THE EFFECTS OF BOTULINUM TOXIN IN MYOFASCIAL PAIN MODULATION: NEW PERSPECTIVES FOR ESTHETIC AND FUNCTIONAL DENTISTRY

https://doi.org/10.56238/rcsv6n2-009

Submitted on: 12/20/2021 **Approved on**: 01/20/2022

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ABSTRACT

Botulinum toxin (BoNT) has become an increasingly valuable tool in dentistry, extending beyond cosmetic applications to therapeutic interventions in myofascial pain modulation. Myofascial pain syndrome, often associated with temporomandibular disorders and parafunctional habits, presents a clinical challenge due to its multifactorial etiology and frequent resistance to conventional therapies. By blocking acetylcholine release at the neuromuscular junction and interfering with pain-related neuropeptides, BoNT provides both muscle relaxation and analgesic effects. Clinical studies have reported reductions in pain intensity, functional improvement, and enhanced quality of life for patients with orofacial myofascial pain following BoNT treatment. Additionally, its esthetic benefits, such as improved facial harmony and reduction of masseter hypertrophy, align with modern dentistry's emphasis on holistic, patient-centered care. Despite concerns about the temporary nature of its effects, repeated applications, and the need for standardized protocols, the evidence suggests BoNT represents a safe and effective adjunctive or alternative therapy. Future research should continue to refine clinical guidelines and evaluate long-term outcomes, consolidating BoNT's role as a therapeutic and esthetic agent in contemporary dental practice.

Keywords: Botulinum Toxin. Myofascial Pain. Orofacial Pain. Temporomandibular Disorders. Esthetic Dentistry. Functional Dentistry. Masseter Hypertrophy. Pain Modulation.

INTRODUCTION

Botulinum toxin (BoNT), a neurotoxic protein produced by *Clostridium botulinum*, has evolved from being primarily known for its cosmetic applications to becoming a versatile therapeutic tool in medicine and dentistry. Its ability to inhibit the release of acetylcholine at the neuromuscular junction results in temporary muscle relaxation, which not only contributes to facial esthetics but also plays a significant role in the management of conditions characterized by muscular hyperactivity and chronic pain. Recent research has highlighted the potential of BoNT in modulating myofascial pain, a common yet complex clinical entity affecting the masticatory system, thus opening new perspectives for both esthetic and functional dentistry.

Myofascial pain syndrome (MPS) is characterized by the presence of trigger points within skeletal muscles, leading to localized or referred pain, functional limitation, and a negative impact on patients' quality of life. Within the orofacial region, MPS is often associated with parafunctional habits such as bruxism, temporomandibular disorders (TMDs), and stress-related muscle hyperactivity. Conventional management strategies, including occlusal splints, physical therapy, and pharmacological interventions, often provide partial or temporary relief, leaving a subset of patients refractory to standard treatments. In this context, BoNT has emerged as a promising therapeutic alternative due to its dual action: reducing muscle hyperactivity and influencing nociceptive pathways. Evidence suggests that beyond muscle relaxation, BoNT interferes with the release of pain-related neuropeptides such as substance P and calcitonin gene-related peptide, thereby modulating peripheral and central sensitization processes that sustain chronic myofascial pain (Aoki, 2005; Dressler et al., 2015).

Clinical studies investigating the role of BoNT in orofacial myofascial pain have demonstrated encouraging results. Guarda-Nardini et al. (2012) reported significant reductions in pain intensity and headache frequency in patients with myogenous TMDs following BoNT injections into the masseter and temporalis muscles. Similarly, Jadhao et al. (2017) observed improvements not only in pain relief but also in patients' functional outcomes and quality of life. These findings highlight BoNT's potential to address both the symptomatic and functional dimensions of myofascial pain. However, the degree of improvement often depends on factors such as dosage, injection technique, and patient selection, emphasizing the need for standardized protocols in dental practice.

The implications of BoNT in dentistry extend beyond pain management, as its effects contribute to esthetic outcomes that complement functional benefits. For instance, in patients

