# ESTHETIC DENTISTRY

## Botulinum neurotoxin A for smile modification




### BACKGROUND

An esthetic smile is achieved when the proportions and relationships of the component structures are properly related. The muscles of facial expression are especially important in achieving the dynamic changes that occur between these structures when an individual smiles. Dentists have modified dental structures to achieve an esthetic smile, most often by performing orthodontic and orthognathic correction and periodontal surgery. The muscular and functional components of smiling are addressed less commonly, but botulinum neurotoxin A (BT-A) offers the ability to induce semi-permanent inhibition of muscle fiber contraction and can be used cosmetically to achieve desirable smiles. Dentists have the necessary anatomic and physiological knowledge of the facial muscles and how they contribute to the smile. Thus dental professionals should be able to apply BT-A orofacially and safely achieve a clinical result. The pharmacology and characteristics of BT-A preparations, clinical uses of BT-A, and adverse outcomes were discussed.

### METHODS

The information was gathered through a search of the PubMed and Google Scholar databases for appropriate literature in English. The results yielded a combination of case reports, literature reviews, and primary research articles.

### FINDINGS

BT-A exerts a potent relaxation effect on muscles that usually occurs 3 to 4 days after injection. It remains clinically evident for about 2 to 3 months, then muscle function gradually returns.

BT-A is available as onabotulinum A (Botox), abobotulinum A (Dysport), or incobotulinum toxin A (Xeomin). This study focused on Botox, which is currently approved by the US Food and Drug Administration for treatment of the upper face as well as various off-label cosmetic purposes and non-cosmetic indications such as migraines and hyperhidrosis. Botox is usually supplied in vacuum-dried form that must be reconstituted before administration. The reconstituted form has a concentration of 4 units of BT-A per 0.1 ml. It should be used within 24 hours of opening and must be stored at 2° to 8° Celsius. Usually administration is via a tuberculin syringe with a small-gauge needle.

### APPLICATIONS

BT-A has a number of applications and can address multiple cosmetic problems that yield an unesthetic or unappealing smile. Among these are thin upper lip, perioral 'smoker's' lines, protrusive or dimpled chin, downturned commissures and/or smile curvature ('gummy smile'), and excessive gingival display.

#### Thin Upper Lip

For patients with a thin upper lip, small concentrated doses of BT-A are injected superficially along the vermillion border of the upper and lower lip, thus increasing vermillion show (Figure 1). Injections into the philtrum region should be avoided because they can flatten the esthetic Cupid's bow lip appearance. Excessive lip lengthening can reduce tooth show and give the patient an 'old' appearance. For patients naöve to BT-A treatment, low doses help to avoid adverse esthetic changes. The recommendation is for doses up to 2 units delivered in 4 injection points.

#### Perioral Rhytids

Perioral rhytids, or 'smoker's lines,' result from repeated lip contraction to maintain a pursed posture, which is seen in musicians or chronic smokers. The dentist should palpate the site while the patient purses the lips to identify the orbicularis oris muscle. Injections are placed peri-orally, about 5 mm concentric to the vermillion border, and at a depth midway between the outer surface and the inner mucosa of the lip (Figure 2). The distribution should be similar to that used for thin upper lip. Caution is required in the philtrum and commissural areas, where there is a risk for causing flattening of the Cupid's bow or spreading the toxin into the risorius muscle.

#### Chin

Chin shape and symmetry can markedly affect overall facial harmony and have major influence on facial shape. Male and female chins have differing lateral chin profiles, with men having a convex


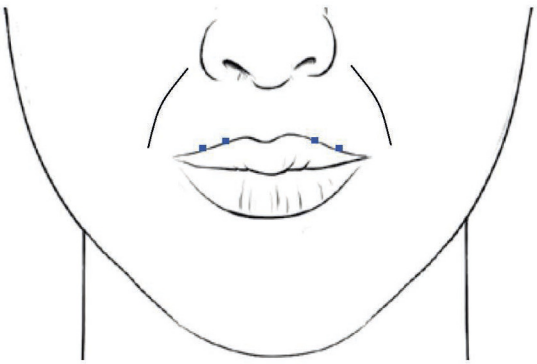

**Figure 1.** Injection points for lip lengthening. (Courtesy of Delpachitra SN, Sklavos AW, Dastaran M: Clinical uses of botulinum toxin A in smile aesthetic modification. *Br Dent J* 225:502-506, 2018.)

