

Treating the lower face and neck with neuromodulators: benefits and complications

Abstract

This article will educate practitioners on the possibilities that botulinum toxin type A can offer their patients, such as effectively tightening and lifting the lower face and neck, using neuromodulators. The author will review ageing factors, discuss anatomy and physiology, explore the mechanism of action of botulinum Toxin type A on the muscles injected, as well as the antagonistic effect on the opposing muscles, and list common complications and how to avoid or manage them. After reading this article, practitioners will understand the mechanism of action for botulinum toxin type A in the lower face and neck and be more comfortable safely offering this service to their patients. Using botulinum toxin type A for re-contouring and re-draping of the face and neck is a novel and effective approach for aesthetic practitioners.

Key words

► Botulinum toxin type A ► Neuromodulators ► Lower face ► Off-label

Since botulinum toxin type A was approved by the Food and Drug Administration (FDA) (2002) for the treatment of moderate-to-severe frown lines, it has become the number one non-surgical aesthetic procedure in the USA (American Society for Aesthetic Plastic Surgery, 2012). However, despite the benefits of reducing visible signs of ageing with botulinum toxin type A (Carruthers and Carruthers, 1992), and the recent buzz surrounding this injectable for treating the lower face and neck (Levy, 2007), in the author's experience injectors are using it for the upper face alone.

In this article, the author will explore the benefits of treating the lower face and neck with botulinum toxin type A, highlight important anatomical locations, advise on dosing and product placement, and draw attention to any likely post-procedure complications.

Signs of ageing: lower face and neck

Over time, decreased levels of collagen, subcutaneous fat loss and the consistent downward pull exerted by depressor and platysma muscles takes its toll on the lower face

and neck, leading to volume loss, sagging and skin deterioration (Goldman and Wollina, 2010). As the skin is forced to drape down into lower descent, the weight gradually accentuates horizontal and radial neck rhytides (Brandt and Bellman, 1998). First of all, the mouth loses its buttressing support, creating the perpetual inversion of both the upper and lower lips, as if "rolling in on top of itself" leaving overhangs as evidence of the once plump existence (Goldman and Wollina, 2010). Then, around the chin, hyperactivity of the mentalis and orbicularis oris muscles causes a deterioration of the skin's integrity revealing a pebbled, wavy appearance often referred to as the 'peau d'orange'; or orange peel skin (Raspaldo et al, 2011).

Bone loss also lends itself to a decrease in support for skin tissue to be upheld, creating an increase in laxity around a previously defined jawline. Platysmal bands become more prominent, creating an aged, skeletal look. As the platysma muscle separates, it loses the buttressing benefit of holding up the subplatysmal fat pad and the fat descends presenting as submental and subplatysmal fat deposits, which add to the look of ageing in the neck (Brandt et al, 2005). Moreover, Levy (2007) found it possible that the constant downward pulling action of the platysma muscle could lead to the development of jowls, loss of mandibular definition, and herniation of the subplatysmal fat pad.

Use of botulinum toxin to treat the lower face and neck

Fifteen years ago, Brandt and Bellman (1998) speculated that injecting the platysmal bands with botulinum toxin type A would minimise the appearance of horizontal rhytides and skin laxity that developed over the muscle with age. After injecting patients' depressors, they reported an 'overall tightening of the neck and re-contouring of the jawline' (Brandt and Bellman, 1998).

Practical considerations

Anatomy

Before injecting the lower face and/or neck, it is important to consider botulinum toxin's mechanism of action, how the drug affects the muscles being treated, and the impact it could have on any antagonistic muscles. The muscles in the lower face/neck regions are necessary for daily use not only for dynamic facial expressions, but also in speaking, chewing, and lip competence. Every muscle



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has antagonistic muscles, and it is essential to define this relationship when trying to deduce what the result of injecting botulinum toxin type A into a particular muscle will be (Raspaldo et al, 2011) (*Figure 1*). Consequently, a careful assessment of muscles in animation is crucial, and patient education, photographic documentation (in animation also) and informed consent needs to be a consistent part of practitioners' treatment protocol.

