

International  
Journal of  
Cosmetic  
Surgery  
and  
Aesthetic  
Dermatology


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Mary Ann Liebert, Inc.  publishers

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# Cosmetic Denervation with Botulinum A Exotoxin

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## ABSTRACT

Cosmetic denervation has gained a lot of popularity in recent years, becoming the fifth most performed cosmetic procedure in the United States and a \$100 million business. The cosmetic use of Botulinum toxin has been very successful because it is safe, effective, time-effective, and a repeatable treatment for facial wrinkles.

## INTRODUCTION

**B**OTULINUM A EXOTOXIN has been used for more than 20 years as a treatment for strabismus and blepharospasm. Nowadays botulinum toxin is used for the treatment of several involuntary muscular spasms and neuromuscular disorders, hemifacial spasm, spastic dysphonia, torticollis, dystonic tics, poststroke spasticity, essential tremor, dyssynergy of the urinary sphincter, and also in patients with seventh nerve palsy, corneal ulcer, or severe Graves' ophthalmopathy by inducing a ptosis. It has also been used in lower lid entropion.

Credit needs to be given to Jean and Allais-tair Carruthers, who were pioneers in bringing botulinum toxin into cosmetics. Cosmetic denervation has gained popularity in recent years, becoming the fifth most frequently performed cosmetic procedure in the United States and a \$100 million business. With the fast pace of life more and more younger patients are looking for the lunch time or weekend procedure. The traditional approach to facial rejuvenation with surgery, laser resurfacing, and chemical peeling has a substantial morbidity and a long recovery time. It is not interesting

for the baby boomers who have wrinkles but have no time.

Blepharoplasty, however, still remains the most frequently requested cosmetic procedure, highly satisfying, and allowing for a very fast recovery. For those who have undergone blepharoplasty, the remaining forehead lines, crows feet, and glabellar lines are very often cosmetically displeasing. Botulinum toxin allows one to enhance the result of the blepharoplasty by treating these wrinkles. To achieve the best results in the use of botulinum toxin, it is important to understand the underlying anatomy.

## CROW'S FEET

The orbicularis muscle is subcutaneous and is the protractor of the eyelids. The orbicularis muscle has two components. The preorbital portion and the palpebral portion are anatomical as well as physiological divisions. The orbital orbicularis arises from the anterior limb of the medial canthal tendon and the periosteum above and below it, taking a circular course overlying the orbital rim. It is involved in



FIG. 1. Patient with crow's feet on the left side (A) before injection of botulinum toxin and (B) 2 weeks after botulinum toxin injection.

forced eyelid closure (winking and blepharospasm) and in facial expressions. It is the thickest and most powerful component of the orbicularis muscle. The palpebral portion is divided into a preseptal and pretarsal orbicularis. The preseptal orbicularis overlies the septum of the upper and lower lid. It arises anteriorly from the medial canthal tendon and posteriorly from the lacrimal fascia and posterior lacrimal crest. Laterally the preseptal muscle forms the lateral palpebral raphe overlying the lateral orbital rim. The preseptal orbicularis is involved in eyelid closure and in winking and blinking. The pretarsal orbicularis arises anteriorly from the interior limb of the anterior canthal tendon and posteriorly at the posterior lacrimal crest. The deep head of the pretarsal muscle encircles both canaliculi to facilitate tear drainage. The upper and lower segments of the pretarsal orbicularis fuse in the

lateral canthal area to become the lateral canthal tendon.

Treatment of crow's feet (lateral orbital area) with botulinum toxin aims to erase the wrinkles (Figs. 1, 2). The lateral fibers of the orbital orbicularis are injected with botulinum toxin. We inject 2-3 units (dilution 1ml/100 U) in the horizontal line of the lateral canthus 1 cm from the orbital rim. A second injection is made 1.5 cm above the lateral canthus and a third one 1-1.5 cm under the orbital rim. Injecting more than what is requested or more interiorly will cause an intraorbital diffusion and a diplopia from the paresia of the lateral rectus muscle. You also do not want to inject too low because sagging will result. Care must be taken not to have the three injection sites too medial so as not to cause palpebral edema by lymphatic drainage insufficiency. If we desire only to raise the brow, we will inject only the upper part of



FIG. 2. Same patient (A) before and (B) after injection on the right side.



