Slovenian Medical Journal

Treatment of bruxism, masseteric myalgia and hypertrophy with botulinum toxin type A

Zdravljenje bruksizma, mialgij in hipertrofij masetrnih mišic z botulinskim toksinom tipa A

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Key words:
bruxism; myalgia; masseteric hypertrophy; TMJ; botulinum toxin

Ključne besede:
bruksizem; mialgija; hipertrofija masetrnih mišic; TMS; botulinski toksin

Received: 21. 1. 2020
Accepted: 3. 10. 2020

Abstract

Background: Bruxism (nocturnal dental clenching and grinding) is a persistent problem that affects many systems and is difficult to treat. It causes pathological abrasions and dental injuries, as well as fractures of prosthodontic reconstructions, painful hypertrophy of masticatory muscles, and sometimes temporomandibular joint pain and headaches. Intramuscular botulinum toxin injections have been reported as a safe and effective means of treatment, causing reversible weakening of the masticatory muscles, which results in symptomatic relief.

Patients and methods: A retrospective analysis of the time period 2007 – 2018 was made, in which 72 patients with bruxism, masseteric myalgia and hypertrophy were treated with botulinum toxin injections.

Results: The majority of patients (58 of 64, i.e. 91%) reported symptomatic relief – pain diminished or subsided as did nocturnal bruxism, the masseters softened and lost volume. The effects of botulin toxin last 4 – 6 months, but in 29 (50%) patients, symptomatic relief was permanent and they did not return.

Conclusion: Treatment of bruxism, masseteric myalgia and hypertrophy with botulinum toxin injections is an effective and safe mode of treatment. Treatments can be repeated if the symptoms recur.

Izvleček

Izhodišče: Bruksizem (nočno škripanje in stiskanje z zobmi) je trdovraten problem, ki lahko prizadene več organskih sistemov. Povzroča obrabo sklenine in poškodbe zob ter protetičnih konstrukcij, bolečo hipertrofijo masetrnih mišic zaradi stalnega preobremenjevanja, včasih tudi bolečine v temporo-mandibularnih sklepih (TMS) in glavobol. Zdravljenje z injekcijami botulinskega toksina v mišico naj bi odpravilo ali omililo simptome.

Metode: Opravili smo retrospektivno analizo obdobja 2007–2018, v katerem smo z vbrizgavanjem botulinskega toksina zdravili 72 oseb z bruksizmom, mialgijami in hipertrofijami masetrnih mišic. Za raziskavo smo uspeli pridobiti podatke o razultatih zdravljenja za 64 bolnikov.

Rezultati: Velika večina (58 od 64 oz. 91 %) je poročala o izboljšanju stanja; bolečnost se je zmanjšala ali izginila, prav tako nočno škripanje, masetrne mišice so vidno uplahnile in se zmehčale. Učinek botulina sicer traja 4–6 mesecev, a smo pri 29 (50 %) bolnikih trajno odpravili simptome, zato se niso več vračali na preglede.

Zaključek: Oslabitev masetrnih mišic z vbrizgavanjem botulinskega toksina je učinkovito in varno zdravljenje, ki za več mesecev oslabi mišice, kar odpravi ali močno zmanjša simptome. Po potrebi se zdravljenje lahko večkrat ponovi.

Cite as/Citirajte kot: Vesnaver A, Troha A. Treatment of bruxism, masseteric myalgia and hypertrophy with botulinum toxin type A. Zdrav Vestn. 2021;90(1–2):3–9.

DOI: https://doi.org/10.6016/ZdravVestn.3030

1 Introduction

Bruxism or teeth clenching and grinding can be a very stubborn problem. It is one of the ways of unconsciously releasing mental tension. It occurs mainly at night, although some patients notice involuntary teeth clenching due to stress during the day as well (1,2,3).

Nocturnal teeth grinding can be surprisingly loud, testifying to the large chewing forces that are released thereby. After several years of such clenching and grinding, characteristic changes appear on the teeth – the crowns of the teeth are shortened and abraded. In addition to teeth, individuals with severe bruxism typically damage or destroy fixed dental prostheses (prosthetic crowns, bridges) (1,3).

