

Expert Approaches to Using Botulinum Toxins

Issue 1
Essential Anatomy

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Editorial

Over the past ten years, botulinum toxin type-A has become the cornerstone of anti-ageing treatments in non-invasive cosmetic medical practice.

The ability to rapidly soften wrinkles caused by facial muscle movement (and in some cases even make them disappear) in a safe and reversible way has catapulted VISTABEL® to the forefront of rejuvenation therapy. The extremely low incidence of side effects coupled with relatively easy-to-learn beginner injection techniques has led to the rapid progression of botulinum toxin usage across an ever growing medical spectrum. The aesthetic endpoints of VISTABEL® therapy have subsequently evolved from simple glabella blockade to a more sophisticated approach with the goal of achieving an overall natural, refreshed look as opposed to a frozen-face effect.

To help provide concise yet comprehensive guidelines to achieving a natural, younger look with VISTABEL® I have the pleasure of introducing and editing this series of brochures entitled “Expert Approaches to using Botulinum toxins”.

A distinguished group of highly experienced practitioners will author this series and provide an in-depth background necessary to ultimately implementing their practical treatment tips and techniques. The first subject of this series is, appropriately, a didactic, anatomical approach to the overall balance of facial musculature with the goal of achieving a natural, refreshed look.

Dr Phillip Levy, Geneva, Switzerland

The importance of understanding anatomy

Under the skin of the face, thin, flat bands of muscle can be seen arising from bone or cartilage and inserting into the dermis of the skin or the fibrous tissue around the eyes and mouth. These are the muscles that determine facial expression.

Any discussion of cosmetic procedures to change the appearance of the face must take account of these muscles, and of the many complex links between them. Individual muscles can be heavily interwoven or merged, and using a minimally invasive technique to change the activity of one these muscles can have important beneficial effects or adverse consequences on other parts of the face.

Only with a detailed understanding of the anatomy of the facial muscles - and of the unique morphology of each patient - can we safely recommend the most appropriate technique for improving and removing unwanted signs of ageing.

As our patients do not have this level of anatomical understanding, it is up to the physician to explain what can and cannot be achieved, and to steer them towards the most effective course of treatment for their particular problem - whether that is botulinum toxin type-A injections for hyperfunctional facial lines, abrasion for superficial lines and wrinkles, fat injections for tissue atrophy, or surgery for sagging features. Ultimately, patients want to feel that the result of the treatments look natural and give the impression of a refreshed and brighter complexion.

Reading the face

When patients come to the clinic, they are usually quite clear about what aspects of their appearance they want to change. 'Frown lines' on the forehead, 'crow's feet' wrinkles around their eyes, sagging of the cheeks, or drooping of the mouth are all common signs of ageing that patients want to wipe away (*figures 1-3*).



Figure 1



Figure 2

In addition, there are the superficial lines and blemishes caused by photodamage, and the loss of tissue bulk that makes the face look thin and gaunt.

In reading the face, it is important to distinguish between the three key features that bother our patients most - sagging, wrinkles and atrophy - as the solutions can be very different.

Sagging results from a loss of elasticity in the skin which comes with age, and can only be corrected by surgery. Atrophy is the result of loss of fat and muscle in the face and requires injections of fat or synthetic fillers.

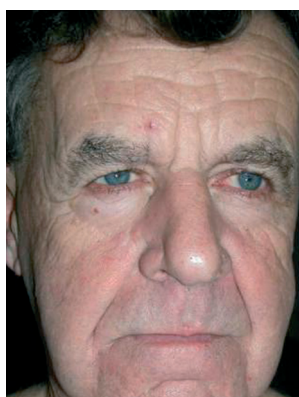


Figure 3

Superficial wrinkles are likely to be caused by sun exposure, and usually treated by chemical, surgical or laser abrasion. But deeper wrinkles are due to a lifetime of facial expressions - frowning, smiling, laughing, anger, surprise - which arise from contraction of the facial muscles. These are most effectively treated with injections of botulinum toxin - now the gold standard treatment for expression wrinkles.