Dilution

When treating the intersecting muscles of the lower face, aesthetic practitioners should take time to consider toxin dilution. Although it would make more sense to use highly concentrated solutions for a more precise distribution to muscles in the lower face (Raspaldo et al, 2011), when treating the neck it might be advantageous to use a less concentrated solution to allow the drug to diffuse more evenly over a broad surface area (Drewa, 2011).

Protocols and off-label prescribing

As with any medical aesthetic procedure, practitioners must work within their clinic's protocols and keep in mind that any treatment outside of areas that are approved are considered as 'off-label' use of botulinum

toxin type A (FDA, 2002). Careful assessment prior to patient selection is crucial. One may consider that lower face and neck botulinum toxin type A brings with it a different, potentially more subtle outcome than in the upper face. Patients should be made aware of the nuances of this application of botulinum toxin type A in their consultation. Pregnant, lactating patients, those with a neuromuscular disease, or those with an active infection in the area of the application, are to be avoided.

Pain relief

Although topical anaesthetic is not routinely applied before injecting the lower face and/or neck, it can be used if the patient is particularly sensitive to pain. However, ice may be equally as effective as a topical anaesthetic, and also has the added benefit of vasoconstriction, which could decrease bruising, particularly in areas of higher vascularity (e.g. along the mandible).

Infection control

Prepare the skin by cleansing the area and removing all make-up before injecting the skin. As a final disinfectant, alcohol is typically applied to the skin and left to evaporate before the procedure begins.