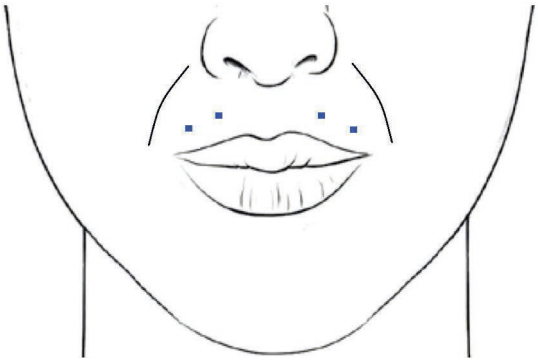

**Figure 2.** Injection points for perioral 'smoker's' lines. (Courtesy of Delpachitra SN, Sklavos AW, Dastaran M: Clinical uses of botulinum toxin A in smile aesthetic modification. *Br Dent J* 225:502-506, 2018.)

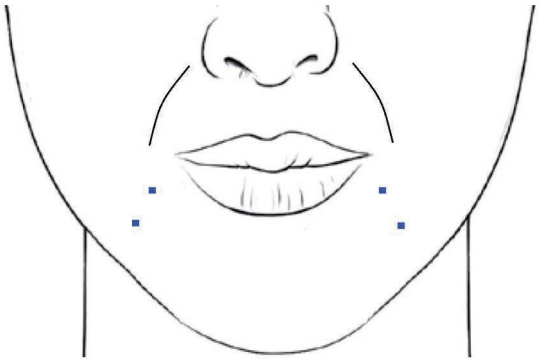

**Figure 4.** Injection points for downturned commissure. (Courtesy of Delpachitra SN, Sklavos AW, Dastaran M: Clinical uses of botulinum toxin A in smile aesthetic modification. *Br Dent J* 225:502-506, 2018.)

mean facial profile and female chins contributing less to the total soft tissue profile. A complete assessment of chin esthetics is required, including an evaluation of the contributions of the skeletal, dental, and soft tissue structures to lower face morphology or dysmorphology. This assessment will indicate the impact and success of soft tissue modifications with BT-A. Generally, 3 indications for the use of BT-A are accepted: (1) deep labiomental fold caused by soft tissue relationships, (2) excessive muscular soft tissue prominence of the chin, and (3) presence of mentalis rhytids ('peau d'orange' chin).

A high dose (5 to 10 units) of BT-A is needed to reduce soft tissue prominence or deep labiomental folds and produce slow atrophy of the muscle. Injections placed deep into the muscle, near the muscle origin at the anterior mandible, risk inadvertent injection into more superficial muscles of expression (Figure 3). Patients need to be aware that the desired effect may not occur for 1 to 2 months.

If removal of the rhytids is desired, the recommended total doses vary from 3 to 6 units. The injections are more superficial, single, and directed into each band of the mentalis muscle. Injection points should be aimed toward the muscle's lowest portion to prevent toxin spread to the orbicularis oris. Injections that are too far laterally can cause inadvertent paralysis of the depressor anguli oris muscle, which can create facial asymmetry.

## Downturned Commissures or Smile Curvature

The bilateral depressor anguli oris (DAO) muscles lower the corners of the mouth, but hyperfunctional DAO muscles can cause an unesthetic lowering. Having secondary rhytids in the area can lend an aged appearance. If the DAO muscles are activated while smiling, the effect can be flattened lips.

Soft tissue modification to alter this effect and produce a more esthetic smile depends on correct positioning of the maxillary incisors. It's important to identify the DAO muscles to avoid accidentally injecting the orbicularis oris, buccinator, or mentalis muscles. This is accomplished by palpating while the patient pulls the corners of the mouth downward. The muscles are inferior and lateral to the oral commissure. Branches of the facial vein can be perforated in the area, which can cause significant hematoma of the lower face. Toxin spread to other muscles can result in asymmetry and loss of oral function. If the DAO muscles are overly paralyzed, patients can have trouble eating and packing

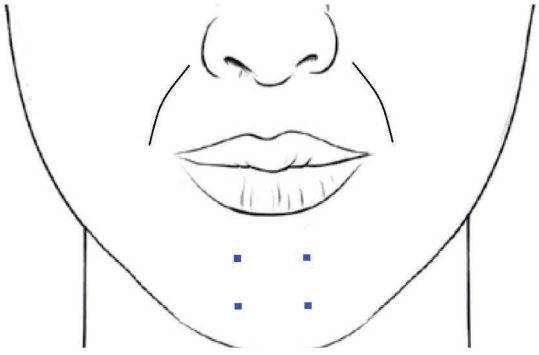

**Figure 3.** Injection points for protrusive/dimpled chin. (Courtesy of Delpachitra SN, Sklavos AW, Dastaran M: Clinical uses of botulinum toxin A in smile aesthetic modification. *Br Dent J* 225:502-506, 2018.)

