

The place of BoNT in TMD: review article and case report

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Over the last decade, there has been a great deal of interest in the application of botulinum toxin (BoNT) as a therapy for temporomandibular dysfunction (TMD), in particular bruxism [1-4]. Although many studies and reviews report a positive outcome in different signs and symptoms of TMD, other studies provide contradictory data [3-5]. The reason for this discrepancy is not fully elucidated but it is likely to be due to the methodological flaws in reports, indications and the misconception regarding the wide array of causes of TMD [5-7]. Therefore, it will make it difficult for day-to-day medical practitioners to adopt a clear-cut therapy. The paramount importance of understanding all the issues related to TMD is illustrated by the following facts: firstly, after tooth pain, temporal mandibular related pain is the most common pain in the oral and facial area [1]. Secondly, TMD affects 70-80% of the population aged between 25-45 [8]. This has led some authors to consider it as a public health issue [8]. Furthermore, because of the localisation of symptoms, patients will consult various specialties including dentists, maxillofacial surgeons, plastic surgeons and medical aesthetic specialists. Given the implications at stake, failure to diagnose and treat this pathology at an early stage can lead

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to serious, sometimes irreversible, complications, including tooth wearing, debilitating chronic pain and sometimes irreversible osteoarthritis [3]. It is also important to stress that BoNT does not constitute the panacea in the therapeutic armamentarium for this condition. The practitioner should recognise the exact and appropriate place and indication for BoNT as a therapy for TMD.

What is TMD and bruxism?

From an anatomical point of view, the temporal mandibular joint is the most commonly used joint in humans. It is a very complex structure that involves the connection between the mandibular condyle within the glenoid fossa [9]. It is mobilised by three groups of muscles including the masseter, temporalis, and the pterygoids which are the cardinal muscles involved in mastication [1]. In fact, this complex joint is capable of a vast array of motion in different axis needed for the function of mastication, swallowing and speech. TMD includes a vast number of disorders involving this complex system. They fall into two categories, namely muscular causes and conditions involving the actual joint. The myofascial conditions can be due to the hyperactivity of the above mentioned muscles, reflected by tension and spasm [6]. Intraarticular causes of TMD can be due to trauma or inflammatory conditions. The latter includes rheumatoid arthritis and ankylosing spondylitis [1].

By far, muscular dysfunction or hyperactivity is the most frequent cause of TMD [1,10]. The so called parafunctional behaviour and conditions such as bruxism are some of the most important causes of TMD [3]. Although it is well established that bruxism consists of hyperactivity of the above mentioned three muscles, particularly the masseter, and it is widely known that it can take place when the patient is asleep or awake, there is still an ongoing debate regarding the exact definition. In 2013, the consensus group defined bruxism as hyperactivity involving the mastication muscles leading to grinding and clenching of the teeth [11].

Later on, the definition was refined by adding the period of the day it takes place [12]. It is now widely accepted that sleep bruxism and awake bruxism are two separate entities as they can present with different symptoms and particularities. In addition, it has been recently suggested that bruxism should be considered as a behavioural entity rather than a condition, hence various forms of psychotherapy constitute an important part of the treatment [13,14].

From a symptomatic point of view, the cardinal sign of TMD consists of pain in the area of the temporalmandibular joint. Particular attention should be given to the fact that this pain may radiate to the areas of the neck and skull. The patient may report a significant increase in the pain when yawning, chewing and following a long period of talking. Clinical examination should assess for abnormal mandibular motion, including reduction or abnormal lateral motion [4]. Often, a clicking noise can be identified when the mandible is in motion [15]. It is paramount to stress that diagnosis of bruxism is almost exclusively clinical. Radiological diagnosis has a limited role but can be helpful in conditions where jaw trauma exists or in severe osteoarthritis [16,17].

Therapeutic options

Treating bruxism can be particularly challenging given that the aetiology is multifactorial and ranges from mechanical trauma to inflammation and behavioural causes. Therefore, the approach has to be multifactorial. In other words, it is extremely difficult to establish a universal therapeutic plan. The therapy for each patient has to be individualised according to the aetiology and the stage of the condition. However, the basic principle behind any therapy for bruxism should aim at diminishing the physiological and psychological stress, reducing the symptoms, particularly pain, and adjusting the occlusion function [2,18].

Before embarking on any therapeutic planning, it is important to remember that more than 40% of patients with TMD can

Case study

A 25-year-old female was diagnosed with TMD by her dentist and GP. All conservative treatments and therapies had been unsuccessful.

Presenting symptoms included teeth grinding, jaw clenching, constant headaches and jaw pain. In addition, she presented with masseter hypertrophy and squareness to her lower face. Dental examination revealed damage to her molar teeth. Treatment was carried out alongside dental input and with the use of a mouthguard at night.

BoNT (Botox®) total 100 units/1ml divided between selected injection points: masseter muscle (three sites) and temporalis muscle (two sites).

