmetry noticeable to the patients was 2 mm. Between 2002 and 2005, we performed botulinum toxin A injections in a group of 115 patients with eyebrow asymmetry of more than 2 mm who requested aesthetic periorbital rejuvenation; patients with trauma, facial palsy, or previous surgery in the periorbital area were excluded. A total of 30 to 45 units of Botox (Allergan, Irvine, CA) were injected in all patients bilaterally and symmetrically to both brow regions, regardless of their brow height measurements.

**Results:** All 115 patients completed the study. Mean pretreatment brow height was 18.59 mm at the right lateral canthus and 18.55 mm at the left lateral canthus. After treatment, the mean brow height was 21.91 mm on the right site and 21.89 mm on the left site. The decrease in discrepancy between the right and left brow heights resulting from symmetrical Botox treatment was statistically significant ( $P < .01$ ). In 83 of 115 patients (72.1%), treatment was successful, with success defined as post-treatment asymmetry of either 0 or 1 mm.

**Conclusions:** We propose that bilateral chemodenervation of the primary depressors and elevators of the eyebrows can result in a symmetrical standstill of the eyebrows in the neutral position. The treatment is easy to administer and involves few complications. (Aesthetic Surg J 2007;27:513–517.)

In daily practice, many patients ask for periorbital rejuvenation, but only the occasional patient seeks correction of asymmetric eyebrows. In many cases, however, a careful analysis reveals that some degree of eyebrow asymmetry is present. Most of the time, the patients are unaware of this phenomenon because the asymmetry is subtle. They may also try to balance a relatively inconspicuous asymmetry by the way they trim their eyebrows. Eyebrow asymmetry and its incidence in the otherwise healthy population are ill defined in the literature. To define this disorder, it is first necessary to analyze the normal values, in this case the height of the brows. In a previous study on 50 healthy individuals, the average distance from mid-pupil to upper edge of brow was estimated to be 25 mm.<sup>1</sup> In another study, caliper measurements from the lateral canthus to the caudal row of brow was mea-

sured as  $13.76 \pm 4.53$  mm.<sup>2</sup> There are no data available in previous studies, however, similarly defining eyebrow asymmetry.

Trauma or previous surgery can cause eyebrow asymmetry. A history of facial palsy can also distort the regional symmetry.<sup>3</sup> In healthy individuals, the shape of the eyebrows is dependent on local muscle balance and dynamics.<sup>4</sup> In this population group, excessive muscle dynamics (hyperkinesia of the frontalis or the orbicularis oculi muscles) is by far the most common cause of eyebrow asymmetry. The habitually raised eyebrow may cause unilateral hyperkinesia of these muscles, and the mimetic hyperactivity causes asymmetry over a period of time. In rare instances, hyperactivity of one depressor supercillii muscle may pull the medial portion of the eyebrow down.<sup>5</sup> There may also be a strong family history associated with eyebrow asymmetry.

Upper eyelid ptosis can also be the cause of eyebrow asymmetry. To compensate for ptosis, patients elevate the eyebrow on the affected side continuously, which results in eyebrow asymmetry. Furthermore, underlying skeletal asymmetry of the orbital region may be another cause of eyebrow asymmetry.

Many surgical procedures have been described to correct eyebrow asymmetry, including superselective neurotomy, open brow lift, endoscopic brow lift, and unilateral eyebrow elevation. The etiology-oriented treatment for hyperkinesia of these muscles ought to be to suppress the hyperkinesia, which acts on the eyebrows. Injection of botulinum toxin A (Botox; Allergan, Irvine, CA) is such a treatment modality. On the basis of the principle of dynamic muscular activity affecting eyebrow height and shape and the history of safe and effective use of botulinum toxin A for treatment of muscle-dependent wrinkles in the periorbital region, we planned a study to determine whether bilateral, symmetric chemodenervation of the primary depressors and elevators of the eyebrows results in a symmetrical standstill of the eyebrows in a neutral position.

### Material and Methods

Between 2001 and 2002, we asked 683 patients who requested reduction of facial rhytids and received a thorough examination and consultation about procedures to complete a questionnaire asking whether they were conscious of any asymmetry between their eyebrows. By using calipers with millimeter gradations, bilateral brow height was measured at a vertical distance from the lateral canthus to the lowest row of eyebrow hairs while the patient was at a predetermined position and height with eyes focused on a fixed point in space (Figure 1).<sup>2</sup> From these measurements, the minimal amount of asymmetry noticeable to patients was found to be 2 mm.