Lower face muscles and their opposition

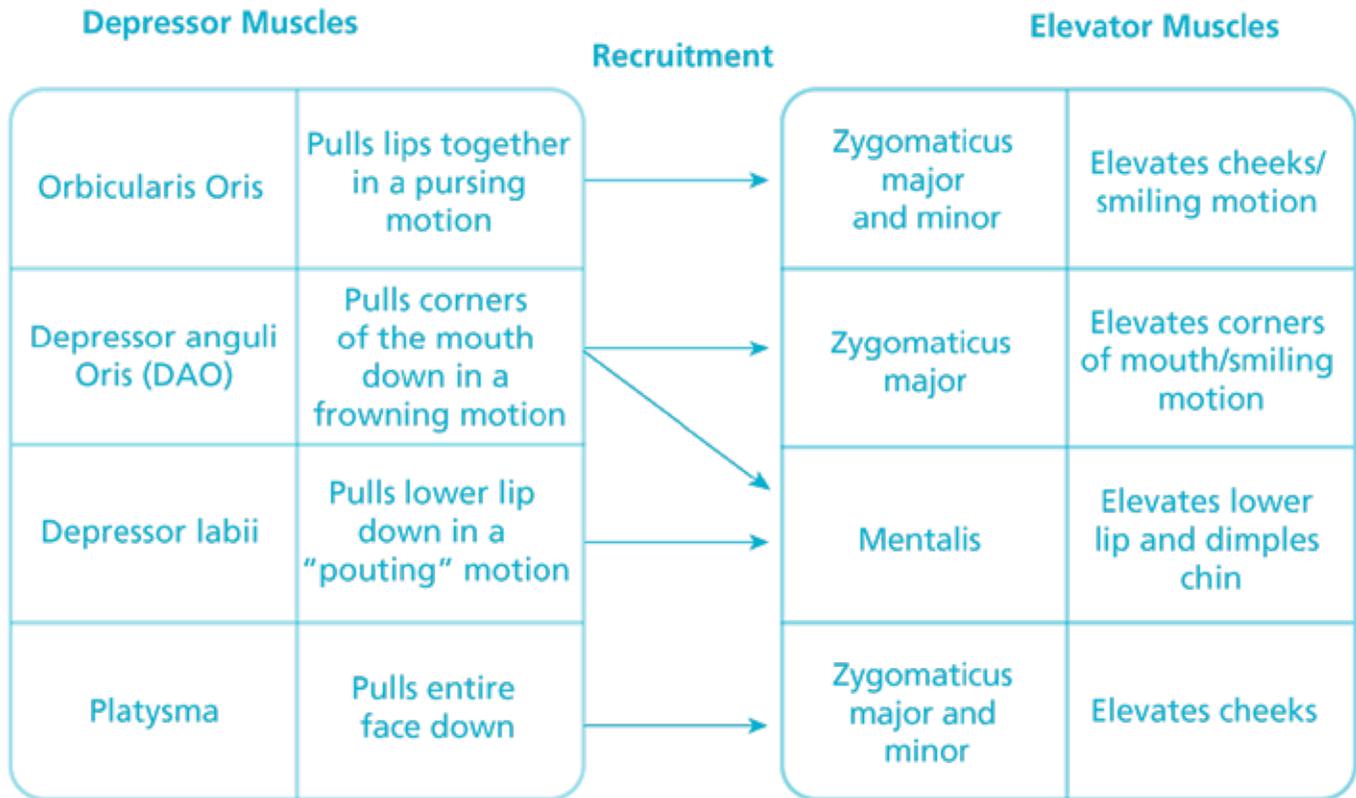


Figure 1. Effects of treating muscles in the lower face with botulinum toxin type A

Areas of treatment

Masseter muscle

The width and shape of the lower face is determined by the mandibular bone, subcutaneous tissue and masseter muscle (Lee et al, 2007). The masseter is a short, thick, rectangular muscle, which has two layers (superficial and deep). Patients who have a predominantly square face may present to aesthetic practitioners with a desire to create more contoured, feminine and tapered facial appearance, which can be done through injecting the masseter muscle with botulinum toxin type A (Figure 2). It is postulated that the predominant mechanism of action when treating masseteric hypertrophy with botulinum toxin type A is the ability of the muscle to atrophy in response to the botulinum toxin type A. Muscle atrophy then causes the shape of the masseter to flatten (von Lindern et al, 2001).

Following repeated injections, the masseter muscle has been shown to respond for at least 12 months, and possibly even transform into an incomplete recovery of excessive muscle function (Lee et al, 2007). This would be a desired effect for patients who present with painful temporomandibular joint disorder symptoms.

Placement

Prior to injecting botulinum toxin type A, it is helpful to outline patients' masseter muscle by asking them to bite down or clench their jaw. To do this, practitioners should palpate for clearly defined muscle borders that are located preauricularly and, for precision, outline the muscle with a white pencil. To avoid diffusion into the risorius muscle, all injection points should be limited to 1 cm within the masseter's border (Raspaldo et al, 2011).

Dosing

Using 1–5 individual injection points, practitioners should inject 18–30 units of botulinum toxin type A into each side of the face, deeply perpendicular to the skin surface (Raspaldo et al, 2011).

Complications

Owing to the masseter's size and strength, there is little danger of affecting patients' ability to masticate with appropriate dosing. However, if toxin is placed improperly (e.g. if injections are too medial to the masseter muscle), practitioners may inadvertently affect the depressor an-



Figure 2. Before and after: masseter muscle

gularis oris muscle, or the depressor labii, causing an elevation to the lower lip on the affected side.

Another possible complication following improper placement is the potential of the product to affect the risorius muscle. On the affected side, this would cause the smile to not retract as wide, as the function of the risorius muscle is to draw the angle of the mouth outward, and compress the cheek during animation.

Further complications reported following treatment may be a result of dosing issues, and can include speech and mastication disturbances (Raspaldo et al, 2011).

Orbicularis oris muscle

The orbicularis oris is the primary articulator for speech. It is a circular muscle surrounding the opening of the mouth, and consists of several layers of fibers oriented in different directions. Functions of the orbicularis oris include closing the mouth, and the rounding and protrusion of the lips (pursing). Therefore, patients who speak publicly, play an instrument, act, scuba dive, are not good candidates for perioral botulinum toxin type A.