Many patients will require more than one technique to give them the facial appearance they are looking for, and it is up to physicians to propose the optimal combination of treatments to address each patient's needs.

Managing the individual patient

Although facial anatomy is broadly the same for each patient, there may be subtle but important differences which should be considered during the assessment for treatment:

Increasing age is likely to affect the degree of change in the face, though this will also be affected by genetics, lifestyle and, not least, previous cosmetic procedures.

- Both men and women can benefit from anti-ageing procedures, but the positioning, size, strength and use of some facial expression muscles, particularly in the glabellar region, can vary considerably between the sexes.
- A completely symmetrical face is rare, and some faces are more asymmetrical than others (*figure 4*).



Figure 4

It is therefore important to consider the impact of treatment to both sides of the face. Existing ptosis also affect the choice and extent of treatment (*figure 5*).

Facial expression is a key component of how people relate to and interact with those around them. To change or lose that expression can have serious consequences. It is thus an essential part of the consultation to look carefully at each patient's individual anatomical and personal characteristics - when their face is at rest and when it is smiling, concentrating, laughing, frowning, tense and relaxed. Only in this way, can we be sure that the treatment recommendations that we are making are appropriate for each patient.



Figure 5

Muscle groups

The muscles of facial expression can be broadly arranged into five groups; 3 groups in the upper face and 2 in the lower. The major muscles of note are as follows (*figure 6*).

