Illustrated Guide to Aesthetic Botulinum Toxin Injections

Basics | Localization | Uses
Content

Preface ....................................................... V

1  The active substance
   botulinum toxin ................................. 1
   1.1  Introduction ................................. 2
   1.2  Structure, serotypes ....................... 2
   1.3  Mechanism of action ....................... 2
   1.4  Duration of effect .......................... 5
   1.5  Products and dosage ....................... 5
   1.6  Contraindications ......................... 7
   1.7  Side effects ................................. 7
   1.8  Toxicity .................................... 7
   1.9  Systemic effect .............................. 7
   1.10 Treatment failure ......................... 7
   1.11 Antidote .................................... 8
   1.12 Off-label use ............................... 8

2  Documentation and organization ....... 9
   2.1 Photo documentation ...................... 10
   2.2 Archiving ................................... 17
   2.3 Practice organization ..................... 17
   2.4 The information session and
       informed consent .......................... 18

3  The examination ............................. 19
   3.1 History .................................... 20
   3.2 Inspection ................................ 20
   3.3 Palpation ................................ 24
   3.4 Functional testing ......................... 25
   3.5 Objective evaluation ...................... 26
   3.6 Documentation ............................. 26

4  Treatment ........................................ 27
   4.1 The treatment setting ..................... 28
   4.2 Positioning the patient ................... 28
   4.3 Ergonomics .................................. 29
   4.4 Accessories ................................ 29
   4.5 Syringes and needles .................... 30
   4.6 Preparing the solution for injection .... 31
   4.7 Injection technique ....................... 33
   4.8 Pre- and post-treatment of the face .... 41
   4.9 Labeling ................................... 41
   4.10 Management of adverse
       treatment effects ....................... 42

5  Regional treatments ....................... 43
   5.1 Overview of the treatment areas ........ 44
   5.2 Horizontal lines on the forehead ....... 46
   5.3 Glabella (frown line) ..................... 50
   5.4 Eyebrows ................................ 54
   5.5 Lateral canthal lines ..................... 60
   5.6 Fine skin creases on the lower eyelid ... 64
   5.7 Open eye (widening the
       palpebral aperture) ...................... 68
   5.8 Bunny lines (nasal lines) ............... 72
   5.9 Gummy smile .............................. 76
5.10 Lines around the upper and lower lip .... 80
5.11 Marionette lines .................................. 84
5.12 Cobblestone chin ................................. 88
5.13 Bruxism/Masseter muscle ................. 92
5.14 Platysmal bands .................................. 96
5.15 Primary hyperhidrosis ....................... 100

6 Case histories .................................. 105
  Horizontal forehead lines – Case 1 ...... 106
  Horizontal forehead lines – Case 2 ...... 107
  Glabella (frown line) – Case 1 .......... 108
  Glabella (frown line) – Case 2 .......... 109
  Chemical brow lift – Case 1 .......... 110
  Chemical brow lift – Case 2 .......... 111
  Lateral canthal lines – Case 1 .......... 112
  Lateral canthal lines – Case 2 .......... 114
  Fine skin creases on the lower eyelid .... 116
  Bunny lines – Case 1 .......... 118
  Bunny lines – Case 2 .......... 120
  Gummy smile ...................................... 121
  Perioral lines ...................................... 122
  Marionette lines – Case 1 .......... 124
  Cobblestone chin – Case 1 .......... 125
  Cobblestone chin – Case 2 .......... 126
  Platysmal bands – Case 1 .......... 127
  Platysmal bands – Case 2 .......... 128
  Top third of the face – Case 1 .......... 130
  Top third of the face – Case 2 .......... 132
  Top third of the face – Case 3 .......... 134
  Top third of the face – Case 4 .......... 136
  Top third of the face – Case 5 .......... 138

7 Aids for the practitioner ................. 141
  Documentation form for
    Aesthetic Treatments ...................... 142
    Merz Aesthetic Scales ...................... 143
    FDA Medication guides .................. 154

8 Appendix .................................. 165
  Web addresses .................................. 166
  List of videos .................................. 166
  Image sources .................................. 167
  Manufacturer directory ...................... 167
  Bibliography .................................. 168
  Index .................................. 170
1.1 Introduction

In its native form, botulinum toxin is a highly effective neurotoxin that inhibits signal conduction to the neuromuscular endplate. It is the most potent poison known to man and even miniscule amounts can be lethal. Its life-threatening dose of 0.001 mg per kg body weight is two million times lower than that of curare and a thousand times lower than that of diphtheria toxin.