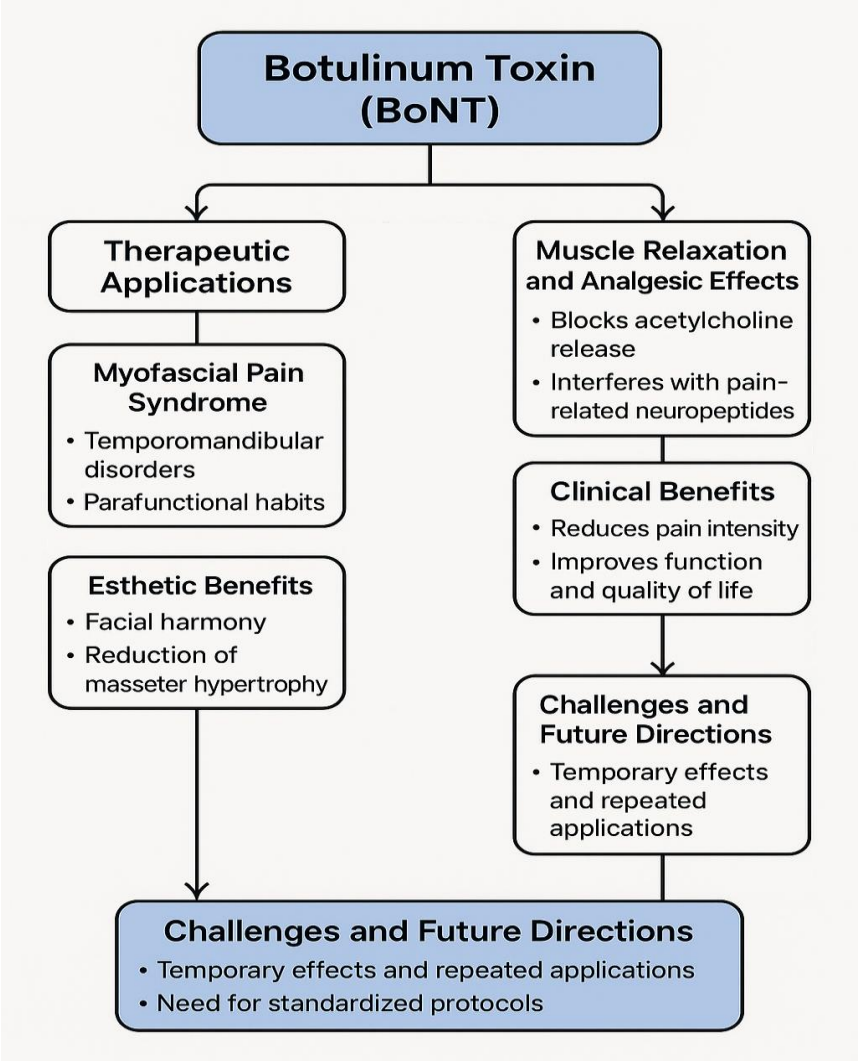
with bruxism-induced masseter hypertrophy, BoNT injections not only alleviate pain and protect dentition from excessive forces but also lead to a reduction in facial muscle volume, enhancing the lower facial contour. This dual outcome reflects the growing integration of esthetic and therapeutic dentistry, where interventions target both patient well-being and appearance. Furthermore, BoNT has been applied in cases of smile asymmetry and excessive gingival display, conditions where muscular imbalance contributes to both functional discomfort and esthetic disharmony (Mazzuco & Hexsel, 2010; Chagas et al., 2018). By bridging the gap between esthetics and function, BoNT consolidates its role as a versatile tool in contemporary dental practice.

Nevertheless, challenges remain regarding the long-term use of BoNT for myofascial pain. Its effects are temporary, typically lasting between three to six months, requiring repeated applications for sustained benefits. Concerns have also been raised about the possibility of antibody development leading to secondary non-responsiveness, as well as potential adverse effects such as excessive muscle weakness, altered mastication, or unintended diffusion to adjacent muscles (Dressler & Adib Saberi, 2017). Despite these limitations, systematic reviews suggest that the benefits of BoNT in carefully selected patients outweigh the risks, particularly when conventional therapies fail to provide relief (Gupta & Bhatia, 2010; Ernberg et al., 2011).

The flowchart illustrates the role of Botulinum Toxin (BoNT) in dentistry, emphasizing its dual therapeutic and esthetic applications. It shows how BoNT reduces muscle hyperactivity and pain by blocking acetylcholine release and interfering with pain-related neuropeptides, leading to muscle relaxation, analgesic effects, and improved patient quality of life. Additionally, the chart highlights esthetic benefits such as enhanced facial harmony and reduction of masseter hypertrophy, aligning with holistic dental care. Finally, it addresses challenges and future directions, including the temporary nature of its effects, the need for repeated applications, and the importance of developing standardized clinical protocols.

Figure 1

Flowchart of Botulinum Toxin (BoNT) Applications in Dentistry: Therapeutic, Esthetic Benefits, and Future Challenges



Source: Created by author.