Due to constant isometric forces, hypertrophy of masticatory muscles occurs, most often the masseters, which may or may not be painful. Headache, jaw pain and pain radiating into the neck, cheekbones, tongue, may also occur (1,2,4,5).

Traditional treatment of bruxism with bite splints and psychotherapy is long-lasting and rarely successful (3,6,7).

Since the effect of temporary muscle weakening after botulinum toxin injection is well known, we decided to try this type of treatment in our patients based on publications in medical literature (1,2,3,4,5,8,9). In this paper, results of twelve years of experience are presented.

2 Methods

In the twelve-year period 2007–2018, we used botulinum toxin injections to treat 72 patients with myalgia and hypertrophy of the masseteric muscles and bruxism, 9 of whom also experienced pain in the temporomandibular joints (TMJ) and associated muscles. For the final evaluation, 8 patients were not available or could not be contacted by phone, mail or e-mail. Therefore, we included 64 patients in the study. In all patients in the study, a minimum of at least 15 months elapsed since the first injection.

Upon our first examination, we first had to distinguish patients with myalgia and masseteric muscle hypertrophy from those with TMJ pain. Patients with myalgia had no TMJ pain on palpation and the jaws moved appropriately when the mouth was opened. However, they had palpably sensitive, enlarged and hard masseter muscles, which were also visibly hypertrophied. In painful temporalis muscles, hypertrophy was less pronounced, but the muscles were hard and painful to palpation.

Treatment with botulinum toxin injection was suggested to all adults and

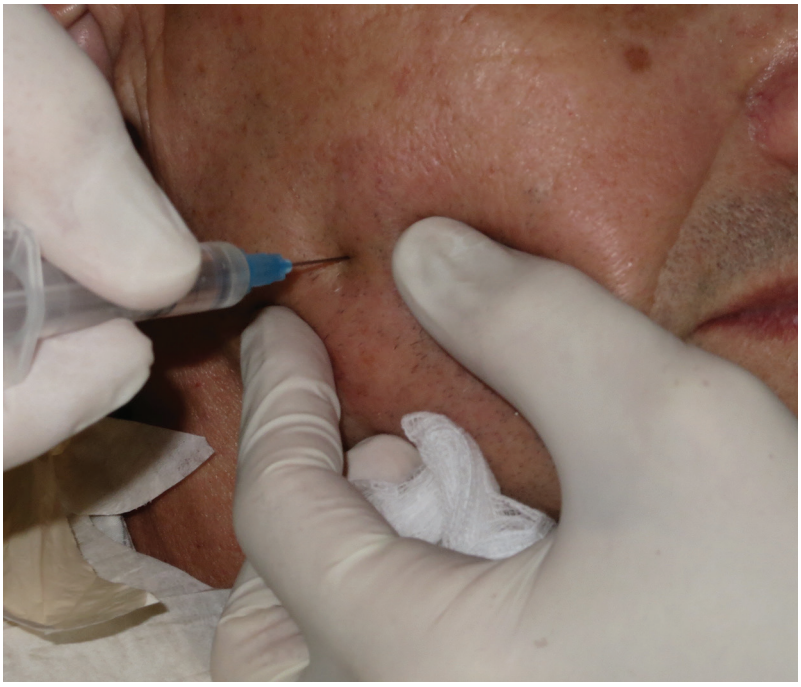

Figure 1: Injection deep into the masseter muscle (supraperiosteal).

adolescents who had problems described above. The mechanism and duration of relief were explained to them prior to treatment. Botulinum toxin was injected to

