

## Pterygoid Botulinum Toxin Injection

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**Botulinum** is a toxic polypeptide produced by the gram-positive anaerobic bacterium *Clostridium botulinum* that inhibits acetylcholine release from nerve endings, resulting in reduced neuromuscular transmission and local muscle activity, as well as cholinergic mediated parasympathetic activities.<sup>1</sup> Its name is derived from the Latin word *botulus*, meaning sausage, as its toxicity was initially attributed to the oil of spoiled sausages. Of late, botulinum, packaged in various commercial forms such as *onabotulinumtoxinA* (Botox® type A, Allergan, Irvine, CA), is popularly used in several medical applications such as blepharospasm, hyperhidrosis and strabismus, and most famously in cosmetic surgery, where Botox® injections are used to eliminate and/or smoothen wrinkles.

In otolaryngology, common indications for Botox® injections include management of rhytids, cervical dystonia and spasmodic dysphonia. Another interesting application is pterygoid muscle injection. The lateral pterygoid muscles (LPM) pull the condylar head of the jaw forward, resulting in the opening of the jaw or displacement of the mandible anteriorly or towards the contralateral side, whereas the medial pterygoid muscles (MPM) pull the angle of the jaw upward and anteriorly to close or protrude the jaw, respectively. Increased or unequal activity of these muscles relative to other muscles of mastication and temporomandibular joint ligaments may result in asymmetry, malocclusion, temporomandibular joint (TMJ) dysfunction or dislocation.<sup>2</sup> Indications for pterygoid muscle botox injection include neurogenic TMJ dislocation, recurrent TMJ dislocation, oromandibular dystonia (OMD) particularly LPM dystonia, LPM spasm in condylar fractures, TMJ clicking, bruxism with myofascial pain and stroke-induced trismus.<sup>3-20</sup>

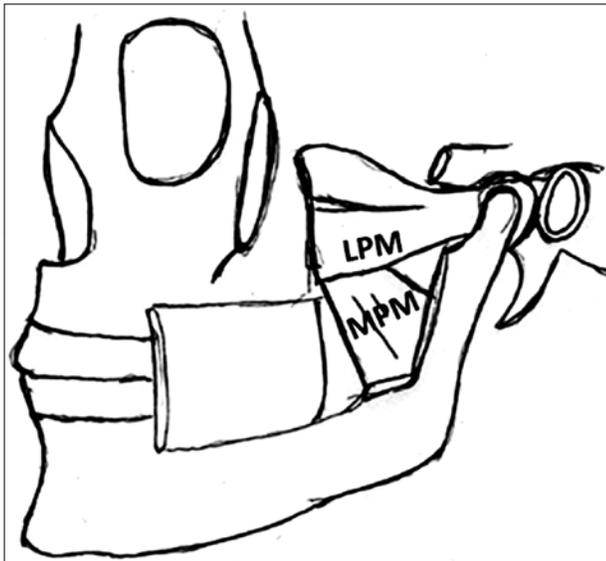
Several patients with indications for Botox® injection of the pterygoid muscle have been seen by this author, including post cerebro-vascular disease (CVD) dystonia with recurrent TMJ dislocation, bruxism, condylar fracture and oromandibular dystonia, but only the latter had the opportunity to acquire Botox® and the electrode needle (Ambu® Neuroline Inoject 50mm/2" length x 0.50mm/25 Gauge Calibre, Ambu A/S, Denmark) due to cost constraints. We used a Caldwell Sierra Wave® V Electromyography (EMG) Machine with v. 10.0.125 software (Caldwell Laboratories, Inc., Kennewick, WA). The most exciting parts of performing the procedure are the anatomy and process of identifying the muscle with EMG guidance and the immediate results after injection.

Electromyography (EMG) – guided botulinum injection can measure muscle activity by recording muscle depolarization or electrical activity. Using cannula needle electrodes with an open lumen, the muscles are identified by their activity during muscle contraction and then injected with Botox® to decrease muscle activity. Anatomically, the LPM is accessible through the mandibular notch which is directly anterior to the condylar head of the mandible. The latter is easily palpable and is anterior to the external auditory canal (*Figure 1*). Using a needle electrode, the LPM can be identified by opening the jaw or moving the jaw to the contralateral side.<sup>2,21</sup> The

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**Figure 1.** Infratemporal fossa with zygomatic arch and coronoid process removed. LPM – lateral pterygoid muscle, MPM – medial pterygoid muscle

MPM is less easily targeted because it generally closes the jaw. However, to further decrease anterior displacement of the jaw, both the LPM and the MPM activity can be decreased. The MPM can be targeted trans-orally by inserting the EMG electrode medial to the jaw and lateral to the pterygomandibular raphe, piercing through the buccinator muscle. Identifying MPM contraction can be done by biting to occlude the upper and lower jaw. With the cheeks retracted and needle inserted, Botox® injection can be done to lower MPM activity.

Clinical outcome can be assessed by measuring inter-incisor distance, mandibular deviation and protrusion, decrease in pain, restoration of masticatory function and proper occlusion. The dosage of botulinum injection in the pterygoid muscles will vary between indications and the specific toxin product used, but is usually in the range of 20 – 30 U/ml. Injection dose is 10 U to 50 U per muscle every three months,<sup>20</sup> with a total limit of 200 U for muscles of mastication. In the author's experience, the 20 units of Botox® wear off at two months after injection in a patient with oromandibular dystonia.

Pterygoid Botox® injection can be an important ancillary to rehabilitation disorders of mastication and the TMJ. However, it is not without risk. Various complications have been reported such as changes in salivary consistency, swallowing and speech and facial muscle weakness.<sup>20</sup> These complications may be attributed to the toxin diffusing to untargeted adjacent structures such as the parotid gland, facial muscles and superior constrictors. Proper technique, sufficient knowledge of pterygoid anatomy and EMG guidance are important in preventing complications. Clinical outcomes for both short- and long-term goals still need to be standardized and defined to allow for

comparison across different case series and trials. A multidisciplinary approach cannot be overemphasized.

**Pearls:**

1. Short-term and long-term goals should be set.
2. Zygomatic arch and condylar head are good landmarks for lateral pterygoid injection via extra-oral approach.
3. Coronoid process and ramus can be palpated intra-orally when doing medial pterygoid muscle injection. The needle is guided medial to the bone, piercing the retromolar trigone.
4. EMG guidance when using cannula electrodes to inject Botox will facilitate muscle identification.
5. Proper dosing and frequency of Botox injection is individualized.

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