Between 2002 and 2005, we recruited, from among 245 patients who answered the questionnaire and in whom eyebrow asymmetry was found to be 2 mm or more (Table 1), 106 women and nine men as a study group. The average age of patients in this group was 42 years. Only patients with aesthetic indications for botulinum toxin injection were selected; those who had received treatment for facial palsy or trauma or who had undergone previous surgery around the region were excluded. Standardized photographs were taken of all patients before the treatment. Preintervention brow measurements were taken by use of calipers with millimeter gradations, as described above. All measurements were taken by the primary investigator. The patients were



**Figure 1.** Measurement of eyebrow height with a caliper.

**Table 1. The distribution of asymmetry among patients (n = 638) who answered the questionnaire**

Asymmetry between eyebrows	0-1 mm	>2 mm
Number of patients	438	245

instructed not to alter their brow position or shape during the course of the study.

Lyophilized Botox was dissolved in 2.5 mL sterile saline solution to achieve a final concentration of 4 U/0.1 mL. Prepared Botox was administered with a 30-gauge needle on an insulin syringe within 24 hours of dilution. A total of 30 to 45 units of Botox were injected to all patients bilaterally and symmetrically to both brow regions, regardless of their brow height measurements (Figure 2). Injections were administered to frontal, glabellar, and orbicular regions bilaterally, with equal doses used on both sides in the usual fashion.

All patients were examined 2 weeks after treatment, when posttreatment measurements were again taken by the primary investigator. Posttreatment standardized photographs were also taken. Each patient was evaluated for specific side effects. Three sets of data were collected: the pretreatment bilateral brow height at the lateral canthus; posttreatment brow height at the lateral canthus; and the discrepancy between the brow heights. For the statistical analysis, the SPSS (Statistical Package for Social Sciences) for Windows 10.0 program was used. The Wilcoxon signed test was used for quantitative comparison of the data.



**Figure 2.** Injection sites for botulinum toxin.

## Results

All 115 patients selected for the study group completed the study. Both eyebrows were treated symmetrically. Pretreatment mean brow height was 18.59 mm at the right lateral canthus and 18.55 mm at the left lateral canthus. Posttreatment mean brow height was 21.91 mm on the right and 21.89 mm on the left (Table 2). The decrease in discrepancy between the right and left brow heights before and after Botox treatment was measured and found to be statistically significant ( $P < .01$ ) (Table 3). Successful correction was achieved in 83 of 115 cases (72.1%), with success defined as posttreatment asymmetry of either 0 or 1 mm (Figures 3 to 5, Table 4). In 11 cases (9.5%), no improvement was obtained. In 21 cases (18.2%), some improvement was obtained, but posttreatment asymmetry was still 2 mm or more. The only complication reported was mild bruising in 12 patients (10.4%), which resolved by 1 week after treatment.

## Discussion

As has been the case with all surgical subspecialty fields, there has been a trend in aesthetic surgery toward use of less-invasive techniques. Newer techniques, such as endoscopic forehead lift and botulinum toxin A treatment of hyperfunctional facial lines, effect changes by altering the dynamic muscular forces that act on the upper third of the face. The ability of botulinum toxin A treatment to efface hyperfunctional lines of the face depends on the resultant denervation of the facial mimetic muscles. With respect to the dynamic muscular forces affecting the height and the shape of the eyebrows,<sup>5,6</sup> a relative weakening of the muscular depressors of the

**Table 2. Mean brow height of the eyebrows before and after Botox treatment**

Location	Before Botox (mm)	After Botox (mm)
Right lateral canthus	18.56	21.84
Left lateral canthus	18.95	21.8

**Table 3. Statistical analysis of discrepancy ratio before and after Botox treatment**

	Asymmetry (mm)
Before Botox (median)	2.78 ± 0.93 (3)
After Botox (median)	0.92 ± 0.87 (1)
Test; $P$	$Z: -8,912; P < 0.01^*$