Botulinum toxin is a metabolic product of the Gram-positive, spore-forming bacterium Clostridium botulinum. It is a ubiquitous bacterium, especially present in soil. The toxin in high doses can cause the disease known as botulism, a type of severe poisoning often acquired by consuming food that has become spoiled and contaminated with botulinum bacteria. The latency period to the onset of symptoms ranges from 4 to 6 hours, but may be up to 14 days in extreme cases. After an initial bout of gastroenteritis, followed by central nervous disturbances such as light flickering before the eyes, double vision, photophobia, difficulty swallowing and reduced salivary gland activity, the condition, if untreated, can lead to death due to respiratory paralysis.

However, increased understanding of the mechanisms of action of this neurotoxin has led to the therapeutic use of botulinum toxin in modern medicine. Apart from its use in the treatment of various neurological disorders, botulinum toxin has become established as the predominant treatment in aesthetic medicine. It is particularly widely used in the cosmetic reduction of wrinkles, achieved by inducing relaxation of overactive facial muscles.

1.2 Structure, serotypes

Botulinum toxin is a two-chain polypeptide consisting of a light chain (L-chain, approx. 50 kDa) and a heavy chain (H-chain, approx. 100 kDa), which are joined by a disulfide bond. While initially formed by Clostridium botulinum as a single chain, the toxin only becomes biologically active following enzymatic splitting (often called nicking) into the two-chain form by bacterial and eukaryotic endoproteases. The final active form of the protein is a complex make-up of the two-chain neurotoxin itself, together with hemagglutinins and non-toxic, non-hemagglutinin proteins. The hemagglutinins and the non-toxic proteins stabilize the neurotoxin and protect it from stomach acid when ingested.

Botulinum toxin can be divided into seven serologically distinct forms, types A to G. The amino acid sequences of the toxins have been decoded and show a high degree of homology to one another. Moreover, they show considerable similarities to tetanus toxin, also originating from a Clostridium species, which is why these substances are also jointly referred to as clostridial neurotoxins. The various serotypes differ in their duration of effect and potency, whereby type A has the most potent effect with the longest duration. Thus, type A shows an effect that is about ten times more potent than that of type C, while being as much as 50 times more potent than type B. Type A botulinum toxin is the main serotype in therapeutic use, especially with regard to aesthetic indications. Types B, C and F also play a role in therapeutic applications.

1.3 Mechanism of action

Botulinum toxin acts directly on the neuromuscular endplate and other cholinergic synapses, where it inhibits release of the neurotransmitter acetylcholine, leading to muscular paralysis of the affected fiber and loss of target organ function. The toxin’s various serotypes all bind to the same receptor, but exert their effect on different proteins within cholinergic nerve endings. Three steps underlie the mechanism of action of botulinum toxin:

1. Binding
2. Internalization
3. Intracellular effect on SNARE proteins.

1.3.1 Binding

When the toxin is injected or absorbed from the gastrointestinal tract, its heavy H-chain initially binds to specific receptors on the plasma membrane of the cholinergic nerve endings. This binding to the presynaptic membrane shows a high degree of affinity and specificity.

1.3.2 Internalization

The neurotoxin is taken up into the nerve cell through receptor-mediated endocytosis. The heavy H-chain of the toxin allows the large molecule to penetrate the cell membrane and the endosome that is thus formed. The H-chain separates from the L-chain as the disulfide bond is broken. This allows the L-chain to enter the cytoplasm of the neuron.

