Mijoska, A., Jovanovski, S., & Naumovski, B. (2024). Application of botulinum toxin in conservative treatment of masticatory muscles dysfunction, *MEDIS - Medical Science and Research, 3*(2), 01-05.
doi: 10.35120/medisij030201m UDK: 615.9.03:616.314-008.28

APPLICATION OF BOTULINUM TOXIN IN CONSERVATIVE TREATMENT OF MASTICATORY MUSCLES DYSFUNCTION

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Abstract: The purpose of this paper is to describe the application of the botulinum toxin in diseases of the temporomandibular system of a muscular type such as masticatory hypertrophy, spasm, bruxism, and tension headaches of idiopathic etiology. The masticatory system is a complex apparatus with great adaptive capacity. Still, when that capacity is exceeded, functional disorders occur followed by a series of symptoms that depend on individual, local, and systemic etiological factors. Occlusal trauma exceeding the physiological limits of the teeth, periodontium, and TMJ leads to a series of functional disorders. Temporomandibular dysfunctions (TMD) are used to describe a large, heterogeneous group of diseases of the temporomandibular joint (TMJ) and its adjacent tissues and organs.

Botulinum toxin type A, hemagglutinin complex with 500 IU (DISPORT Ipsen Biopharm, UK) was used for the therapy of muscle disorders like bruxism or night teeth clenching in female patient 26 years old. Depending on the dose that was applied to the targeted muscle, a complete or partial reduction in contraction occurs with reduced function and weakening of the muscle.

Two weeks after applying the neuromodulator, the patient reported a reduction in pain and episodes of teeth grinding and clenching. Bilateral hypotrophy of left and right masseter muscles was noticeable after 2 months.

We concluded that botulinum toxin could be used as an effective treatment for reducing nocturnal bruxism and myofascial pain in patients with bruxism.

Keywords: botulinum toxin, neuromodulator, TMJ, bruxism
Field: Medical Sciences and Health

1. INTRODUCTION

The masticatory system is a complex apparatus with great adaptive capacity. Still, when that capacity is exceeded, functional disorders occur followed by symptoms that depend on individual, local, and systemic etiological factors. Occlusal trauma exceeding the physiological limits of the teeth, periodontium, and TMJ leads to a series of functional disorders. Temporomandibular dysfunctions (TMD) are used to describe a large, heterogeneous group of diseases of the temporomandibular joint (TMJ) and its adjacent tissues and organs (Kapusevska B, 2019).

One of the most common TMD diseases in the last decade is bruxism, a functional movement disorder or involuntarily teeth clenching and grinding which can cause jaw pain, muscle pain, headache, depression, tooth wear, fractures of the teeth, and restorations. (Raluca, 2020). Bruxism has a multifactorial etiology, still unclear, but psychological factors are playing a dominant role (Manfredini 2013). Awake and sleep bruxism are considered as two entities, based on muscle activities (Klasser, 2015). Other etiological factors contributing to disorder in masticatory muscle contraction are mentioned for two different types of bruxism (Kebede, 2011).

Sleep bruxism (SB) is primarily a sleep-related movement disorder, with multifactorial etiology and complex physiological processes. Tooth grinding sounds during sleep, abnormal tooth wear, transient morning jaw muscle pain or fatigue, temporal headache, and jaw locking on awakening present diagnostic criteria for sleep-related bruxism based on the International Classification of Sleep Disorders (American Academy of Sleep Medicine, 2014.)

Legg in 1880, presented masseteric hypertrophy (MH) as a rare unilateral or bilateral benign enlargement of the masseter muscles. MH has no gender prevalence, patients are aged 20 to 40. In 1969, Achelgren found that swelling of the angulus mandibullae may also arise from masseter hypertrophy caused by hyperfunctioning in bruxism. Enlargement of the muscle and mandibular angle leads to the so-called "square face" and asymmetry of the lower face. MH when related to bruxism, can be accompanied by trismus, orofacial, and temporomandibular joint pain (Lee, 2007). The first treatment options consisted of invasive procedures such as surgical resection of the muscle and osteotomy. The unpredictability and

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irreversible nature of these procedures together with the multiple risks involved, have led to a growing demand for more conservative therapies such as occlusal splints and muscle relaxation (Baek, 1994, Beckers, 1977).

Several treatment options for bruxism have been proposed during the last decades (Moore, 1994). Pharmacotherapy, physiotherapy, and occlusal splints are the most common, but since these conventional therapies may not be completely effective, some alternative methods are still being investigated by the Food and Drug Administration (FDA). Neuromodulators as Botulinum toxin - Abobotulinum (Botox) is a neurotoxin produced by the bacterium Clostridium botulinum and a novel treatment option for MH associated with bruxism. Its mechanism is blocking the release of acetylcholine from motor nerves at the neuromuscular synopsis and inhibiting muscular contraction. In 2000, Tan proposed botox as a conservative, alternative treatment for patients with bruxism.

The purpose of this paper is to describe the application of the botulinum toxin in diseases of the temporomandibular system of a muscular type such as masticatory hypertrophy, spasm, and bruxism.