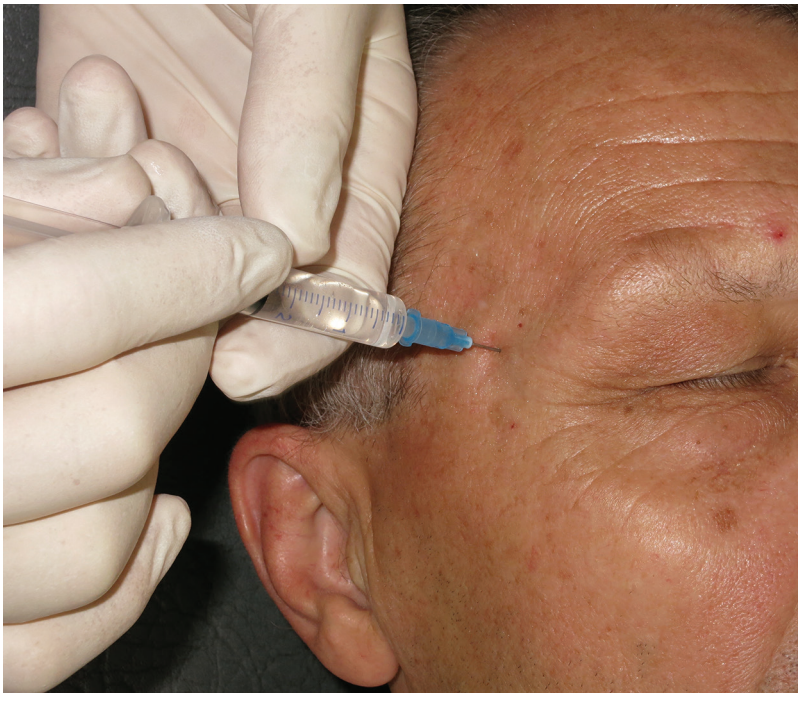

Figure 2: Injection deep into the temporalis muscle (supraperiosteal).

everyone who agreed.

The Ethics Commission was of the opinion that the analysis of the collected data was not contrary to ethical standards in healthcare. Permission to publish the images was given to us by all the patients who appear in the photos in the article.

2.1 Intervention

In all patients, skin markings were made above the points of the largest bulges of the masseter muscles upon teeth clenching. Most often we marked 1–2 points, in rare cases even 3. One vial of Dysport® (IPSEN) containing 500 units (U) of botulinum toxin type A was then taken and diluted with 2.5 ml of saline solution; 0.5 ml of the solution thus contained 100 U of botulinum toxin. The solution was then aspirated into a 3 ml syringe and 50–150 units of Dysport® (i.e. 0.25–0.75 ml of solution) was injected deep into the masseter muscle just above the periosteum at the site of markings (Figure 1).

A total of 100 U to a maximum of 500 U of Dysport® was injected bilaterally into the masseter muscles in the places of the most pronounced bulges (one, two or three points), i.e. 50–250 U of Dysport on each side.

In case of painful and hardened temporal muscles, Dysport® was prepared in the same way, and 100–150 U of Dysport® was injected deep into the temporal cavity on both sides (Figure 2).

For safety reasons, patients were never injected with more than a total of 500 U of Dysport® or the entire content of 1 vial.

We explained to the patients that the effect of attenuation of the bite force would onset gradually, that it would fully develop within 7–14 days and that it would last 4–6 months. We explained that the bite force would be reduced, but that they would still be able to chew food without

any problems, and that due to the weakening of the muscles, pain relief, reduction of nocturnal teeth grinding and gradual narrowing of the face could be expected.

2.2 Monitoring and recurrent treatment

Patients were monitored and appointed for follow-up after 1–2 weeks, after 2–3 months and then as needed: we agreed that they would come back for another checkup if, after the effect of Dysport® had subsided, they began to painfully clench their teeth again after a few months.

2.3 Condition assessment

During examinations, patients were asked about the pain and nocturnal teeth grinding and clenching. We asked them if they felt any difference in bite force. We palpated the masticatory muscles and subjectively assessed whether they were softer and less pronounced than at the first examination. Patients were photographed en face and the images were compared with images before treatment.

3 Results

Of the 64 patients included in the study, 42 (66%) were female and 22 (34%) were male. The mean age was 42 years, ranging from 14 to 71 years.

In 55 patients (86%), the problems occurred bilaterally, and only in 9 (14%) unilaterally.

The vast majority of patients were referred to us due to TMJ problems or pain: 19 patients (30%) had TMJ dysfunction, 4 (6%) had arthralgia, which makes a total of 23 patients (36%). 9 patients (14%) were referred for bruxism and 6 patients (9%) for bilateral or unilateral hypertrophy of the masseter muscles. Only 5 patients (8%) were referred for myalgia. Other diagnoses were sporadic: impacted teeth, facial asymmetry, post-injury condition, sialolithiasis, trismus, trigeminal neuralgia, atypical facial pain, swelling of the upper jaw, prognathism.