1.3.3 Intracellular effect on SNARE proteins

The botulinum toxin light chain acts as a zinc-dependent endopeptidase with proteolytic activity. In the cytosol, depending on serotype, it splits a specific protein of the SNARE complex (soluble N-ethylmaleimide-sensitive factor attachment receptor), which is responsible for one step of the exocytosis of the acetylcholine vesicles. The SNARE
Physiological processes of neuromuscular innervation

Overview – view into a synapse: As a result of a nerve stimulus, the synaptic vesicles, which contain the neurotransmitter fuse with the cell membrane. This causes the release of acetylcholine (ACh) into the synaptic cleft. ACh binds to the post-synaptic ACh receptors on the motor muscle cell. The depolarization triggered by this leads to contraction of the muscle fibers.

- Synapse
- Vesicle containing the transmitter
- Acetylcholine within the vesicle
- Acetylcholine receptor
- Striated muscle.

The release of ACh from the synapse takes place with the aid of a synaptic fusion complex, the SNARE complex. SNAP-25 and syntaxin are located on the cytosol side of the presynaptic membrane. They form a complex with the synaptobrevin, which is integrated into the vesicle membrane and anchors it to the internal neuron membrane.

- SNARE complex.

This three-protein complex initiates docking of the vesicle and its fusion with the presynaptic plasma membrane. Fusion leads to the release of ACh into the synaptic cleft.
Treatment

The reconstitution of the vial contents and the withdrawal of the solution into the syringe should take place over a surface that is easily cleaned to catch any splashes. The exposed part of the vial rubber stopper should be cleaned with 70% alcohol before inserting the needle.

First, 2.5 ml of preservative-free, sterile saline solution is injected into the 100 unit Xeomin vial using a 2-ml syringe. The NaCl solution is drawn in directly by the negative pressure in the vial.

The vial is now carefully swirled until the substance has dissolved fully in the saline. Shaking must be avoided, as this generates foam; swirling prevents foaming. The ready-to-use solution can now be drawn up into suitable syringes (cf. section 4.5, p. 30 f.).

When drawing up the solution, care is needed to ensure that the tip of the needle does not touch the glass: this can damage the tip, making the injection painful for the patient. E.g. 1 ml of the reconstituted solution Xeomin contains 40 LD50 units. Therefore, 0.1 ml of the solution contains 4 LD50 units (cf. Tables 4.1 and 4.2 for further details). According to the product insert, once reconstituted, the solution should be used within hours.

<table>
<thead>
<tr>
<th>Product</th>
<th>Units* in vial</th>
<th>Saline</th>
<th>Units per ml standard solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ml</td>
<td>0.0125</td>
</tr>
<tr>
<td>Xeomin</td>
<td>100</td>
<td>2.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Botox 50</td>
<td>50</td>
<td>1.25</td>
<td>0.5</td>
</tr>
<tr>
<td>Botox 100</td>
<td>100</td>
<td>2.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Dysport 300</td>
<td>300</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Dysport 300 (one-half dilution)</td>
<td>300</td>
<td>3</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Table 4.1 Units per ml ready-to-use solution after standard reconstitution. The information in this table refers to the 3 FDA-approved botulinum toxin A products in application for aesthetic indications (using 0.3-1 ml syringes). Figures do also apply to other product names containing identical substance preparations after similar reconstitution process.

* The biological potency of one unit is specific to the preparation and cannot be equated amongst products from different manufacturers.

<table>
<thead>
<tr>
<th>Product</th>
<th>ML standard solution</th>
<th>ML saline</th>
<th>Units per ml “two-third dilution”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ml</td>
<td>0.01875</td>
<td>0.0375</td>
</tr>
<tr>
<td>Xeomin</td>
<td>0.1</td>
<td>0.2</td>
<td>0.25</td>
</tr>
<tr>
<td>Botox</td>
<td>0.1</td>
<td>0.2</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Table 4.2 Units per ml ready-to-use solution after preparation of a “two-third dilution.” The dilution adding two volumes of saline to one volume of the standard solution is useful in low-dosed injection of Xeomin or Botox when large diffusion is desired. The given information also applies to other product names containing identical substance preparations.