Facial Muscles

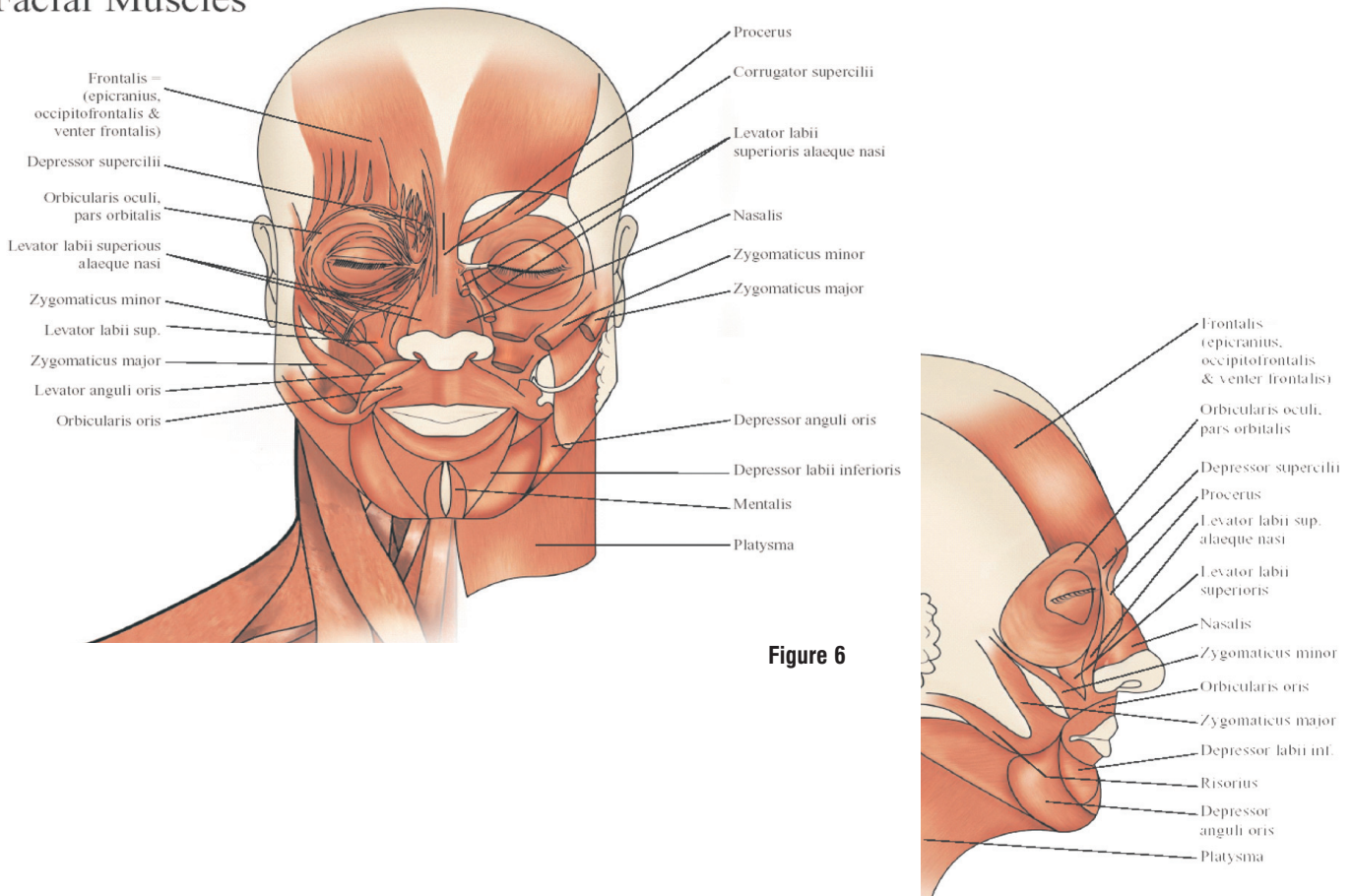


Figure 6

Upper Face

- Epicranial:
 - Occipitofrontalis muscles which move the scalp, and draw the eyebrows upwards.
 - Corrugator supercilii which draw the eyebrows together.
- Orbital:
 - Orbicularis oculi which close the eyelids.
- Nasal:
 - Procerus which wrinkles the nose, and the nasalis which narrows the nostrils.

Lower Face

There is a great complexity of the muscles of the lower face.

- Oral:
 - Includes orbicularis oris which closes the lips and makes them protrude, the zygomaticus major and minor which alter the angle of the mouth and the levator labii superior which lifts the upper lip, the depressor labii inferior which draws down the inferior lip, and the mentalis muscle which wrinkles the skin of the chin.
- Neck:
 - Platysma muscles which tense the skin of the neck.

The importance of muscle balance

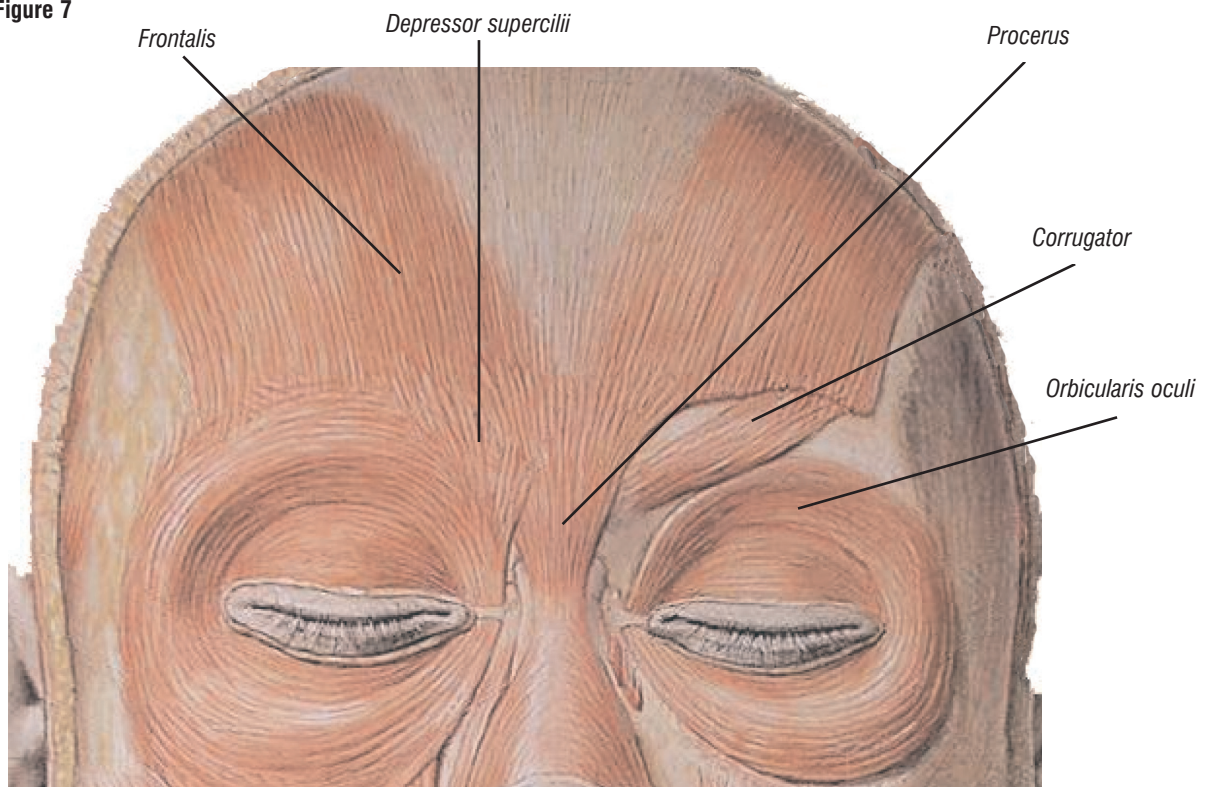
We need to be aware of the muscle balance in the face. Some muscles are 'elevators' (eg: frontalis). When they contract, they pull tissue upwards. Other muscles are 'depressors' (eg: corrugator, procerus, depressor supercilii and orbicularis oculi). They pull tissue downwards when they contract.