By exerting a constant pull on the upper and lower lips, the orbicularis oris gradually forms vertical perioral lines, referred to as 'smokers lines' or 'lipstick lines' (Raspaldo et al, 2011). However, treating the orbicularis oris muscle

with botulinum toxin type A can reduce the inversion of the lip that occurs during the ageing process. Slight augmentation of the lip can also be seen, as the natural lip is rolled out when relaxed. Moreover, treatment causes radial lip lines to soften, and prevents any additional lines.

Results following injection to the orbicularis oris tend to last around 8–10 weeks. This is a result of the low dosage used during treatment, as well as the hyperfunctional activity of the muscle (particularly in women).

Dosing

Dosing should start low when treating the orbicularis oris, using a total dose of 1–2 units of botulinum toxin type A (Sengelmann et al, 2005). In the author's experience, it is beneficial to add one unit of botulinum toxin type A per every subsequent visit, until the maximum dose is reached without side effects. The maximum dose for treating the orbicularis oris is usually under 10 units (Carruthers et al, 2008; Raspaldo et al, 2011).

It is recommended that practitioners treat either the upper or the lower lip on the first visit, adding in the other on a subsequent visit. Practitioners should continually counsel patients, as they may not see or feel anything at first, or they may feel some changes in their lip competence during the first two weeks post procedure.

Placement

If aesthetic practitioners are looking to thin out patients' vermilion border, they may choose to inject the vermilion border directly. However, if the aim of treatment is to address patients' radial lip lines, it would be more appropriate to place injections 3–5 mm above the vermilion border. In both of these cases, always stay medial to the alar rim of the nose to avoid inadvertent injection into the modiolus, the chiasma of where several muscles of facial expression join together, controlling the corner of the mouth (Finn and Cox, 2005).

If the integrity of the philtral columns is intended to be maintained, or indeed heightened, practitioners should also avoid injecting into the philtral columns. Leaving the columns untreated elicits a heightening in function of the medial portion of the orbicularis oris, which accentuates the curves of the Cupid's bow. This strong definition of the philtrum is seen in youth, and therefore can be considered a desirable outcome (Tan and Glogau, 2005).

On the lower lip, practitioners can cover the span in between the alar rim and across the entire lower lip. Injection points can be perpendicular to the tissue in one or two spots, or parallel and threaded across the stretch of the area that needs to be addressed.

Complications

When injecting the orbicularis oris, practitioners should aim to avoid the modiolus, which elevates the labial commissures during smiling. The modiolus is the chiasma of where several perioral muscles of facial expression join

together, controlling the corner of the mouth (Finn and Cox, 2005; Raspaldo et al, 2011). If practitioners inadvertently inject the modiolus, patients will have difficulty smiling, either unilaterally, or bilaterally. To avoid this negative outcome, aesthetic practitioners should stay medial to the alar rim.

Another muscle to avoid is the depressor labii, which is located directly inferior to the orbicularis oris. If placement occurs into this muscle, it will usually happen unilaterally and the affected side will elevate. This will cause the contralateral side to depress even further, creating a 'stroke' like look, where on the ipsilateral side of the inadvertent injection the lip is elevated and on the contralateral side of the inadvertent injection, the outcome will be lower lip ptosis (Finn and Cox, 2005). If this complication occurs, practitioners should inject the lower side with 1–2 botulinum toxin type A units to elevate the low side, creating symmetry until the effect wears off on both sides, and the bilateral height of the lower lip returns to normal (Krishtul et al, 2005).

Other potential complications include telangiectasia at the injection site, difficulty articulating words and smiling, decreased facial expression, asymmetric smile, flattened Cupid's bow, increased depressor septi function, decreased mouth competence and difficulty sipping or drinking from a straw (Sengelmann et al, 2005). To avoid these side effects, practitioners need to have a heightened awareness of facial anatomy, and ensure they start treatment with very low doses of toxin.

Depressor anguli oris muscle

The depressor anguli oris muscle is triangular and originates at the external oblique line of the mandible. Its function is to protrude the lower lip and moves it downward. The fibers extend upward and are inserted into the angle of the mouth. It is continuous with the platysma at the origin with the orbicularis oris and risorius at their insertion points. Their action is to depress the angle of the mouth. Acting together with the mentalis, their contributing role to ageing is to draw the angle of the mouth directly backward, in an arc-like 'frowning' fashion.