Preparing a “two-third dilution”

The “two-third dilution” is used by the senior author when he applies the preparations Xeomin or Botox where small doses together with a maximal diffusion range of the active substance are indicated (e.g. in lines on the forehead or fine wrinkles on the lower eyelid). To do this, 0.1 ml of the reconstituted standard solution is diluted with 0.2 ml of preservative-free, sterile 0.9% NaCl solution. This gives 4 units per 0.3 ml instead of 4 units per 0.1 ml as in the original solution (cf. Tables 4.1 and 4.2).
There are various injection techniques that can be used to administer the active substance. Five techniques are described below:

- **Direct injection**
- **Two-level injection**
- **Intradermal wheal technique**
- **Directed injection**
- **EMG-guided injection.**

Which technique is recommended in individual cases is dependent on the target muscle and the individual anatomical and functional findings in the target region as well as on the practitioner’s practical experiences. A general distinction is made between deep injections, which administer the substance directly into the muscle belly and superficial injections applying the substance in a subcutaneous level, from which it gets to its muscular destination gently via diffusion.

### 4.7.1 Basic rules

The practitioner may administer the injections either sitting or standing. In either case, care must be taken to work ergonomically (cf. Chapter 4.3, p. 29). The elbow of the injection arm should ideally be supported on the treatment chair or table. The syringe is held between the index and middle fingers, with the thumb placed loosely on the plunger. The injection hand is supported on the outer edge of the little finger either directly on the patient or on the non-injecting hand. This is the basic injecting position. Two fingers of the non-injecting hand can be used to fix and lightly compress the target muscle for a more precise injecting.

**Video:** “Basic hand position”
http://www.kvm-tv.de/BTX/btx003.mp4

The injection is carried out after provoked muscular activation. One of the basic rules is that the injections have to be as painless as possible for the patient. The use of syringes with extra fine cannula, as well as a careful insertion technique, are elementary in that context. Pain can be caused when the needle is inserted too deeply so that it pushes against the muscle-underlying periost and gets bent. To prevent this, needles always should be inserted slowly and diagonally to the skin surface.

**Video:** “Basic rules of injection”
http://www.kvm-tv.de/BTX/btx004.mp4

**Tip**

The senior author further recommends the so-called “knocking technique” to reduce pain during injection. By patting the patient’s forehead with firm and rhythmic slaps, s/he creates mechanical deflection. In doing so immediately before the injection is done, the practitioner is able to decrease the injection pain by up to 80% as clinical experience has shown.

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**Preparing the ready-to-use solution**

**Step 1:** Dissolve the active substance, supplied in powder form, with preservative-free, sterile 0.9% NaCl solution.

**Step 2:** Swirl the solution carefully until the active substance has dissolved completely. Caution: do not shake, as this causes foaming.

**Step 3:** Draw up the ready-to-use solution into suitable syringes.

**Video:** "Basic hand position”
http://www.kvm-tv.de/BTX/btx003.mp4

**Step 1:** Dissolve the active substance, supplied in powder form, with preservative-free, sterile 0.9% NaCl solution.

**Step 2:** Swirl the solution carefully until the active substance has dissolved completely. Caution: do not shake, as this causes foaming.

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**Video:** “Basic rules of injection”
http://www.kvm-tv.de/BTX/btx004.mp4
Besides prevention of pain, there are further basic rules important to follow during the injecting in order to avoid possible unwanted side effects of the therapy with botulinum toxin A. As an example, superficial subcutaneous injections or the use of dilutions (e.g. the “two-third dilution,” p. 32) do allow an extra carefully substance dosing in areas with a given risk of overcorrection like the forehead. Concerning botulinum toxin injections around the eyebrows, a possible paralysis of the superior tarsal muscle (Mueller’s muscle), leading to ptosis, has to be averted. Ptosis can occur after unwanted distribution of the substance behind the orbital septum, normally inhibited by the epicranial aponeurosis (Galea aponeurotica), which functions as a natural diffusion barrier. Along with careless injections, it is possible that the epicranial aponeurosis gets damaged by the needle allowing diffusion of the substance in the area of the superior tarsal muscle. For that reason, it is important to inject with a maximal distance to the orbital boundary. By using the thumb or forefinger of his contralateral hand, the practitioner is able to segregate the target muscle from its bony basis at a maximal level, ensuring safe injections along the eyebrow without the given risk of ptosis.
Basic rules for safe injecting

The fine needles used for botulinum toxin injections can bend if they reach the periost, which will cause pain while performing injections. For that reason, injections to the bone have to be avoided in any case.