The vast majority of patients, i.e. 58 out of 64 (91%) reported a marked improvement at the first check-up (after 1–2 weeks): the pain disappeared or decreased significantly, and nocturnal teeth grinding disappeared. At the second check-up (after 2-3 months), atrophy of the masseter muscles was clearly noticeable, as they visibly and palpably subsided, which can be seen very clearly when comparing en face photos (Figures 3A and B). Patients noticed a marked decrease in bite force, which did not bother them when eating. No injuries of teeth or prosthetic replacements were reported during treatment with botulinum injections.

In 29 of these 58 patients (50%), a single injection was sufficient and they never returned, 14 patients (24%) came for 2 injections and 9 of them (16%) came 3 times. Six patients (10%) come regularly, every 6-12 months and have undergone treatment with botulinum toxin injections 5 times or more.

In patients who returned for another botulinum toxin injection, the absence of symptoms lasted for about half a year, in some cases up to one year.

3.1 Side effects

The only unpleasant side effect that occurred only 8 times (out of a total of 135 injections, i.e. in 6%) was a temporary weakening of the risorius muscles due to diffusion of botulinum toxin into the mimic muscles. The result was a partial smile paresis, which is uncomfortable for the patient, but is always only temporary and disappears within a few months.

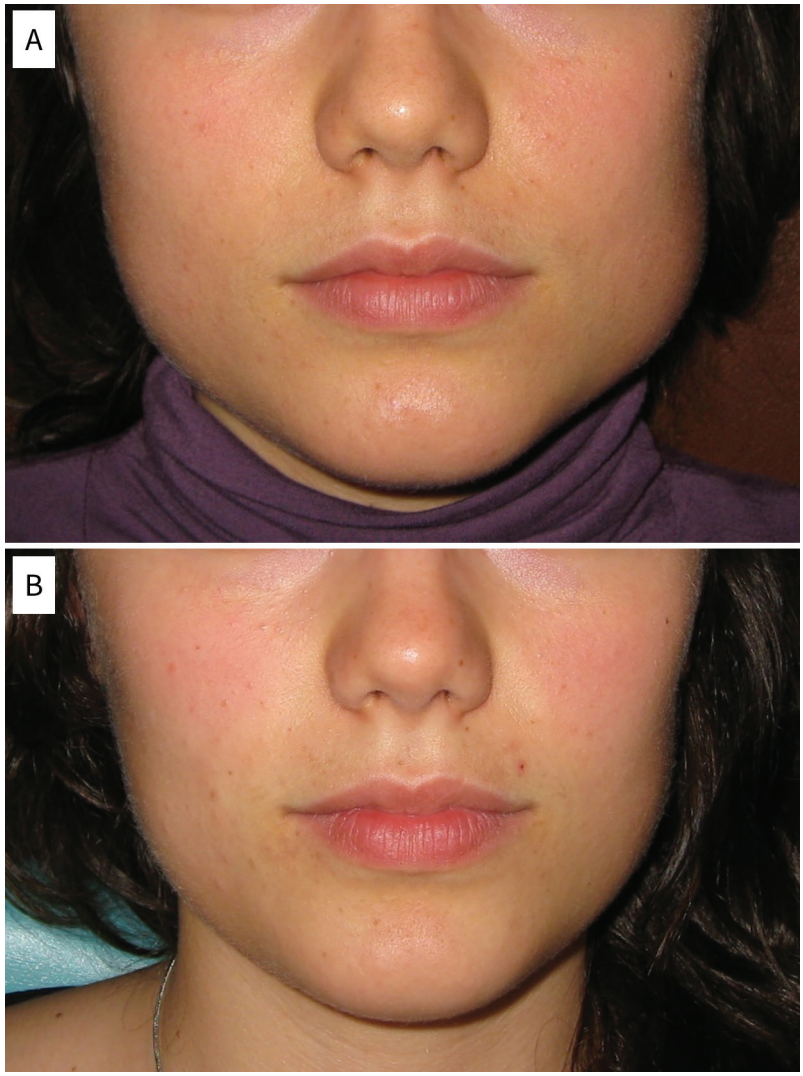

Figure 3: Hypertrophy of the masseter muscles before the injection of botulinum toxin into the muscle (A) and after (B). A marked decrease in the volume of both masseter muscles is clearly visible.