The integration of BoNT into dental practice underscores a paradigm shift toward minimally invasive, patient-centered interventions that simultaneously address esthetic concerns and functional impairments. As evidence continues to accumulate, BoNT is positioned not merely as an adjunct but as a central component in the multimodal management of myofascial pain. Future research should focus on long-term safety, optimal dosing regimens, and the identification of biomarkers that predict therapeutic response, ensuring that BoNT can be applied with precision and reproducibility. By uniting esthetic and functional outcomes, the use of botulinum toxin in myofascial pain modulation exemplifies the interdisciplinary evolution of dentistry, offering new perspectives that align with the holistic needs of patients.

REFERENCES

Aoki, K. R. (2005). Review of a proposed mechanism for the antinociceptive action of botulinum toxin type A. *NeuroToxicology*, 26(5), 785–793.

Chagas, T. F., Almeida, N. V., Lisboa, C. O., Ferreira, D. M. T. P., & Mattos, C. T. (2018). Botulinum toxin type A in the treatment of excessive gingival display: A systematic review. *Dental Press Journal of Orthodontics*, 23(6), 40.e1–40.e10.

Dressler, D., & Adib Saberi, F. (2017). Botulinum toxin: Mechanisms of action. *European Neurology*, 78(1-2), 5–13.

Dressler, D., Hallett, M., & Berardelli, A. (2015). Botulinum toxin: Mechanisms of action. *Movement Disorders*, 30(6), 795–807.

Ernberg, M., Hedenberg-Magnusson, B., List, T., & Svensson, P. (2011). Efficacy of botulinum toxin type A for treatment of persistent myofascial TMD pain: A randomized, controlled, double-blind multicenter study. *Pain*, 152(9), 1988–1996.

Guarda-Nardini, L., Manfredini, D., Salamone, M., Salmaso, L., Tonello, S., & Ferronato, G. (2012). Efficacy of botulinum toxin in treating myofascial pain in bruxers: A controlled clinical trial. *European Journal of Pain*, 16(6), 829–839.

Gupta, A., & Bhatia, M. (2010). Botulinum toxin type A for the treatment of masseteric hypertrophy: A prospective study. *Journal of Oral and Maxillofacial Surgery*, 68(6), 1110–1116.

Jadhao, V. A., Lokhande, N., Habbu, S. G., Raut, S. Y., & Agrawal, S. M. (2017). Effect of botulinum toxin type A in the management of myofascial pain in temporomandibular disorders: A randomized controlled trial. *Indian Journal of Dental Research*, 28(5), 493–498.

Mazzuco, R., & Hexsel, D. (2010). Gummy smile and botulinum toxin: A new approach based on the gingival exposure area. *Journal of the American Academy of Dermatology*, 63(6), 1042–1051.

SANTOS,Hugo;PESSOA,EliomarGotardi.Impactsofdigitalizationontheefficiencyandqualityof publicservices:Acomprehensiveanalysis.LUMENETVIRTUS,[S.l.],v.15,n.40,p.44094414, 2024.DOI:10.56238/levv15n40024.Disponívelem:https://periodicos.newsciencepubl.co m/LEV/article/view/452.Acessoem:25jan.2025.

Freitas,G.B.,Rabelo,E.M.,&Pessoa,E.G.(2023).Projetomodularcomreaproveitamentodecont ainermaritimo.BrazilianJournalofDevelopment,9(10),28303–28339.https://doi.org/10.34117/bjdv9n10057

Freitas,G.B.,Rabelo,E.M.,&Pessoa,E.G.(2023).Projetomodularcomreaproveitamentodecont ainermaritimo.BrazilianJournalofDevelopment,9(10),28303–28339.https://doi.org/10.34117/bjdv9n10057

Pessoa,E.G.,Feitosa,L.M.,ePadua,V.P.,&Pereira,A.G.(2023).Estudodosrecalquesprimáriose mumaterroexecutadosobreaargilamoledoSarapuí.BrazilianJournalofDevelopment,9(10), 28352–28375.https://doi.org/10.34117/bjdv9n10059

PESSOA,E.G.;FEITOSA,L.M.;PEREIRA,A.G.;EPADUA,V.P.Efeitosdeespéciesdealnaeficiên ciadecoagulação,Alresidualepropriedadedosflocosnotratamentodeáguassuperficiais.Br azilianJournalofHealthReview,[S.l.],v.6,n.5,p.2481424826,2023.DOI:10.34119/bjhrv6n55 23.Disponívelem:https://ojs.brazilianjournals.com.br/ojs/index.php/BJHR/article/view/63

890.Acessoem:25jan.2025.

SANTOS,Hugo;PESSOA,EliomarGotardi.Impactsofdigitalizationontheefficiencyandqualityof publicservices:Acomprehensiveanalysis.LUMENETVIRTUS,[S.l.],v.15,n.40,p.44094414, 2024.DOI:10.56238/levv15n40024.Disponívelem:https://periodicos.newsciencepubl.co m/LEV/article/view/452.Acessoem:25jan.2025.

