Botox For Rhytides of the Forehead - A Case Report

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Abstract: Positive effects on mood have been observed in subjects who underwent treatment of fore head frownlines with botulinum toxin and, in an open case series, depression remitted or improved after such treatment. This study shows that treatment of the forehead region with botulinum toxin may shortly accomplish a strong and sustained alleviation of depression in patients, who did not improve sufficiently on previous medication. It supports the concept, that the facial musculature not only expresses, but also regulates mood states.

Keywords: Facial feedback, Emotional contagion, Major depression, Botulinum neurotoxin.

I. Introduction

Botox is a Botulinum Toxin derived from Clostridium botulinum. It prevents the release of the neurotransmitter acetylcholine from axon endings at the neuromuscular junction and thus causes flaccid paralysis. There are seven types of botulinum toxin, named A-G. In cosmetic applications, botulinum toxin is considered safe and effective for reduction of facial wrinkles, especially in the uppermost third of the face. Injection of botulinum toxin into the muscles under facial wrinkles causes relaxation of those muscles, resulting in the smoothing of the overlying skin. Smoothing of wrinkles is usually visible three days after treatment and is maximally visible two weeks following injection. The treated muscles gradually regain function, and generally return to their former appearance three to four months after treatment. Muscles can be treated repeatedly to maintain the smoothed appearance.

Anatomy

Contraction of the frontalis muscle elevates the brow and results in dynamic transverse forehead rhytides. The frontalis is the principal elevator of the brow, originating in the galea aponeurotica and inserting into the subcutaneous tissues and deep dermis of the skin overlying the superciliary arch. Although commonly depicted as 2 distinct muscle bellies, anatomic variation is common, with many showing significant medial overlapping and structural difference between the medial and lateral aspects. The glabellar complex depresses the medial brow and consists of the paired corrugator superciliimuscles and the central procerus muscle. The action of the medial orbicularis is also to depress the brow, but its contribution is weak by comparison. The corrugators originate on the frontal bone medially, where their fibers can interdigitate with those of the medial preorbital orbicularis oculi, and insert into the dermis of the forehead, just above the eyebrow at the midpupillary line. Their primary action is to mediallyize and depress the medial brow. Hyperactivity contributes to vertical glabellar rhytides. The procerus muscle is a vertically oriented, midline structure, originating from the soft tissues overlying the nasal bones and inserting into the skin of the lower central forehead, superior to the nasal root. Contraction of this muscle produces transverse horizontal rhytides at the nasal root.

Treatment Recommendations

The goals of treating the forehead are to soften the appearance of dynamic rhytides without giving an unnatural, unexpressive appearance and avoiding iatrogenic brow ptosis. The efficacy and safety of BTA in treating this area of the face have been well documented in the literature.

Case Report

Treatment of the forehead is highly variable because of the anatomic variability of the frontalis muscle and characteristics of each patient's animation patterns. Before injection, any brow asymmetry is noted and discussed with the patient, as this may only come to their attention after treatment. Patients are asked to forcefully elevate their brow to assess the strength of frontalis contraction and the location of dynamic rhytides. The frontalis is typically injected in 4 to 6 sites, with care taken to stay at least 1 to 2 cm above the supraorbital rim to avoid brow or eyelid ptosis.
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The authors prefer to inject each belly of the frontalis in a V-shaped pattern; however, this varies based on each patient’s muscular patterns. Muscle size, strength, and location can be estimated by asking the patient to frown maximally. Any asymmetry in muscle strength or contractions should be carefully evaluated before injection. The authors typically inject in a 5-point V pattern, with 2 injection sites in each corrugator and 1 in the central procerus. Injections should be kept a minimum of 1 cm above the orbital rim to avoid diffusion into the levatorpalpebrae superioris muscle, causing iatrogenic ptosis (Picture 3). The patient is asked to frown to confirm the location of each muscle belly just before injection. In patients with mild muscle activity, 3 injection points may be used instead.

II. Discussion

In 1820, Justinus Kerner, a small-town German medical officer and romantic poet, gave the first complete description of clinical botulism based on extensive clinical observations of so-called “sausage poisoning”. Following experiments on animals and on himself, he concluded that the toxin acts by interrupting signal transmission in the somatic and autonomic motor systems, without affecting sensory signals or mental
functions. He observed that the toxin develops under anaerobic conditions, and can be lethal in minute doses. His prescience in suggesting that the toxin might be used therapeutically earned him recognition as the pioneer of modern botulinum toxin therapy. In 2002, following clinical trials, the FDA approved Botox Cosmetic, botulinumA toxin to temporarily improve the appearance of moderate-to-severe glabellar lines.

The cosmetic effect of BTX-A on wrinkles was originally documented by a plastic surgeon from Sacramento, California, Richard Clark, and published in the journal Plastic and Reconstructive Surgery in 1989. Canadian husband and wife ophthalmologist and dermatologist physicians, JD and JA Carruthers, were the first to publish a study on BTX-A for the treatment of glabellar frown lines in 1992. After formal trials, on April 12, 2002, the FDA announced regulatory approval of botulinum toxin type A (Botox Cosmetic) to temporarily improve the appearance of moderate-to-severe frown lines between the eyebrows (glabellar lines). Subsequently, cosmetic use of botulinum toxin type A has become widespread. The results of Botox Cosmetic can last up to four months and may vary with each patient.

Botulinum toxin is synthesized as a 150-kDa protein that undergoes posttranslational modification into a 100-kDa heavy chain and a 50-kDa light chain, linked by a disulfide bridge. The heavy chain binds to the presynaptic neurons at the neuromuscular junction and facilitates entry of the light chain into the cell cytoplasm. There, each serotype’s light chain targets a component of the soluble N-ethylmaleimide-sensitive factor attachment protein receptor (SNARE) complex, which it cleaves to and thereby inactivates. The components of the SNARE complex are all essential for microvesicle fusion and release of stored neurotransmitter. BTA targets synaptosomal-associated protein, 25 kDa BTB target synaptobrevin, also known as vesicle-associated membrane protein. By inhibiting the release of stored neurotransmitter at the neuromuscular junction, botulinum neurotoxins cause a flaccid paralysis of target muscles. Paralysis and a near-complete loss of motor end plate potentials occur within a few hours of botulinum neurotoxin injection; however, the clinical effect may not become evident for up to 1 week after administration. The latency to clinical effect may be caused by spontaneous, non-vesicle-associated release of acetylcholine at the neuromuscular junction. The neuromuscular blockade from botulinum toxin administration is irreversible. Axonal sprouting and the formation of new neuromuscular junctions are responsible for the dissipation of clinical effects over time.

Currently, there are 4 commonly used preparations of botulinum toxin: onabotulinumtoxin (Botox; Botox Cosmetic, Allergan, Irvine, CA), abobotulinumtoxinA (Dysport; Ipsen, Ltd, Berkshire, UK), incobotulinumtoxinA (Xeomin; Merz Pharmaceuticals, Frankfurt, Germany), and rimabotulinumtoxinB (Myobloc; Solstice Neurosciences, San Francisco, CA).

III. Conclusion

The findings of this study support the use of BTA for the treatment of hyperkinetic lines of the face although further studies with more sample size are required.
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References