By carefully inserting the needle in a diagonal direction to the skin surface, injections are as painless as possible.

When injecting near the eyebrow, possible windowing of the epicranial aponeurosis by the needle can lead to an undesired diffusion of the active substance behind the orbital septum causing paralysis of the Mueller’s muscle and ptosis.

Two fingers of the non-injecting hand are used to create a maximal distance between the muscular target parts and the orbital margin, allowing safe injecting.

Video: “Rules for safe injecting”
http://www.kvm-tv.de/BTX/btx005.mp4
Regional treatments

Planning of treatment

The goal of the treatment is to reduce the dynamically produced lines that run across the forehead. The frontal part of the epicranius is the only muscle that lifts the brows. Overcorrection, by overly weakening the muscle, can intensify the activity of the depressors and lead to eyebrow ptosis. This produces a cosmetically undesirable, sad or tired or angry facial expression. The effect is dose-dependent and reversible. This complication can be avoided by adjusting the dose so that adequate activation of the muscle is still possible. Furthermore, the injections need to be given a sufficient distance from the eyebrows. The brow ptosis can often be remedied by soft tissue augmentation in the eyebrow region and forehead.

Practical tip

Overdosing and subsequent eyebrow ptosis have to be avoided when injecting into the frontalis muscle and, in particular, into its weaker lateral parts. Superficial injections at low dosages using the subdermal wheal technique are most appropriate in this respect. The authors recommend for this the use of dilutions (cf. two-third dilution, p. 32 and Chapter 5.6, p. 64 ff.) realizing maximal distribution of minimal doses, especially useful in patients at risk (i.e. pronounced wrinkling at low muscle tone).

In some cases, it is worth doing the treatment in two sessions: the glabella is treated first and the result of this awaited, as the procerus muscle may be involved in forming the lines across the forehead. After 14 days to 4 weeks, the forehead lines can then be treated more predictably. Advanced injectors typically treat these areas at the same time.

Treatment regimen

In the medial region, deeper injections (●) administered in a V-shape into the predicted muscular region.

In the lateral region, superficial injections (○) preferably by making use of the two-third dilution.

Caution: The lower part of the frontalis muscle (up to a distance of approx. 2 cm from the orbital margin) should better not be treated in order to prevent possible eyebrow ptosis.

Please observe the off-label therapy warnings relating to the licensed products (cf. section 1.12, p. 8) and the relevant product inserts.
Horizontal lines on the forehead

Treatment

**Injection**

<table>
<thead>
<tr>
<th>Injection site</th>
<th>Product</th>
<th>Units/point</th>
<th>mL solution/point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial frontalis muscle (in V-shape)</td>
<td>Xeomin</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Botox</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Dysport</td>
<td>5</td>
<td>0.025</td>
</tr>
<tr>
<td>Lateral frontalis muscle</td>
<td>Xeomin</td>
<td>0.5</td>
<td>0.0125 / 0.0375*</td>
</tr>
<tr>
<td></td>
<td>Botox</td>
<td>0.5</td>
<td>0.0125 / 0.0375*</td>
</tr>
<tr>
<td></td>
<td>Dysport</td>
<td>1.25</td>
<td>0.00625 / 0.0125**</td>
</tr>
</tbody>
</table>

Table 5.1 The authors’ consensus dose recommendations for the treatment of horizontal front lines. * Two-third dilution  ** One-half dilution. The same data apply for products with identical substance preparations. Higher doses may be needed in patients with a very high forehead. A second treatment line may need to be placed above the first if this is the case.