The patient showed a dramatic relief in symptoms related to TMD with the use of BoNT therapy with relief lasting up to six months. Alongside the therapeutic effect, there was also an associated cosmetic effect with slimming of the lower face (Figure 1).



Figure 1: Before and after photos of the patient.

experience a complete disappearance of their symptoms without any intervention or therapy [19]. In addition, between 50-90% of individuals suffering from this condition respond favourably to conservative therapy. Therefore, with regards to the therapeutic approach, the logical steps include the following: a purely conservative treatment should be adopted first and should involve psychotherapy, educational approach, relaxation of the jaw, avoidance of hard food and application of warm gauze on the area where the patient reports the pain [20].

Given the, fairly recent, demonstration of the high correlation between TMD and cognitive / psychological status, a great deal of emphasis is now placed on various therapies including cognitive behavioural approaches, psychoanalysis, hypnosis and other forms of psychotherapy [21]. Other techniques, including biofeedback, have been adopted in order to alter the very physiology of this condition [13].

Pharmacological treatments should only be used when conservative approaches have failed. They should be prescribed within the appropriate medical setting and include benzodiazepam, beta blockers and anti-convulsive medication as well as anti-inflammatories [22].

Role of BoNT

There is a strong scientific basis regarding the effect of BoNT as a therapeutic option for bruxism. Firstly, through its inhibitory effect of acetylcholine release and the subsequent muscle paralysis, it can alleviate or eliminate the muscle hyperactivity. Secondly, it has recently been demonstrated that BoNT can act on

the peripheral nociceptive network system via the neuropeptide [5]. In addition, there is an abundant body of evidence supporting the beneficial effect of BoNT as an efficient therapy for bruxism. However, there is still debate as to the degree of efficiency, as reflected by several studies [7,23-25].

With that respect, a fairly recent report reviewed several randomised control trials (RCTs) and reached the conclusion that there is no consensus with regards to the real advantage of BoNT as a therapy for TMD [26]. It is indeed striking that some studies, including RCTs, report an unequivocal positive effect of BoNT in bruxism, whilst others show no effect [26]. The discrepancy may be due to several methodological issues. Firstly, there is still a debate on the exact definition of bruxism [11]. In addition, some studies fail to distinguish between awake and asleep bruxism [27]. Furthermore, whilst bruxism remains a clinical diagnosis and is very often based on self-reporting, this method of diagnosis is now seriously questioned [28]. One author argues that tooth grinding cannot be considered as a solid parameter to indicate sleep bruxism [29]. In fact, sleeping tests, which are the gold standard for diagnosing sleep bruxism are very rarely used because of the cost and the time-consuming aspect. Another issue relates to the small size population reported in most of the positive studies [2,4,25]. Additionally, there is often a lack of consensus related to the dose used [30]. However, there seems to be a general agreement regarding the fact that BoNT should not be used as a first-line therapy for bruxism but rather when other therapies have failed [3,5,28].

Its real place will be determined once the methodological flaws have been addressed.

Conclusion

The vast majority of TMD symptoms subside spontaneously. A large proportion of patients respond to conservative therapy. BoNT should only be used when those therapies have failed. The global approach to TMD and bruxism should be multidisciplinary.

References

1. Lomas J. Temporomandibular dysfunction. *Australian Journal of General Practice* 2018;**47**(4):212-5.
2. Da Silva MCP, de Castro Rodrigues CM, Figueiredo CE, et al. Effect of botulinum toxin treatment in patients with bruxism and orofacial pain-randomized double-blind clinical trial. *Research, Society and Development* 2020;**9**(9):e917998206.
3. Ladino LG, Vargas M, Rodriguez J, López E. Bruxism management: a comprehensive review. *Clin Med Rev Case Rep* 2020;**7**:316.
4. Kahn A, Bertin H, Corre P, et al. Assessing the effectiveness of botulinum toxin injections into masticatory muscles in the treatment of temporomandibular disorders. *Journal of Oral Medicine and Oral Surgery* 2018;**24**(3):107-11.
5. Kumar A, Spivakovsky S. Bruxism - is botulinum toxin an effective treatment? *Evidence-Based Dentistry* 2018;**19**(2):59.
6. Long H, Liao Z, Wang Y, et al. Efficacy of botulinum toxins on bruxism: an evidence-based review. *International Dental Journal* 2012;**62**(1):1-5.
7. Shim YJ, Lee HJ, Park KJ, et al. Botulinum toxin therapy for managing sleep bruxism: a randomized and placebo-controlled trial. *Toxins* 2020;**12**(3):168.
8. Bogucki ZA, Kownacka M. Clinical aspects of the use of botulinum toxin type a in the treatment of dysfunction of the masticatory system. *Strabismus* 2016;**2**:8.
9. Ahmed J, Sujir N, Shenoy N, et al. Morphological assessment of TMJ spaces, mandibular condyle, and glenoid fossa using cone beam computed tomography (CBCT): a retrospective analysis. *Indian Journal of Radiology and Imaging* 2021;**31**(01):78-85.