When changing the activity of an elevator muscle, it is important to bear in mind the impact on corresponding depressor muscles. Likewise, when injecting depressor muscles, it is important to consider the effects on corresponding elevator muscles.

Why do people get forehead lines?

The horizontal expression wrinkles that occur across the forehead with age are the result of contraction of the largest muscle in the face - the frontalis muscle. On either side of the head, this muscle runs vertically from the cranium down the forehead, ending in the deepest layer of skin on the inner two thirds of each eyebrow and the area between the eyebrows (*figure 7*).

Figure 7



Most people have a small gap (diastasis) between the left and right branches of the frontalis muscle where they meet between the eyebrows, but sometimes the two muscles join to form a continuous muscular surface. This should be borne in mind when considering botulinum injections in this area. An injection placed in the diastasis may not affect frontalis activity.

The frontalis muscle is the only elevatory muscle in the upper part of the face. When it contracts, folds appear in the forehead and the eyebrows are raised. It is important to remember both these actions when considering treatment for horizontal wrinkles. Relaxing the upper part of the frontalis muscle with botulinum toxin smooths out the horizontal wrinkles of the forehead.

We should avoid putting injections in the lower part of the frontalis muscle as this may make the eyebrow droop, resulting in a 'hang dog' expression and/or ptosis of the eyelid. It may also precipitate a loss of facial expression above the eyes. With this good knowledge of facial anatomy and careful patient assessment, there should be no need for loss of facial expression around the eyes.

Why do people have glabellar frown lines?

Vertical expression lines (frown lines) between the eyebrows arise from contraction of the corrugator muscle which pulls the head of the eyebrow downwards and inwards.

The corrugator muscle is attached to the bony, glabellar protuberance, about 7mm from the mid line and 11mm above the orbital rim. Above each eye, the corrugator muscle lies transversally outwards and slightly upwards, beneath the frontalis muscle and part of the orbicularis muscle of the eyelid (*figure 7*).

The fact that the corrugator muscle lies underneath these other important muscles, should be taken into consideration when treating it. Injections of botulinum need to be carefully and thoughtfully placed for maximal effect in each patient.