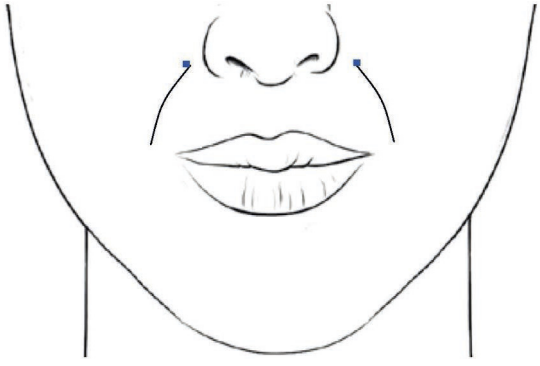

**Figure 5.** Injection points for anterior excessive gingival display. (Courtesy of Delpachitra SN, Sklavos AW, Dastaran M: Clinical uses of botulinum toxin A in smile aesthetic modification. *Br Dent J* 225:502-506, 2018.)

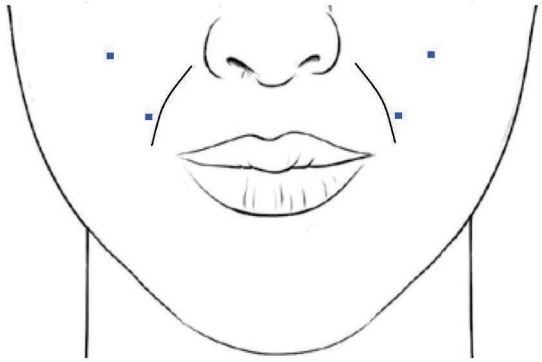

**Figure 6.** Injection points for posterior excessive gingival display. (Courtesy of Delpachitra SN, Sklavos AW, Dastaran M: Clinical uses of botulinum toxin A in smile aesthetic modification. *Br Dent J* 225:502-506, 2018.)

food in the lower vestibule. The recommended dose of BT-A is 2 to 5 units injected at moderate depth at 2 points diagonally along the direction of the muscle fibers (Figure 4).

### 'Gummy Smile'

Gummy smile is defined as more than 3 mm of gingiva exposed on smiling. Women have this problem more commonly than men. Anatomic factors that contribute to it include lip length, crown length, vertical maxillary excess, and oral muscle behavior. BT-A is indicated when perioral muscle hyperfunction causes the gingival display, but it's also useful when the goal is to mask other causes of this problem.

Generally a single injection is directed into the 'Yonsei point,' which is a surface landmark located lateral to the ala at the convergence of the levator labii superioris, levator labii superioris alaeque nasi (LLSAN), and zygomaticus minor. The recommended dose is 2 to 5 units.

Four types of gummy smiles have been identified: the anterior, posterior, mixed, and asymmetric. For the *anterior gummy smile,* the dentist must identify the bilateral LLSAN by palpating in the superior part of the nasolabial folds, lateral to the nares, during function. The best landmark is 0.5 cm below and lateral to the nasal ala (Figure 5). Injection of 2 to 5 units has been able to reduce the height of an anterior exposure.

For the *posterior gummy smile,* hyperfunction of the paired zygomaticus major and minor muscles is at fault. The identification of these fine muscles is challenging, especially in patients who have significant facial adiposity. Absolute clinical certainty is essential before proceeding with injection if serious clinical complications are to be avoided. Posterior gummy smile can be safely managed using just 2 injection points of 2.5 units of BT-A on each side and placing them along the palpable path of the zygomaticus muscles (Figure 6).

*Mixed and asymmetric gummy smiles* can result from LLSAN and zygomaticus hyperfunction. Treatment is targeted to the specific muscles involved and should address the patient's specific complaint. Patients receiving their first BT-A injection should be given lower doses to avoid overtreatment. Doses should be determined on a case-by-case basis, considering muscle strength, type, and contributing factors.

## ADVERSE EFFECTS OF TREATMENT

The use of BT-A to manage smile alteration depends on the dentist understanding all aspects of the regional anatomy of the lower face. BT-A's effects are technique sensitive and can cause various complications and adverse outcomes. Results are unlikely to be perfect, so patient expectations must also be managed. Most complications are mild and short-lived.

The most common adverse outcomes are asymmetry, overcorrection, under-correction, and perioral droop. In addition, patients may be less satisfied with dynamic results than with those seen at rest. Among the serious complications that can occur are airway compromise and difficulty with mastication and swallowing. Repeated use of BT-A for cosmetic purposes is not associated with an increase in adverse outcomes or changes in the safety profile.

Patients should be carefully selected when considering smile modification. This includes assessing the patient's mental well-being and his or her psychological stability, expectations, and fears. Physical factors to consider include muscle dynamism, balance, and symmetry before injection, when determining dosage site and depth, and postoperatively.

### Clinical Significance

Dental practitioners should understand that the use of BT-A can be valuable in changing a patient's smile profile. However, they should also consider the medico-legal implications of BT-A, as well as whether BT-A use is considered to fall under the scope of dentistry.

Delpachitra SN, Sklavos AW, Dastaran M: Clinical uses of botulinum toxin A in smile aesthetic modification. *Br Dent J* 225:502-506, 2018

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