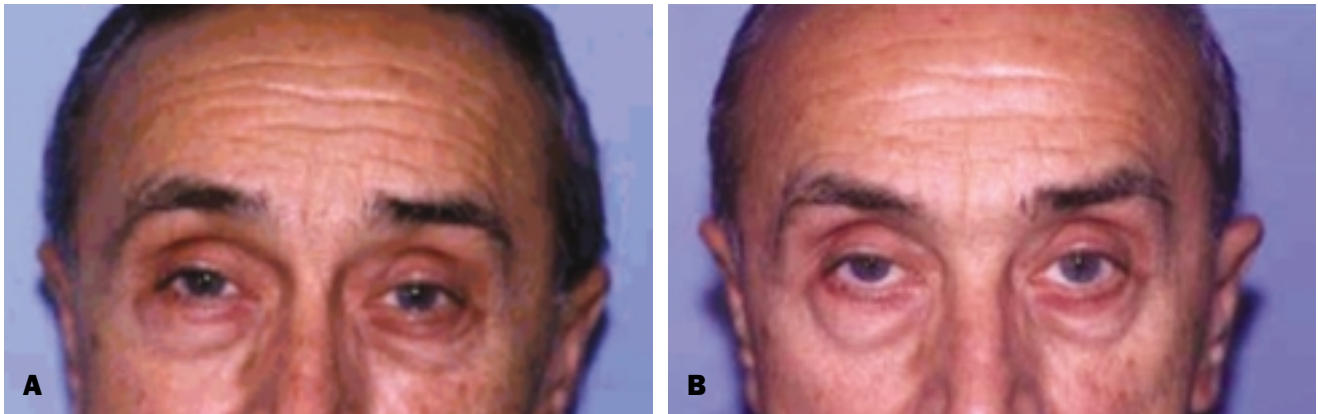
\* $Z$ , Wilcoxon sign test.

brow (orbicularis oculi, depressor supercillii, procerus, and corrugator muscles) against the primary brow levator, the frontalis muscle, results in a visibly appreciable amount of brow elevation.<sup>2</sup> To determine the objective amount of brow elevation, it is necessary to take the preintervention brow measurements, which is a routine procedure in our clinic. The triggering factor for this study was the high incidence of eyebrow asymmetry in healthy individuals seeking cosmetic enhancement in the upper face region.

Many surgical procedures for correction of eyebrow asymmetry have been described.<sup>3,4</sup> A high-riding eyebrow may be lowered to the level of the normal side through a superselective neurotomy of the final branches of the frontal nerve on the affected site.<sup>7</sup> In cases in which the asymmetry was caused by trauma or previous surgery, this method may be the treatment of choice. But when the asymmetry is caused by excessive muscle dynamics, as is most often the case in healthy individuals, it is much easier and less risky to correct the underlying disease instead of creating an irreversible injury to the healthy tissue. The open brow lift is a rare indication in cases of asymmetrical ptosis of the eyebrow with additional surplus of skin. The overall results are good and permanent. Endoscopic brow lift is another option, but in our view it is an unnecessarily aggressive one, especially if it is proposed for young patients without any profound complaints other than mild asymmetry and mild aging of the face.<sup>4</sup>



**Figure 3. A,** Pretreatment view of a 43-year-old woman with brow asymmetry. **B,** Posttreatment view of eyebrows 2 weeks after Botox injections.