10. Reiter S, Goldsmith C, Emodi-Perlman A, et al. Masticatory muscle disorders diagnostic criteria: the American Academy of Orofacial Pain versus the research diagnostic criteria/temporomandibular disorders (RDC/TMD). *Journal of Oral Rehabilitation* 2012;**39**(12):941-7.
11. Lobbezoo F, Ahlberg J, Raphael KG, et al. International consensus on the assessment of bruxism: report of a work in progress. *Journal of Oral Rehabilitation* 2018;**45**(11):837-44.
12. Lee SJ, McCall Jr WD, Kim YK, et al. Effect of botulinum toxin injection on nocturnal bruxism: a randomized controlled trial. *American Journal of Physical Medicine & Rehabilitation* 2010;**89**(1):16-23.
13. Jokubauskas L, Baltrušaitytė A. Efficacy of biofeedback therapy on sleep bruxism: a systematic review and meta-analysis. *Journal of Oral Rehabilitation* 2018;**45**(6):485-95.
14. Gouw S, de Wijer A, Creugers NH, et al. Bruxism: is there an indication for muscle-stretching exercises? *International Journal of Prosthodontics* 2017;**30**(2):123-32.
15. Poluha RL, Canales GDLT, Bonjardim LR, Conti PCR. Oral behaviors, bruxism, malocclusion and painful temporomandibular joint clicking: is there an association? *Brazilian Oral Research* 2021;**35**:e090.
16. Hilgenberg-Sydney PB, Bonotto DV, Stechman-Neto J, et al. Diagnostic validity of CT to assess degenerative temporomandibular joint disease: a systematic review. *Dentomaxillofacial Radiology* 2018;**47**(5):20170389.
17. Kwon KH, Shin KS, Yeon SH, Kwon DG. Application of botulinum toxin in maxillofacial field: part I. Bruxism and square jaw. *Maxillofacial Plastic and Reconstructive Surgery* 2019;**41**(1):1-13.
18. Laskin DM. The use of botulinum toxin for the treatment of myofascial pain in the masticatory muscles. *Oral and Maxillofacial Surgery Clinics* 2018;**30**(3):287-9.
19. Garefis P, Grigoriadou E, Zarifi A, Koidis PT. Effectiveness of conservative treatment for craniomandibular disorders: a 2-year longitudinal study. *Journal of Orofacial Pain* 1994;**8**(3):309-14.
20. Gauer R, Semidey MJ. Diagnosis and treatment of temporomandibular disorders. *American Family Physician* 2015;**91**(6):378-86.
21. Lobbezoo F, Van Der Zaag J, Van Selms MKA, et al. Principles for the management of bruxism. *Journal of Oral Rehabilitation* 2008;**35**(7):509-23.
22. Kanathila H, Pangi A, Poojary B, Doddamani M. Diagnosis and treatment of bruxism: Concepts from past to present. *Int J Appl Dent Sci* 2018;**4**(1):290-5.
23. Sendra LA, Montez C, Vianna KC, Barboza EP. Clinical outcomes of botulinum toxin type A injections in the management of primary bruxism in adults: A systematic review. *The Journal of Prosthetic Dentistry* 2021;**126**(1):33-40.
24. Patel J, Cardoso JA, Mehta S. A systematic review of botulinum toxin in the management of patients with temporomandibular disorders and bruxism. *British Dental Journal* 2019;**226**(9):667-72.
25. Al-Wayli H. Treatment of chronic pain associated with nocturnal bruxism with botulinum toxin. A prospective and randomized clinical study. *Journal of Clinical And Experimental Dentistry* 2017;**9**(1):112.
26. Chen YW, Chiu YW, Chen CY, Chuang SK. Botulinum toxin therapy for temporomandibular joint disorders: a systematic review of randomized controlled trials. *International Journal of Oral & Maxillofacial Surgery* 2015;**44**(8):1018-26.
27. Manfredini D, Ahlberg J, Aarab G, et al. Towards a Standardized Tool for the Assessment of Bruxism (STAB) – overview and general remarks of a multidimensional bruxism evaluation system. *Journal of Oral Rehabilitation* 2020;**47**(5):549-56.
28. De la Torre Canales G, Câmara-Souza MB, Do Amaral CF, et al. Is there enough evidence to use botulinum toxin injections for bruxism management? A systematic literature review. *Clinical Oral Investigations* 2017;**21**(3):727-34.
29. Raphael KG, Janal MN, Sirois DA, et al. Validity of self-reported sleep bruxism among myofascial temporomandibular disorder patients and controls. *Journal of Oral Rehabilitation* 2015;**42**(10):751-8.
30. De Lima MC, Rizzatti Barbosa CM, Duarte Gavião MB, Ferreira Caria PH. Is low dose of botulinum toxin effective in controlling chronic pain in sleep bruxism, awake bruxism, and temporomandibular disorder? *Cranio* 2021;1-8 [Epub ahead of print].



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