FIG. 3. Patient with horizontal frontal lines (A) before injection and (B) 10 days after botulinum toxin injection.

the orbicularis, since laterally the orbicularis muscle is a depressor of the brow. In the case of hypertrophic orbicularis of the lower lid we inject 1 unit of botulinum toxin in the pretarsal orbicularis and massage it with a cotton-tipped applicator. A snap test is requested to check for lid laxity and avoid the round eye appearance.

#### FOREHEAD AND GLABELLA

The frontalis muscle arises with the skin and superficial fascia of the eyebrow and passes superiorly to insert on the galea about midway between the coronal suture and the brow. The frontalis muscle is the main elevator of the brow. It thins up temporally and this may account for some of the temporal brow ptosis we

see in involutional changes. The frontalis muscle is usually absent in the middle 2.5 cm of the upper central forehead. Normally injections in this central upper triangle can be avoided.

The corrugator supercillii has its origin from the periosteum of the nasal process of the frontal bone. The muscle fibers insert into the skin of the medial eyebrow. The corrugator fibers blend with the deeper portions of the orbital orbicularis and frontalis muscle. The corrugator is obliquely oriented. It produces the vertical glabellar furrows. The procerus muscle originates from the lower part of the nasal bone. It is continuous with the inferior medial margin of the frontalis muscle. The procerus produces a down-pulling of the medial end of the eyebrow and causes the horizontal furrowing in the glabellar area.



FIG. 4. Horizontal frontal lines during active contraction (A) before and (B) after injection.



FIG. 5. Before (A) and 2 weeks after (B) injection of botulinum toxin in the glabellar area.

Treatment of the horizontal frontal lines is determined by the size of the forehead (Figs. 3-5). The horizontal wrinkles determine the site and the number of injections needed. We inject 2 units (1 ml/100 U) in the muscle and not in the wrinkle along the horizontal lines. We avoid injecting too laterally and too inferiorly.

Botulinum toxin is contraindicated in case of significant brow ptosis. One should always avoid injecting the frontalis muscle 2 cm above the eyebrow. In the glabellar area five or six injections are given with 10-20 units. The injections are located in the belly of the corrugator muscle on each side and medially in the right and left glabella, and one or two injections for the procerus muscle. Direct pressure at the supraorbital rim reduces the potential for the fusion of the toxin into the levator muscle.

### DISCUSSION

Each facial rejuvenation procedure must address the cause of the cosmetic condition it is trying to correct. Blepharoplasty addresses redundant skin on the upper lid and fat prolapse ( $\pm$ skin) on the lower lids. For the hyperfunctional mimetic facial lines, botulinum toxin injections improve the cosmetic appearance and enhance the results of blepharoplasty by fading or erasing horizontal forehead creases, glabellar frown lines, and the crow's feet, and by elevating the eyebrows if that is desired. If we desire

to elevate the entire eyebrow, both the medial brow depressor (corrugator, procerus and the medial portion of the orbicularis) and lateral brow depressor (the lateral portion of the orbicularis) are injected. The lateral eyebrow elevation is the most frequently requested and most desirable shape. Therefore, only the lateral brow depressors are injected, leaving the frontalis muscle action on the brow position uninhibited.

Facial lines due to age-related loss of dermal elasticity or actinic changes will respond incompletely to the toxin and should be treated with adjunctive modalities. For this reason patients aged 30-50 are the most optimal recipients of botulinum toxin injections.

### CONCLUSION

Botulinum toxin is an important addition to and very valuable in facial cosmetic surgery. It has been successful because it is safe, effective, time effective and a repeatable treatment for facial wrinkles. In the future a ready-to-use, longer-acting Botulinum toxin, specific for cosmetics and with a different name will benefit more patients.

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