**Correction factor**

- Man with active expressions: Factor 2
- Age / inactive facial expressions: Factor 0.5.

**Combined treatment options**

It may be a good idea to supplement the treatment with superficial augmentation of residual lines or with supportive skin regeneration therapy by percutaneous collagen induction, alias Medical Needling.

**Caution**

There is considerable variability in the anatomy of the forehead as well as the strength of the forehead musculature, which means there is always a risk of an overtreatment and resultant eyebrow ptosis. It is essential for the injector to try to avoid this.

**Complications / Managing complications**

Since the frontal part of the epicranius is the only muscle that lifts the brows, an individual overtreatment leads to eyebrow ptosis. This effect is dose-dependent and reversible. The risk can be reduced by administering lower doses and considering the option of follow-up injections after 10 to 14 days. If necessary, the ptosis may be remedied by soft tissue augmentation in the eyebrow region and forehead.

If the central parts of the frontalis muscle are treated, its lateral parts may allow a certain amount of contraction in the outer regions, leading to lateral raising of the eyebrows (“Spock effect” cf. section 5.4, p. 54 ff.). This brow elevation is treated with a small dose of BTX-A injected into the lateral parts of the frontalis muscle. When performing this correction, care must be taken to inject a sufficient distance above the bony orbital margin to avoid producing eyebrow ptosis.

The lower 2 cm are often left alone when treating the frontalis muscle. Its residual activity enhances arching of the brows. Small, comma-shaped lines may form above the brows. These fine lines can be satisfactorily treated with added filler augmentation.

Video: “Treatment of horizontal forehead lines”
http://www.kvm-tv.de/BTX/btx011.mp4
Planning of treatment

The goal of the treatment is to smooth out the vertical and horizontal lines in the glabellar region by partial or complete deactivation of the appropriate muscles, taking into consideration the patient's individual wishes. In this context, it will be necessary to evaluate to what extent any residual function should be preserved.

Practical tip

It is often not possible to cause any reduction in the hypertrophic muscle bellies of the corrugator muscles in a single session, especially in men. Repeated treatment of the glabellar region at 4-month intervals over a period of 1 to 2 years encourages smoothing of these lines, thus leading to a lasting effect accompanied by a reduction in the chronically hypertrophic muscle segments.

Treatment regimen

Procerus muscle: medially at the root of the nose, one to two points above that in the midline and additional injections medially and cranially into the central parts of the muscle

Corrugator supercili muscle: one injection medially, directed along the fibers (other lateral injection points can also be considered)

Orbicularis oculi muscle, orbital part: one superficial injection (further injections along the eyebrow may be attached since a brow lift is often wished at the same time).

Please observe the off-label therapy warnings relating to the licensed products (cf. section 1.12, p. 8) and the relevant product inserts.
Treatment

Injection

Activation
The practitioner instructs the patient to contract the muscle actively: “Pull your eyebrows together towards the nose and down,” or “Frown.”

Injection technique

Procerus muscle: direct injection with vertical needle insertion
Corrugator supercilii muscle: directed injection into the center of maximum activity
Orbicularis oculi muscle, orbital part: intradermal wheal technique with tangential insertion.

Products and doses

<table>
<thead>
<tr>
<th>Injection site</th>
<th>Product</th>
<th>Units/point</th>
<th>Ml solution/point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procerus</td>
<td>Xeomin</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Botox</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Dysport</td>
<td>5</td>
<td>0.025</td>
</tr>
<tr>
<td>Corrugator supercilii</td>
<td>Xeomin</td>
<td>2–4</td>
<td>0.05–0.1</td>
</tr>
<tr>
<td></td>
<td>Botox</td>
<td>2–4</td>
<td>0.05–0.1</td>
</tr>
<tr>
<td></td>
<td>Dysport</td>
<td>5–10</td>
<td>0.025–0.05</td>
</tr>
<tr>
<td>Orbicularis oculi (orbital part)</td>
<td>Xeomin</td>
<td>1</td>
<td>0.025 / 0.075*</td>
</tr>
<tr>
<td></td>
<td>Botox</td>
<td>1</td>
<td>0.025 / 0.075*</td>
</tr>
<tr>
<td></td>
<td>Dysport</td>
<td>2.5</td>
<td>0.0125 / 0.025**</td>
</tr>
</tbody>
</table>

Table 5.3 The authors’ consensus dose recommendations for the treatment of glabellar (frown) lines. * Two-third dilution ** One-half dilution. The same data apply for products with identical substance preparations.

