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Clinical Paper
TMJ Disorders

Botulinum toxin injection for management of temporomandibular joint clicking

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Abstract. The aim of the present study was to investigate the effect of botulinum toxin type A (BTX-A) injection in the lateral pterygoid (LP) muscle on temporomandibular joint (TMJ) clicking. The study enrolled seven patients with a total of 11 joints; all patients were stage I or II of Wilke's staging for internal derangement. BTX-A was injected in the ipsilateral LP muscle with electromyogram (EMG) guidance and the subjects were assessed for 4 months. Maximum inter-incisal opening, range of lateral movement, and the presence of a click were recorded throughout the follow-up period, and magnetic resonance imaging (MRI) was ordered at the end of the 4 months. The results showed that the decrease in inter-incisal opening and side to side movement immediately postoperative was statistically significant, while the difference by the end of the follow-up period was insignificant. MRI showed a marked improvement in disc position postoperatively. It may be concluded that BTX injection in the LP muscle leads to the disappearance of joint clicking clinically and a significant improvement in disc position as shown on MRI.

Key words: temporomandibular joint; click; BOTOX; MRI.

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Temporomandibular disorders (TMD) is a collective term used for a number of clinical problems that involve the masticatory muscles, temporomandibular joint (TMJ), and/or associated structures.[1] Anterior disc displacement (ADD) is one of the major findings in TMDs, as well as the most common cause of TMJ sounds.[2] Currently followed treatment regimens for disc displacement include splint therapy, therapeutic exercises, and surgery. Often, the joint clicking does not change considerably with conservative treatment.[2,3]

Joint lavage has also been suggested as a treatment option. Some studies have reported this to improve function, reduce clicking, and reduce joint pain,[4] while others have reported no significant improvement.[5] Arthroscopic disc repositioning has also been reported as a treatment option and has proved to be more cosmetically acceptable than open surgery, but requires higher skills and extensive training.[6] It has been proposed that uncoordinated function between the muscle bundles of the upper head and the superior part of the lower head of the lateral pterygoid (LP) muscle could lead to abnormal movements of the disc therefore causing a click. Further investigation on the relationship between disc displacement and attachment of the LP directly

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into the disc has been carried out,[7,8] and a close relationship has been claimed between anterior disc displacement with reduction (ADDR) and the activities of the LP; this was also concluded after two electromyographic studies.[2,9]

Botulinum toxins (BTX) were first recognized by Christian Andreas in 1817, when he found that food-borne botulism was due to a toxin that paralyzed skeletal muscles and parasympathetic function. He further suggested that these toxins could be used to treat involuntary muscular spasms and movements.[10] The therapeutic value of BTX is due to its ability to cause chemodenervation and to produce local paralysis when injected into a muscle.[10] Several serotypes of BTX have been discovered, of which BTX-A is the one approved for human application, with the best results and least complications. The therapeutic use of BTX-A includes cases of blepharospasm, oromandibular dystonia, laryngeal dystonia, hemifacial spasm, cervical dystonia, tremors, and tics.[10,11] BTX-A has been shown to be effective in the treatment of many TMDs.[1,2,12,13] Its success in treating cases of ADDR was reported in a study conducted on two patients.[2] The aim of the present study was to further investigate the effect of BTX-A injection in the LP on TMJ clicking based on the theory suggesting that the hyperactivity of the muscle is an etiologic factor of the click.

Patients and methods

The study enrolled six patients (one male, five females) with a total of 11 joints; patients were aged a mean 26.55 ± 5.66 years. All patients were selected from the outpatient clinic, complaining of a painless TMJ click with no muscle tenderness, associated with ADDR confirmed by magnetic resonance imaging (MRI). A thorough clinical examination and medical history were taken, and candidates with neuromuscular disorders (e.g. myasthenia gravis) and musculoskeletal disorders were excluded. All patients were informed and consented on the procedures to be followed throughout the study. MRI was ordered for all the affected joints to confirm the clinical diagnosis (ADDR) and to document the disc position before injection (parasagittal T2 slices). The images were made on a 1.5 T machine with the following parameters: TR, 3190; TE, 66; slice thickness, 3 mm; interslice gap, 0.3 mm. The TMJ disorders fulfilled stage I or II of Wilke's staging of internal derangement.[14] The preoperative maximal inter-incisal opening (MIO), the opening at which the click occurred, and the range of lateral movement were measured using a Vernier calliper, recorded in millimetres (mm) and stored for later statistical analysis.

A BTX-A vial was reconstituted with 2 ml of 0.9% normal saline to obtain a 5 U/0.1 ml solution (BOTOX 100 U powder for solution for injection; *Clostridium botulinum* type A neurotoxin complex, Allergan, Westport Co., Mayo, Ireland); 0.7 ml of this solution containing 35 U BTX-A were then prepared for injection in a 1-ml insulin syringe. This was injected into the ipsilateral LP muscle with the guidance of an electromyogram (EMG) device (Signal Amplifier for BTX-A; Barrett Engineering, Fortuna, CA, USA). With the patient sitting in an upright position on the dental chair, the LP muscle was approached intraorally from the contralateral side with the mouth opened wide. The injection needle was directed towards the neck of the condyle where the LP inserts (Fig. 1). The patient was then instructed to remain in an upright position for 4 h (to reduce diffusion into pharyngeal muscles which may cause nasal regurgitation).

Patients were recalled weekly during the first month, then monthly for three more months. The same preoperative measurements were taken at each of the follow-up sessions. MRI was ordered at the end of the follow-up period with the same parameters as used preoperatively. The pre- and postoperative MR images were compared for a change in disc position antero-posteriorly. The most centralized image in the closed mouth position in the pre- and postoperative MR images was chosen and an x–y graph drawn according to the set of anatomic points adapted from Arayasantiparb and Tsuchimochi.[15] The x-axis extended from the lowest point of the articular eminence to the highest point of the external auditory meatus. The y-axis was drawn automatically by the Plot Digitizer computer program (Plot Digitizer Program 2.5.0, Joseph A. Huwaldt) perpendicular to the x-axis extending from the lowest point of the articular eminence. The anterior-most and posterior-most points of the articular disc were chosen and the program calculated their (x, y) coordinates, which were saved for the pre- and post-injection images of the same joint. Distances between the disc points and the head of the condyle were calculated using the formula:

$$\sqrt{(x_2 - x_1) + (y_2 - y_1)^2}$$

The anatomic assessment points were as follows: point T: lowest point of the articular eminence – and will mark the (0,0) point of the (x,y) graph to be drawn; point DA: anterior-most convexity of the articular disc; point DP: posterior-most convexity of the articular disc; point C: uppermost point of the mandibular condyle; point GP: lowermost point of the posterior glenoid tubercle – and will mark the (10,0) point on the graph to be drawn; and point A: the uppermost point of the external auditory meatus. The mathematical formula $\sqrt{\ }(a_2 - a_1)2 + (b_2 - b_1)^2$ was used to determine the difference between the two points pre- and postoperatively, i.e. the coordinates of the anterior point of the disc (point A) were compared pre- and postoperatively and the same for the posterior point of the disc

Fig. 1. Botulinum toxin type A (BTX-A) injection in the lateral pterygoid muscle.