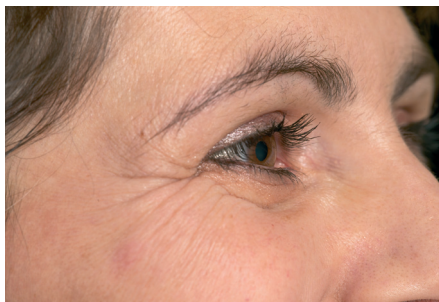
Horizontal lines across the bridge of the nose, between the eyebrows, result from contraction of the procerus muscle. In effect, this is an extension of the frontalis muscle, and it is attached to the nose bone and the triangular cartilages of the nose, like an upward pyramid. It lies over the median part of the corrugator muscle. Contraction of the procerus muscle lowers the head of the eyebrow.

Careful assessment of the patient and clear objectives with the relevant muscles and muscular balance in mind are the key to good treatment. Ask the patient to animate, pinch the muscles, gain a good understanding of the depth, strength and insertion points, visualise the impact of gentle relaxation of each individual muscle.

Why do people have lines around their eyes?

Laughter lines or crow's feet are some of the names given to the expression lines that radiate outwards from the corner of the eye

Figure 8



(*figures 8 and 9*). They are caused by contraction of the orbicularis oculi muscle of the eyelids (*figure 7*).

The orbital section of this muscle forms a large flat ring which is also layered over other muscles in the region notably the zygomaticus minor muscle which lifts the

lip. Injection less than approximately 2cm from the zygomatic muscle may lead to drooping of the upper lip and should be avoided.

The orbicularis oculi muscle is also close to the oculomotor muscles which control the movement of the eyeball. Care should be taken when injecting close to the eye. Botulinum toxin should be injected at least 1cm outside the rim of the orbital bone, so that no toxin can diffuse into the oculomotor muscles and impair the normal movement of the eye.

Figure 9



Considering the ageing process when treating the upper face.

With age, muscles initially lengthen but a reactive hypertonic contraction leads to subsequent shortening. In contrast, skin tends to stretch with age, because of diminishing elasticity, and there is no compensatory tightening.

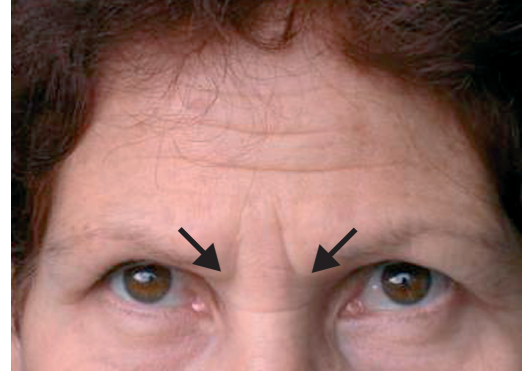
This difference in response to ageing between skin and muscle is particularly apparent in the eyelid when folds appear in the lid because the skin has become too large for the muscular mattress beneath.

The extent of this folding will depend on the balance between the activity of the muscles that control the position of the eyebrow, namely the elevatory effects of the frontalis muscle and the lowering effects of the corrugator, procerus and orbicularis muscles.

The eyebrow is divided into three zones - inner (head), middle (body) and outer (tail).

In the inner zone, the position of the head of the eyebrow depends on the balance between the elevatory frontalis muscle and the depressor corrugator muscle and, to a lesser extent, the procerus and depressor supercillii (*figure 7*). As all of these muscles shorten with age, the powerful depressor muscles tend to out-pull the frontalis muscle, so the head of the eyebrow is likely to drop, with folding of the inner part of the eyelid (*figure 10*).

Figure 10



In the middle zone, the position of the body of the eyebrow depends on the balance between the elevatory effects of the frontalis muscle and the depressor effects of the orbicularis muscle. In this zone, the shortening of the frontalis muscle with age tends to be more forceful than the depressor action of the orbicularis, so there is often a lifting of the middle of the eyebrow. However, if the reverse occurs, the upper eyelid may droop.



Figure 11

In the outer zone, the position of the tail of the eyebrow depends mainly on the activity of the orbicularis muscle, because only a few fibres of the frontalis muscle extend to this part of the eyebrow. With age, the orbicularis muscle will increasingly pull the corner of the eyelid downwards, but this can be corrected simply by injecting botulinum toxin into the orbicularis, so that the tail of the eyebrow is raised, thus widening the eye.