4 Discussion

Botulinum toxin is the most acutely toxic substance with a median lethal dose of 1 ng/kg of body weight (when injected). The toxin is produced by the obligate anaerobe *Clostridium botulinum*. Botulinum toxin exists in 7 different antigenic variants, of which almost exclusively type A is used in medicine. All variants are characterized by a simple double-stranded polypeptide structure of heavy and light chains, which are interconnected by a disulfide bond. The light chain is an endopeptidase that irreversibly prevents fusion of acetylcholine vesicles with the terminal membrane of motor neurons and neurons of the autonomic nervous system. Therefore, no stimulus is transmitted via the cholinergic synapse to the target cell. The most common consequence is months of loose paralysis of striated and smooth muscles (1,6,10,11). Re-innervation occurs slowly with the sprouting of new dendrites on the presynaptic neuron. The dendrites create new synapses, allowing the muscle to function again. The re-innervation process takes several months (11).

In addition to its most popular use in aesthetic medicine, for so-called wrinkle smoothing by triggering target paresis of certain mimic muscles, botulinum toxin is used to block neuromuscular transmission in blepharospasm, strabismus, spasticity, migraine (vascular smooth muscles), neurogenic bladder, etc. (4,6,8,12). Botulinum toxin, however, has also been shown to be very effective in the treatment of Frey's syndrome by blocking transmission in parasympathetic cholinergic synapses of sweat glands, as previously reported (13). In the same way, socially disturbing sweating of the armpits and palms can be eliminated (12). These and other non-cosmetic conditions in the head and neck area, where botulinum toxin treatment has been shown to be effective, have been reported in the literature (6,8).

In all patients in our group, we wanted to achieve long-term weakening of painful and hypertrophic masseteric muscles and eliminate bruxism. As botulinum toxin temporarily paralyzes or weakens muscles, it is therefore also effective in eliminating or reducing involuntary teeth clenching and grinding and in masseteric hypertrophy (4,5). Treatment of bruxism with injections of botulinum toxin into the muscles is not new. The first treatment

of this type was reported as early as 1990 in a patient with permanent CNS injury (9). Later, the effectiveness in treatment of masseteric myalgias (2,3,6) and hypertrophies (1,4,5), began to be reported.

Patients feel relief or reduction of muscle tension, which is present due to overloading, and the pain is reduced or eliminated. In addition to relaxation, other mechanisms are most likely also present in reducing muscle pain (2,6,7,11). As the activity of the masseteric muscles decreases, they also atrophy significantly (up to 30% loss of their volume) and the face gets a nicer shape (1,4,5).

The absence or alleviation of symptoms in patients lasts for different lengths of time, which was also observed by others. However, it often lasts longer than the re-innervation itself (2,4). We concluded that some patients simply got out of the habit of jaw clenching. Therefore, the effect lasts much longer than the effect of the botulinum itself on synapses (3,4).

The protocol of injection into the masseter and temporal muscles (sites, number, doses) was summarized according to the recommendations from the literature (1,2,3,4). Later, we switched from two-point to one-point injection into the muscle and did not notice any reduction in the effect.

There are few contraindications to botulinum toxin injection: local infection, pregnancy, breastfeeding, neuromuscular dystrophy (1,2). Injecting low doses of botulinum toxin into the masseter muscles is also safe, as even when injecting the entire Dysport vial (500 U), we do not come close to the median lethal dose of LD 50 for Dysport, which is estimated at around 10,000 U or 20 vials (1,11).

Temporary paresis of mimic muscles was actually the only side effect of injection into the masseter muscles, and even this occurred rarely and mostly at the beginning of our series. If botulinum toxin is not injected deep enough, it can seep from the masseter muscle to the superficial mimic muscles. We need to be especially careful in very slim people, and inject very slowly and deeply into the masseter muscles, just above the periosteum, to avoid the diffusion of the toxin to the mimic muscles (4).