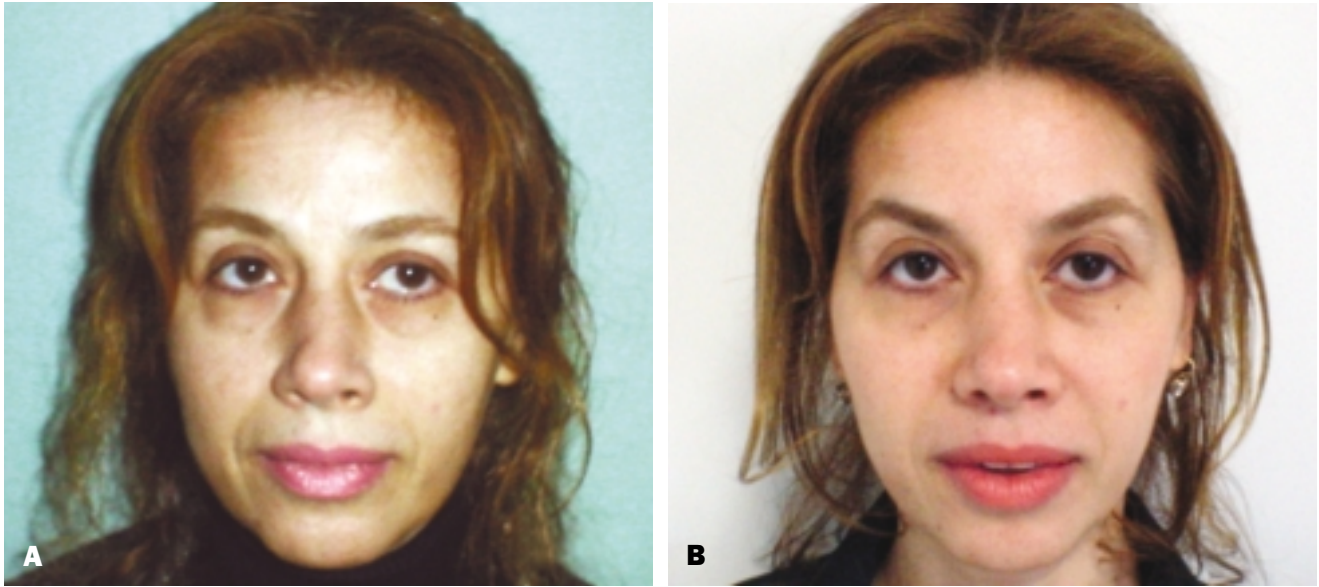
**Figure 4. A,** Pretreatment view of a 61-year-old man with brow asymmetry. **B,** Posttreatment view of eyebrows 2 weeks after Botox injections.

The unilateral injection of Botox for correction of eyebrow asymmetry has been described in the literature discussing facial nerve paralysis cases as well.<sup>3</sup> In one study, the author experienced difficulty in finding the exact dosage to correct the disorder unilaterally without creating a reversed asymmetry.<sup>4</sup> This difficulty was the result of the unilateral treatment of asymmetry.<sup>8</sup> Furthermore, complications developed in three of the five patients in this study, an exceptionally high rate. This was probably due to the use of additional procedures to achieve the desired symmetry because of the difficulty of the unilateral correction. On the other hand, our data demonstrate that significant correction of asymmetry can be achieved simply by bilateral and

symmetrical chemodenervation of the primary depressors and elevators of the eyebrows, resulting in a symmetrical standstill of the eyebrows in a neutral position, a technique that avoids the difficulties and risks of unilateral treatment.

In our series, 83 of 115 patients were successfully treated, whereas no improvement was seen in 11 patients. The failure in these cases is probably due to underlying congenital skeletal asymmetries. According to our experience, those patients with an asymmetry of more than 4 mm should be warned that secondary injections might be needed. After a trial of two Botox injections, if asymmetry still continues, it is necessary to recommend another method to solve the problem. In all the





**Figure 5. A,** Pretreatment view of a 46-year-old woman with brow asymmetry. **B,** Posttreatment view of eyebrows 2 weeks after Botox injection.

**Table 4. The distribution of asymmetry in the study group after Botox injections**

Asymmetry between the eyebrows	0-1 mm	2 mm or more	No change
Number of patients	83	21	11

other individuals, an improvement to some degree of existing asymmetry was noted.

**Conclusion**

Hyperkinetic eyebrow asymmetry is a common problem in patients seeking periorbital rejuvenation. Aesthetic surgeons need to draw attention to this problem in preoperative consultations to minimize postoperative dissatisfaction with respect to brow symmetry after surgery or Botox treatments.

In most cases, eyebrow asymmetry is due to muscle dynamics that affect eyebrow height and shape. As a result, any treatment should focus on both eyebrows. We propose that bilateral chemodenervation of the primary depressors and elevators of the eyebrows results in a symmetrical standstill of the eyebrows in a neutral position. Botulinum toxin A therapy is a problem-oriented, safe, and reproducible method for correction of eyebrow asymmetry that provides significant control over eyebrow symmetry, height, and shape. ■

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