Correction factor

Man with active expressions: Factor 2
Age / inactive expressions: Factor 0.5.

Combined treatment options

Soft tissue augmentation with fillers is a possible supplementary treatment option, especially for deeper lines or in older patients. A measure that can always be considered as a possible adjuvant is natural skin regeneration therapy by percutaneous collagen induction ("Medical Needling").

Complications / Managing complications

Ptosis, sometimes asymmetric, can occur after uncareful injection into the orbicularis oculi muscle due to unwanted diffusion of the toxin behind the orbital septum (cf. section 4.7.1, p. 33 ff.). If this happens, limited stimulation of the Mueller’s muscle can be produced by local administration of a sympathomimetic agent such as phenylephrine (e.g. Vasocon eye drops). Renewed intensification of the activity of the corrugator muscles may occur after 3 to 4 months, producing frown lines. In this case, follow-up injections should be given in the lateral parts of the corrugator supercilii muscle on each side.

Even if sufficient relaxation of the relevant muscles has been achieved, some individuals can produce frown lines voluntarily by recruiting the medial parts of the orbicularis oculi muscle. If this is the case, small superficial doses can be given into the palpable areas of activity of the orbicularis oculi muscle. Slight bleeding may occur at the injection sites. This can be controlled by compression with a Q-tip (cotton bud).

Video: “Treatment of glabella lines”
http://www.kvm-tv.de/8TXbtx012.mp4
**Regional treatments**

**Planning of treatment**

The treatment goal of the therapy with botulinum toxin type A is a dose-dependent reduction of tone of the individual platysmal muscle cords. Treatment of the platysmal cords should also be considered in therapy of marionette lines with botulinum toxin.

*Treatment regimen*

The injections are given in each cord at 2-cm intervals.

⚠️ Please observe the off-label therapy warnings relating to the licensed products (cf. section 1.12, p. 8) and the relevant product inserts.
### Products and doses

<table>
<thead>
<tr>
<th>Injection site</th>
<th>Product</th>
<th>Units/point</th>
<th>ML solution/point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platysma</td>
<td>Xeomin</td>
<td>1–2</td>
<td>0.025–0.05</td>
</tr>
<tr>
<td></td>
<td>Botox</td>
<td>1–2</td>
<td>0.025–0.05</td>
</tr>
<tr>
<td></td>
<td>Dysport</td>
<td>2.5–5</td>
<td>0.0125–0.025</td>
</tr>
</tbody>
</table>

**Table 5.16** The authors’ consensus dose recommendations for the treatment of platysmal bands. The same data apply for products with identical substance preparations.

**Correction factor**
- Man with active expressions: Factor 2
- Age / inactive expressions: Factor 0.5

**Combined treatment options**
Horizontal lines can be treated with augmentation methods.

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### Complications / Managing complications

If the injection is too deep, BTX-A can diffuse into the underlying muscles and lead to difficulties with swallowing and speech. Therefore, injections into the laryngeal region should be avoided if at all possible.

Slight bleeding or minor hematomas may occur after the injections.
Planning of treatment

Sweating is an important thermoregulatory function. In patients with axillary, palmar or plantar hyperhidrosis, the condition is independent of thermoregulation. The Minor test described above is recommended for the hands and feet, as the distribution of hyperhidrotic areas can be variable.

Treatment regimen

**Treatment regimen for the foot**
The injections are given at intervals of about 2 cm. Guide lines may be drawn to help identify the correct locations. Between 10 to 50 injection sites will be needed on the foot (examples of injection sites are shown here – there is no set injection scheme).