2. METHODOLOGY

A 27-year-old female patient came to the University Dental Clinical Centre “Ss’ Panteleimon”, Skopje for treatment of the bilateral MH associated with regular episodes of nocturnal teeth grinding with noises, headache upon awakening, and muscle pain. She has already visited several dental practitioners for her symptoms and was diagnosed with nocturnal bruxism. The only treatment she received was a soft mouth guard – an intraoral splint for preventing additional teeth contacts during sleep. However, they did not manage her symptoms, and she noticed continuous muscle bulging and anterior incisal teeth wear (Figure 1). The pain and spasms were also getting worse, so she decided to look for specialist help.

First, we conducted a thorough clinical investigation, extra and intra-oral examination, and took general health and lifestyle questionnaires including smoking habits, alcohol drinking, depression, anxiety, and stress. We investigated patient’s sleeping habits and found that she was making a grinding noise during sleep. We noted that the right masseter was larger, with asymmetry of the lower third of the face. Extraoral muscle palpation showed tenderness of the external masseter branch.

Figure 1. Extraoral view with bilateral masseter hypertrophy

Intra-oral examination revealed intact teeth in the upper and lower jaw, the presence of tooth wear, lateral tongue indentation, and linea Alba on the buccal mucosa, all typical signs and symptoms of bruxism (Figure 2). The patient was completely aware of her condition, and she also considered this to be a major aesthetic problem.

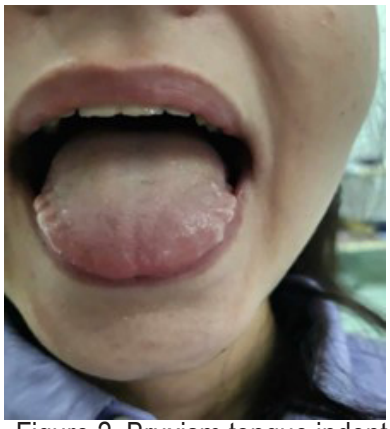

Figure 2. Bruxism tongue indentations

Next, we took impressions from both jaws and made studio models for analyses of the occlusion and articulation habits. An occlusal acrylic hard stabilization splint (SS) was manufactured for the lower teeth (Figure 3). The splint is orthotics appliance used for preserving the biomechanical balance between physiological loading and stress generated by stress relaxation (Gholampour et al., 2019). The patient was advised to wear the splint every night, and couple of hours during the day. The splint should not be used during eating or any other functional activities.

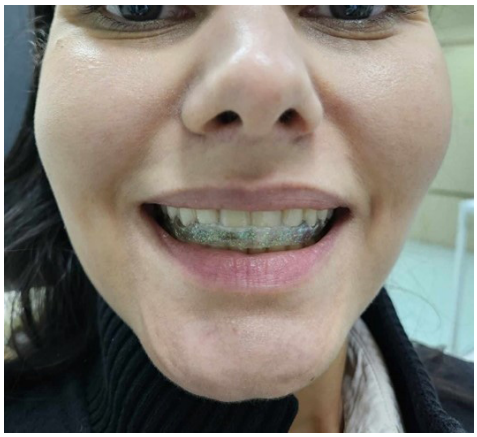

Figure 3. Occlusal stabilization splint - intraorally

Tan et al. in 2000 also suggested that botulinum toxin is a safe and effective treatment for people suffering from severe bruxism, reducing muscular activity. So, as the second therapy modality after 4 weeks of wearing the SS and primary symptom reduction, we administrated 20-30 IU diluted neurotoxin Dysport 500 IU (Ipsen, UK), in the two injection points with a needle 30 gauge in each masseteric muscle on both sides of the face (intramuscular application). It is advised that no more than 40-60 IU Dysport should be administered in the single treatment. The individual dose is chosen according to the severity of the hypertrophy and other symptoms. The result of the treatment was the inhibition of the release of acetylcholine in motor neurons resulting in temporary muscle weakness. The duration of therapeutic effect is usually no more then 3–6 months, afterwards the muscles begin to contract and spasm. Additional doses of botulinum toxin are prescribed according to the clinical situation.

3. RESULTS

Pharmacotherapy including NSAID Ibuprofen, Magnesium 400 mg / a day has shown to reduce pain and tenderness of the muscles. Stabilization splints significantly reduced SB episodes immediately after the insertion of the device, and 4 weeks later, with mild relief of the pain and tenderness. We noticed a positive impact on psychological impairment and an increase in positive stress-coping strategies. Two months after botulinum toxin treatment reduction in muscle hypertrophy with narrowing of the lower third of the face was significantly evident (Figure 4).