Relaxing the depressor muscles will help to lift the eyebrow and smooth the fold in the eyelid, but if there is significant sagging of the eyelid this can only be corrected surgically.

Most people are quite happy if the strength of their frontalis muscle lifts the middle part of their eyebrow and hence minimises folding of their lid (*as shown in figure 11*).

However, paralyzing the depressor muscle may lead to excessive eyebrow lift - the 'Spock' or 'Mephisto' effect - which may need to be corrected by subsequent injection of the lateral fibres of the frontalis muscle.

Why do people get nasolabial folds?



Figure 12

Nasolabial folds (*figure 12*) are due to sagging of the facial tissues, not to contraction of facial expression muscles. As mentioned previously, sagging is best dealt with by surgery or careful use of various fillers depending on the desired outcome.

Expression lines and wrinkles on the sides of the nose are caused by contraction of the nasalis muscles (*figure 13*). These can be corrected with careful use of botulinum toxin type A injections.



Figure 13

Why do people get lines around their mouth, chin and neck?

Expression wrinkles above the top lip are caused by contraction of the orbicularis oris muscle, but injecting this muscle carries a risk of over relaxing the lips and should be avoided in all but the most skilled hands.

Drooping of the corners of the mouth may arise from the depressor effects of the anguli oris which result from ageing (*figure 14*).

Irregularities at the top of the chin can be caused by involuntary contractions of the mentalis muscles which are inserted under the skin



Figure 15



Figure 14

at this part of chin (*figure 15*). These irregularities can be smoothed by relaxation of these two muscles with injection in their inferior part.

Injections should be kept well away from the orbicularis oris muscle, in order to avoid any disturbance of mouth function.

In general, although there is deep muscular involvement in the lines of the mid and lower face, corrective procedures are more complex and can be best addressed by surgery and filling materials, although certain types of platysmal bands do respond well to botulinum toxin injections.

Conclusions

Practitioners now have a wide range of anti-ageing treatments at their disposal which offer patients better results than ever before. However, a good understanding of facial anatomy, and the similarities and differences between individual patients, is essential if the right treatment decisions are to be made.

A clear explanation to the patient about what can and cannot be achieved is also important for realistic expectations about therapy.

The advent of botulinum toxin treatment has given us the option of offering a very accessible treatment to a much wider range of patients because of its simplicity and safety. The relaxation of muscles by the direct action of botulinum toxin treatment will create a soft rejuvenated, natural look if its use is based on accurate knowledge of the dynamic and static muscular anatomy of each individual patient.

Frequently asked questions:

1. What practical considerations are important with individual facial anatomy?

A: Textbook musculature should be interpreted in the light of a careful, dynamic assessment of the individual patient. Have the patient frown in all directions to check amplitude and muscle balance. Men tend to have stronger facial muscles than women, especially the corrugator-procerus muscle complex. Check for asymmetry of eyebrows and eyelids. Good clinical 'dynamic' examination and observation of each patient is essential.

2. Which muscles are most likely to vary between individuals?

A: The most common variation is likely to be seen in the frontalis muscle. While the majority of patients do have a small gap (diastasis) between the left and right branches of the frontalis muscle where they meet between the eyebrows, a small percentage do not, and this will affect the positioning of botulinum injection.

3. Should I use EMG guidance to identify some muscles?

A: Using EMG guidance makes the procedure longer and complicated and is therefore not useful in routine practice.

4. How can I be sure I've found the right muscle to inject?

A: It goes without saying that knowing your anatomy is fundamental to correct injection techniques. In addition, it is important to palpate the muscle while the patient contracts and relaxes it, and observe the response, before you inject.

5. What are the anatomical 'danger zones' in the face, which I must be careful to avoid?

A: We should avoid putting injections in the lower part of the frontalis muscle as this may make the eyebrow droop or lead to a loss of facial expression above the eyes. We should also be careful with all injections close to the eyes or mouth. We should keep at least 1cm outside the orbital rim of the eye, so that no toxin can diffuse into the oculomotor or levator palpebrae muscles.

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Further background reading

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