Treating the depressor anguli oris muscle with botulinum toxin type A can reduce signs of facial ageing by releasing the depressing muscle, allowing the corner of the mouth to become unopposed and able to elevate naturally, revealing an aesthetically pleasing 'smile' effect.

Dosing

Average dosing for the depressor anguli oris ranges from 3–5 units of botulinum toxin type A per each side of the face (Sengelmann et al, 2005).

Placement

There are two specific landmarks to identify when injecting the depressor anguli oris muscle. Practitioners can first locate the masseter and then move one fingerbreadth

away to inject medial to their finger. Alternatively, practitioners can use a cotton tip applicator and follow the applicator down the nasolabial fold. At the mandibular angle, practitioners are advised to inject botulinum toxin type A at a 90-degree angle. This technique helps the injector stay lateral and inferior to the depressor labii muscle, avoiding an inadvertent injection point potentially causing asymmetry (Sengelmann, 2005; Levy, 2007).

Mentalis muscle

The mentalis muscle originates at the incisive fossa, where its fibers run downward and are inserted into the skin of the chin. The action of the mentalis' fibers is to raise and protrude the lower lip, which consequently wrinkles the skin over the chin (Finn and Cox, 2005). Treating the mentalis with botulinum toxin type A can smooth out rolled, uneven chins (*Figure 3*). Wrinkling up the chin, has been shown to have a negative effect on people's appearance, as it emits a negative message of uncertainty, or frailty (Raspaldo et al, 2011).

Dosing

When injecting the mentalis, dosing can vary from 2–8 onabotulinum toxin type A units (Sengelmann et al, 2005). This variance is based on the size of the muscle, its presentation, and goals for treatment.

Placement

Placement depends on the presentation of the muscle. If there is a definitive cleft in the chin, the dose should be divided into equal parts on each side of the cleft. For example, if you are injecting 4 units, 2 units should be injected on either side of the cleft. However, if no cleft is present, practitioners can superficially place multiple injections across the entire muscle. Unless the area is being injected very superficially with intradermal injections, practitioners should keep injections near the midline and as close to the mandible as possible to avoid affecting the function of the depressor labii.

Complications

Following migration or improper placement, it is possible to affect the depressor labii and create an asymmetrical smile by elevating the side that has been inadvertently injected (Raspaldo et al, 2011). As a result, the contralateral side will depress even further, creating a 'stroke' like look. If this occurs, practitioners should inject the lower side with 1-2 botulinum toxin type A units to elevate the low side, creating symmetry until the bilateral height of the lower lip returns to normal (Krishtul et al, 2005). Other dose-dependent complications include decreased mouth competence, difficulty sipping or drinking out of a straw and smile changes at the mandibular angle.



Figure 3. Before and after: mentalis muscle

Platysma muscle

The platysma is a broad, thin sheet of muscle that originates in the upper portion of the clavicle (Carruthers and Carruthers, 1999). In 15% of patients, the platysma interlaces at approximately the thyroid cartilage. This creates a type of sling, or corset to the submental tissue. In 75% of patients, the bands of the platysma decussate a few centimetres below the insertion in the mandible. In these patients there is a corset as well, but because it is smaller, it is less effective in securing the submental fat pad. In 10% of patients the platysma never interdigitate but instead present as two separate muscles at the midline. This presentation offers no vertical pressure against the submental fat pad, and therefore these patients tend to present with more prominent submental adiposity (Brandt and Bellman, 1998; Brandt, 2005). All three types vary in terms of where the muscle decussates its interlacing fibers submentally (Brandt et al, 2005). Its posterior fibers insert

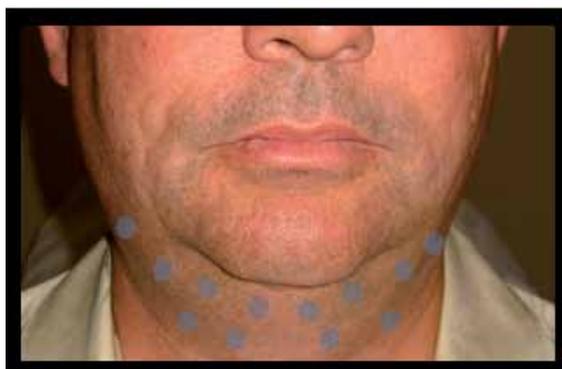


Figure 4. Injection points for thinning out the neck

into the depressor anguli oris and risorius muscles, as well as into the orbicularis oris.