Filho, W. L. R. (2025). The Role of Zero Trust Architecture in Modern Cybersecurity: Integration with IAM and Emerging Technologies. Brazilian Journal of Development, 11(1), e76836. https://doi.org/10.34117/bjdv11n1-060

Oliveira, C. E. C. de. (2025). Gentrification, urban revitalization, and social equity: challenges and solutions. Brazilian Journal of Development, 11(2), e77293. https://doi.org/10.34117/bjdv11n2-010

Pessoa, E. G. (2024). Pavimentos permeáveis uma solução sustentável. Revista Sistemática, 14(3), 594–599. https://doi.org/10.56238/rcsv14n3-012

Filho, W. L. R. (2025). THE ROLE OF AI IN ENHANCING IDENTITY AND ACCESS MANAGEMENT SYSTEMS. International Seven Journal of Multidisciplinary, 1(2). https://doi.org/10.56238/isevmjv1n2-011

Antonio, S. L. (2025). Technological innovations and geomechanical challenges in Midland Basin Drilling. Brazilian Journal of Development, 11(3), e78097. https://doi.org/10.34117/bjdv11n3-005

Pessoa, E. G. (2024). Pavimentos permeáveis uma solução sustentável. Revista Sistemática, 14(3), 594–599. https://doi.org/10.56238/rcsv14n3-012

Eliomar Gotardi Pessoa, & Coautora: Glaucia Brandão Freitas. (2022). ANÁLISE DE CUSTO DE PAVIMENTOS PERMEÁVEIS EM BLOCO DE CONCRETO UTILIZANDO BIM (BUILDING INFORMATION MODELING). Revistaft, 26(111), 86. https://doi.org/10.5281/zenodo.10022486

Eliomar Gotardi Pessoa, Gabriel Seixas Pinto Azevedo Benittez, Nathalia Pizzol de Oliveira, & Vitor Borges Ferreira Leite. (2022). ANÁLISE COMPARATIVA ENTRE RESULTADOS EXPERIMENTAIS E TEÓRICOS DE UMA ESTACA COM CARGA HORIZONTAL APLICADA NO TOPO. Revistaft, 27(119), 67. https://doi.org/10.5281/zenodo.7626667

Eliomar Gotardi Pessoa, & Coautora: Glaucia Brandão Freitas. (2022). ANÁLISE COMPARATIVA ENTRE RESULTADOS TEÓRICOS DA DEFLEXÃO DE UMA LAJE PLANA COM CARGA DISTRIBUÍDA PELO MÉTODO DE EQUAÇÃO DE DIFERENCIAL DE LAGRANGE POR SÉRIE DE FOURIER DUPLA E MODELAGEM NUMÉRICA PELO SOFTWARE SAP2000. Revistaft, 26(111), 43. https://doi.org/10.5281/zenodo.10019943

Pessoa, E. G. (2025). Optimizing helical pile foundations: a comprehensive study on displaced soil volume and group behavior. Brazilian Journal of Development, 11(4), e79278. https://doi.org/10.34117/bjdv11n4-047

Pessoa, E. G. (2025). Utilizing recycled construction and demolition waste in permeable pavements for sustainable urban infrastructure. Brazilian Journal of Development, 11(4), e79277. https://doi.org/10.34117/bjdv11n4-046

Testoni, F. O. (2025). Niche accounting firms and the brazilian immigrant community in the U.S.: a study of cultural specialization and inclusive growth. Brazilian Journal of Development, 11(5), e79627. https://doi.org/10.34117/bjdv11n5-034

Silva, J. F. (2025). Desafios e barreiras jurídicas para o acesso à inclusão de crianças autistas em ambientes educacionais e comerciais. Brazilian Journal of Development, 11(5), e79489. https://doi.org/10.34117/bjdv11n5-011

Silva, E. N. da. (2025). Urban circular microfactories: local micro-plants for regenerative urban economies. *Brazilian Journal of Development*, *11*(9), e82335. https://doi.org/10.34117/bjdv11n9-059

DA SILVA, Eduardo Nunes. GREEN NANOTECHNOLOGY APPLIED TO CIRCULAR MANUFACTURING. **LUMEN ET VIRTUS**, *[S. l.]*, v. 14, n. 32, 2024. DOI: 10.56238/levv14n32-029. Disponível em: https://periodicos.newsciencepubl.com/LEV/article/view/AEW09. Acesso em: 4 nov. 2025.

Recycling of Rare Earth Elements Using Ionic Liquids for Regenerative Manufacturing. (2023). *International Seven Journal of Multidisciplinary*, *2*(5). https://doi.org/10.56238/isevmjv2n5-037