**Treatment regimen for the hand**
The injections are given at intervals of about 2 cm. Guide lines may be drawn to help identify the correct locations. Between 10 to 30 injection sites will be needed on the hands (examples of injection sites are shown here – there is no set injection scheme).

**Treatment regimen for the axilla**
The injections are given at intervals of about 2 cm, but may be staggered for better coverage of the area. Guidelines may be drawn to help identify the correct locations. About 10 or more injection sites will be needed in the axilla (examples of injection sites are shown here – there is no set injection scheme).

Practical tip

Pay particular attention to the lateral areas on the foot, as increased sweat production can also occur here. The needles used for the axillary, palmar or plantar injections should be about 10–20 mm in length. In the armpit, the region of highest sweat production is usually identical to the area of hair growth. This area can be relatively large in men.

⚠️ Please observe the off-label therapy warnings relating to the licensed products (cf. section 1.12, p. 8) and the relevant product inserts.
Primary hyperhidrosis

Treatment

**Injection**

<table>
<thead>
<tr>
<th>Injection site</th>
<th>Product</th>
<th>Units/point</th>
<th>mL solution/point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot/hand/axilla</td>
<td>Xeomin</td>
<td>2.5–5</td>
<td>0.0625–0.125</td>
</tr>
<tr>
<td></td>
<td>Botox</td>
<td>2.5–5</td>
<td>0.0625–0.125</td>
</tr>
<tr>
<td></td>
<td>Dysport</td>
<td>10–20</td>
<td>0.05–0.1</td>
</tr>
</tbody>
</table>

**Table 5.17** The authors’ consensus dose recommendations for the treatment of primary hyperhidrosis. The same data apply for products with identical substance preparations.

**Injection technique for the foot**
By preference, the injections are given intradermally, but sometimes also subcutaneously. The lateral side of the foot should also be treated if the Minor test is positive.

**Caution:** Take care in the medial region of the foot, as paresis may occur here due to possible diffusion of the toxin.

**Injection technique for the hand**
By preference, the injections are given intradermally, but sometimes also subcutaneously.

**Caution:** Take care in the thenar and hypothenar region, as muscle weakness ranging up to paresis may occur here due to possible diffusion of the toxin, making grasping difficult.

**Injection technique for the axilla**
By convention, the injections are given intradermally, but increasingly also subcutaneously.

**Caution:** Injection into the axilla is almost free of complications, but local hematomas may develop.

**Complications / Managing complications**

The injection is usually very painful in the hands and feet, so that anesthetic measures (e.g. conduction anesthesia) may be necessary.
Case histories

Fine skin creases on the lower eyelid

Baseline finding right: clearly visible, fine wrinkling of the periorbital skin at rest.

Marked smoothing of the skin and reduction of the lines can be seen 16 days after the treatment with botulinum toxin.
Fine skin creases on the lower eyelid

Baseline finding left: there is clearly visible, fine wrinkling of the periorbital skin at rest.

Marked smoothing of the skin and reduction of the lines can be seen 16 days after the treatment with botulinum toxin.
Aids for the practitioner

**F Lateral canthal lines – at rest**

- **0** No lines
- **1** Mild lines
- **2** Moderate lines
- **3** Severe lines
- **4** Very severe lines
Lateral canthal lines – dynamic

0 No lines
1 Mild lines
2 Moderate lines
3 Severe lines
4 Very severe lines
Aids for the practitioner

<table>
<thead>
<tr>
<th></th>
<th>Lip wrinkles – at rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No wrinkles</td>
</tr>
<tr>
<td>1</td>
<td>Mild wrinkles</td>
</tr>
<tr>
<td>2</td>
<td>Moderate wrinkles</td>
</tr>
<tr>
<td>3</td>
<td>Severe wrinkles</td>
</tr>
<tr>
<td>4</td>
<td>Very severe wrinkles</td>
</tr>
</tbody>
</table>
Lip wrinkles – at rest | Lip wrinkles – dynamic

1 Lip wrinkles – dynamic

<table>
<thead>
<tr>
<th>0</th>
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