Contraction of the platysma draws the mandible, lower lip, and oral commissures downward and lateral (Finn and Cox, 2005). When those structures move, a residual wrinkling of the neck skin in an oblique direction occurs, contributing to the signs of ageing on the neck, lower face and jowls (Brandt and Bellman, 1998). Therefore, as people age, the anterior portion of the platysma muscle separates to form multiple ageing bands.

Dosing and placement

It is easier to find the most definitive portion of the cord when patients are completely upright, or alternatively trying hard to sit forward (as in doing sit-ups). When the cord has been found, practitioners should grasp the area between their thumb and forefinger. The length of each band should then be treated with injection points every 1.5 cm (1/2 inch) or so down the line (Brandt et al, 2005). Further to this, titrating the dose as practitioners descend downward on each band will effectively treat the superior portion, which tends to respond best with higher doses. For example, just under the mandible for the first two or three vertical injections one could place 3-4 units. Then, as injections descend down inferiorly, the dose could drop to 1-2 units.

Appropriate dosing for the platysma is 11-20 units of botulinum toxin type A per band, with a maximum dose per treatment of 60 units. (Carruthers et al, 2008). Injections should remain superficial to reduce the potential for dysphagia or dysphonia (Raspaldo et al, 2011).

Neck wattle

Because of the presenting variance of the separation of the platysma, about 90% of patients could benefit from using botulinum toxin type A to treat 'neck wattle' or 'turkey neck' with botulinum toxin type A. According to Brandt et al (2005): 'Relaxing the platysma with botulinum toxin type A allows the unopposed contraction of the fibers overlying the fat pad and therefore applies vertical pressure onto the fat pad, which causes an aesthetically pleasing retraction of the submental fat pad.' Additionally, the pterygoid muscles may have an antagonistic effect on the platysma, producing a thinning effect on the neck. When muscles such as the depressor angularis oris and the platysma are relaxed, it is postulated that the unopposed mentalis muscle compensates, allowing the chin to elevate, taking the lax tissue with it as it slides forward and upward (Levy, 2007). Further to this, the levator anguli oris, zygomaticus major and minor play a crucial antagonistic role in strategic facial lifting (Goldman and Wollina, 2010). When only portions of the platysma muscle are isolated with their injections, this allows isolated portions of the facial elevators to work in compensation that much harder in compensation (Levy, 2007; Goldman and Wollina, 2010).

Dosing and placement

First of all, practitioners should find the area of most laxity and grasp the area between their thumb and forefinger. Then, inject lax tissue with 15-25 units of botulinum toxin type A. The pattern will typically end up being distributed in a vertical line down the medial aspect of the neck, using around 8-10 injection points.

Alternatively, if the laxity or heaviness extends farther out laterally, practitioners should inject in a "T" type pattern using 10-15 separate injection points (*Figure 4*).

Necklace lines

Loss of collagen during the ageing process lends itself to lax, deteriorated skin tissue (Tan and Glogau, 2005). This breakdown leads to decreased structural support around the lower face and neck, causing the skin to fold over onto itself, and leaving horizontal lines that are sometimes referred to as necklace lines (Brandt and Bellman, 1998). Necklace lines are best treated with a multimodality approach, incorporating the use of stimulatory skin care. When treating necklace lines and generalised neck laxity with botulinum toxin type A, the target muscle is the platysma muscle.

Dosing and placement

Practitioners should locate the horizontal necklace lines and inject on either side in a matrix-like pattern.