5 Conclusion

The use of botulinum toxin type A has been shown to be an effective, safe, simple and predictable method for the treatment of bruxism, myalgias and hypertrophies of the masseter muscles. It should be noted that the treatment often needs to be repeated several times, but the time interval for recurrences is long, from 4 to 12 months or more, which is acceptable for patients. Elimination of pain and nocturnal teeth grinding and jaw clenching, improved appearance and reduction of damage to teeth and dental prostheses also outweigh the price of the product, which is relatively high.

References

1. Kwon KH, Shin KS, Yeon SH, Kwon DG. Application of botulinum toxin in maxillofacial field: part I. Bruxism and square jaw. Maxillofac Plast Reconstr Surg. 2019;41(1):38. DOI: 10.1186/s40902-019-0218-0 PMID: 31649901
2. Mor N, Tang C, Blitzer A. Temporomandibular myofacial pain treated with otbulinum toxin injection. Toxins (Basel). 2015;7(8):2791-800. DOI: 10.3390/toxins7082791 PMID: 26213970
3. Al-Wayli H. Treatment of chronic pain associated with nocturnal bruxism with botulinum toxin. A prospective and randomized clinical study. J Clin Exp Dent. 2017;9(1):e112-7. PMID: 28149474

4. Smyth AG. Botulinum toxin treatment of bilateral masseteric hypertrophy. Br J Oral Maxillofac Surg. 1994;32(1):29-33. DOI: 10.1016/0266-4356(94)90169-4 PMID: 8136335
5. To EW, Ahuja AT, Ho WS, King WW, Wong WK, Pang PC, et al. A prospective study of the effect of botulinum toxin A on masseteric muscle hypertrophy with ultrasonographic and electromyographic measurement. Br J Plast Surg. 2001;54(3):197-200. DOI: 10.1054/bjps.2000.3526 PMID: 11254408
6. Freund B, Schwartz M, Symington JM. Botulinum toxin: new treatment for temporomandibular disorders. Br J Oral Maxillofac Surg. 2000;38(5):466-71. DOI: 10.1054/bjom.1999.0238 PMID: 11010775
7. Zhang LD, Liu Q, Zou DR, Yu LF. Occlusal force characteristics of masseteric muscles after intramuscular injection of botulinum toxin A(BTX - A)for treatment of temporomandibular disorder. Br J Oral Maxillofac Surg. 2016;54(7):736-40. DOI: 10.1016/j.bjoms.2016.04.008 PMID: 27138229
8. Persaud R, Garas G, Sanjeev S, Stamatoglou C, Chatrath P, Patel K. An evidence-based review of botulinum toxin (Botox) applicationa in non-cosmetic head and neck conditions. J R Soc Med Sh Rep. 2013;4(2):10. DOI: 10.1177/2042533312472115 PMID: 23476731
9. Van Zandijcke M, Marchau MM. Treatment of bruxism with botulinum toxin injections. J Neurol Neurosurg Psychiatry. 1990;53(6):530. DOI: 10.1136/jnnp.53.6.530 PMID: 2380736
10. Arnon SS, Schechter R, Inglesby TV, Henderson DA, Bartlett JG, Ascher MS, et al.; Working Group on Civilian Biodefense. Botulinum toxin as a biological weapon: medical and public health management. JAMA. 2001;285(8):1059-70. DOI: 10.1001/jama.285.8.1059 PMID: 11209178
11. Berry MG, Stanek JJ. Botulinum neurotoxin A: a review. J Plast Reconstr Aesthet Surg. 2012;65(10):1283-91. DOI: 10.1016/j.bjps.2012.04.016 PMID: 22552262
12. Kostrzewa RM, Segura-Aguilar J. Botulinum neurotoxin: evolution from poison, to research tool—onto medicinal therapeutic and future pharmaceutical panacea. Neurotox Res. 2007;12(4):275-90. DOI: 10.1007/BF03033911 PMID: 18201955
13. Prodnik L, Vesnaver A. Predstavitev kliničnega primera: zdravljenje Freyevega sindroma z botulin toksinom tip A. Zdrav Vestn. 2009;78(4):203-5.