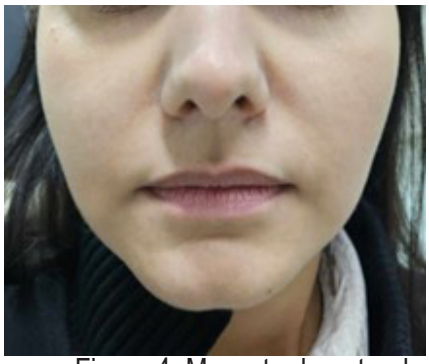

Figure 4. Masseter hypotrophy

4. DISCUSSION

Adjustment of the dental occlusion has long been promoted as a therapy treatment option for temporomandibular disorders (TMD), but in 1996 National Institute of Health revealed that occlusal intervention is not more successful than noninvasive methods. The contemporary protocol for patients with bruxism promotes the concept of conservative therapy, without irreversible occlusal adjustments, including pharmacotherapy – nonsteroidal anti-inflammatory analgetic (NSAID), physiotherapy, splint therapy, vitamin supplements towards symptom relief (Van der Glass, 2000; Tsukiyama Y, 2001).

Mandibular orthotics used to balance the occlusions at centric relation (CR) have shown significant reduction or elimination of TMD complaints, suggesting a relationship between balancing occlusion in CR and optimum management of TMD (Barker, 2004). Stabilization splints are commonly used as the first-line therapy treatment for Bruxism and some other TMD.

When using neuromodulators like Botulinum toxin for TMD treatment we are aware that the effects on the muscle are transient and they will return to normal function, but the effect of muscular atrophy is secondary to relaxation, therefore awareness of this longevity is relevant as it will dictate the need for booster injections (Shim, 2020).

5. CONCLUSION

This novel non-invasive approach with the use of neuromodulators like Botulinum toxin presents a viable option for the treatment of bruxism and benign MH. Botulinum toxin, Dysport have shown decrease in muscle motor activity, muscle atrophy, and cosmetic contouring of the lower face. Complications relating to the use of neuromodulator Botox are very rare and transient, yet we lack a standardized protocol for any form of TMD.

REFERENCES

Almukhtar RM, Fabi SG. (2019). The masseter muscle and its role in facial contouring, aging, and quality of life: a literature review. Plast Reconstr Surg. 143(1):39e-48e.

Baek SM, Baek RM, Shin MS. (1994). Refinement in aesthetic contouring of the prominent mandibular angle. Aesthetic Plast Surg. 18(3):283-9.

Barker D. K. (2004). Occlusal interferences and temporomandibular dysfunction. General dentistry, 52(1), 56–62.

Beckers HL. (1977). Masseteric muscle hypertrophy and its intraoral surgical correction. Journal of Maxillofacial Surgery.5: 28-35.

Gholampour S., Gholampour H., Khanmohammadi H. (2019). Finite element analysis of occlusal splint therapy in patients with bruxism. BMC Oral Health. 19(1)

J. Ahlgren, K.-Å. Omnell, B. Sonesson, N.G. Toremalm; Bruxism and Hypertrophy of the Masseter Muscle: A Clinical, Morphological and Functional Investigation. Practica Oto-Rhino-Laryngologica 1 January (1969) 31 (1): 22–29.

Kebede B, Megersa S. (2011). Idiopathic masseter muscle hypertrophy. Ethiop J Health Sci. 21(3):209-12.

Klasser GD, N Rei, GJ Lavigne. (2015). Sleep Bruxism Etiology: The Evolution of a Changing Paradigm. J Can Dent Assoc. 81:f2

Kapusevska B. (2014). Бруксизам и оклузални парафункции: општ дел. Скопје, Стоматолошки Факултет,

Lee CJ, Kim SG, Kim YJ, et al. (2007). Electrophysiology change and facial contour following botulinum toxin injections in square faces. Plast Reconstr Surg. 120:769-78.

Manfredini D, Lobbezoo F. Role of psychosocial factors in the etiology of bruxism. J Orofac Pain 2009; 23(2):153-66.

Moore AP, Wood GD. (1994). The medical management of masseteric hypertrophy with botulinum toxin type A. Br J Oral Maxillofac Surg. 32:26-8.

Ommerborn, M. A., Schneider, C., Giraki, M., Schäfer, R., Handschel, J., Franz, M., & Raab, W. H. (2007). Effects of an occlusal splint compared with cognitive-behavioral treatment on sleep bruxism activity. European journal of oral

sciences, 115(1), 7–14.
Raluca A, D Raluca, A Dragomir, C Ilie, et al. (2020). The use of botulinum toxin in the management of bruxism and facial arthromyalgia syndrome. Romanian Journal of Medical Practice 15(1):77-81
Sleep related bruxism. In: International classification of sleep disorders. 3rd ed. Darien, IL: American Academy of Sleep Medicine; 2014.
Shim YJ, Lee HJ, Park KJ, et al. (2020). Botulinum toxin therapy for managing sleep bruxism: a randomized and placebo-controlled trial. Toxins (Basel).12(3):168.
Tan EK, Jankovic J. Treating severe bruxism with botulinum toxin. (2000). JADA.131:211-6.
Tsukiyama Y, Baba K, Clark GT. (2001). An evidence-bases assessment of occlusal adjustment as a treatment for temporomandibular disorders. J Prosthet Dent. 86:57-66.
Van der Glas, H. W., Buchner, R., & van Grootel, R. J. (2000). Comparison of treatment options for myogenous temporomandibular dysfunction]. Nederlands tijdschrift voor tandheelkunde, 107(12), 505–512.