The depth should be in a superficial plane, creating intradermal wheels as the 15-30 botulinum toxin type A units are dispersed above and below the targeted wrinkle throughout the entire neck (Brandt et al, 2005).

Generalised neck laxity

When treating generalised neck laxity with botulinum toxin type A, there is no longer a single target muscle. Instead, practitioners will be treating a combination of the utmost superficial fibers of the platysma, as well as the very superficial arrector pili muscle. This microscopic band of tiny smooth muscle attaches to the base of every hair follicle on one end, and the dermal tissue on the other (Mal and Mongy, 2005). When contracted, this muscle's role is to elevate the skin tissue (Mal and Mongy, 2005); however, when injected with botulinum toxin type A, the smooth muscle will respond immediately with a skin retraction which could be likened to a 'shrink wrap' contractive effect (Drewna, 2011; Wu, 2011). The skin will subsequently appear to be tighter and more compressed, and any fine horizontal lines will disappear into the tissue. Wu (2011) coined the terms 'mesobotox' or 'microbotox' to describe this chemoresurfacing technique.

Dosing and placement

Practitioners should locate the area of greatest laxity with skin deterioration and inject botulinum toxin

into the utmost superficial plane, creating intradermal wheels. Large quantities of separate injection points (60-75) are dispersed throughout the entire neck in a matrix-like pattern, alternating rows and columns to assure sufficient spread of the drug, delivering a total of 15-30 units (Wu, 2011). The neck is a large surface area to cover, and some dispersion is advantageous, so a larger dilution is recommended (3-6 cc dilution) (Drewa, 2011). Careful injection technique is crucial to achieve the desired outcome, and delivering superficial microdroplets of botulinum toxin type A over the large surface area is key.

Complications

Caution should be taken using this application on patients who have a wide smile that uses the platysma muscle as an accessory to assist in smiling. If injections are placed too deep, the infrahyoid muscles may be affected causing dysphagia or dysphonia (Raspaldo, 2011). There have also been reports of neck muscle weakness with doses that were too high for the individual's muscles (Levy, 2007). Injecting only the central platysmal or lateral platysmal bands at one time may cause recruitment of the untreated bands. Patients should be made aware of this before treatment, so that blame is not placed on the practitioner for 'creating new neck bands'.

Nefertiti lift

The Nefertiti lift was named after Greek goddess Nefertiti, who was known to have a strong, dominant jawline (Levy, 2007). Whereas the primary muscle the Nefertiti lift is targeting is the platysma muscle, part of the platysma complex is the depressor anguli oris (Goldman and Wollina, 2010). The Nefertiti lift is indicated for patients with vertical neck bands, downturned oral commissures and modest laxity around the neck and jawline (Levy, 2007; Goldman and Wollina, 2010). The mechanism of action is to release the depressors and allow the antagonistic elevators, such as the levator anguli oris, and the zygomatic major and minor muscles to increase their workload (Levy, 2007; Goldman and Wollina, 2010). By relaxing the depressor muscles, the elevators have less opposition to movement and the face has been shown to lift (Levy, 2007; Goldman and Wollina, 2010).

Dosing and placement

Landmarks consist of injection points from lateral end below the masseter muscle to the medial area under the depressor labii oris. All injections are submandibular, placed perpendicular to the skin in 4-7 injection points into the platysma. If platysmal bands have started to form under an overly prominent 'jowl' a second or third injection could be placed in a second row to address the additional vertical pull. (See photo below) Average dosing for the Nefertiti lift would range from 15-20 botulinum toxin type A units per side, with 2-5 botulinum toxin type A units in each injection (Levy, 2007).

Conclusion

Botulinum toxin type A has become an integral tool in the non-surgical arsenal for effective treatment of the ageing face and neck. As this industry progresses into a more artistic, yet precise use of botulinum toxin type A into the lower face, we will be able to truly offer our patients a comprehensive treatment for their head to clavicle concerns. The injector should remember that using botulinum toxin type A in the lower face and neck is more likely to result in complications than in the upper face, and perhaps the novice injector should become overly familiar and comfortable with the upper face before branching into the intricacies of injecting the lower face. 

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