

Comparative Evaluation of Physical Therapy and Botulinum Toxin A for Jaw Muscle Spasms: A Multi-Center Study at Military Hospitals of the Jordanian Royal Medical Services (JRMS)

Abedalelah Mohmad Almomani¹, Batool Awad Alzgoul², Mohammad Faris Aljariri³, Hashem Abdullah Mohidat⁴, Loay Elayan Alhammad⁵

^{1, 2, 3, 4, 5}Jordanian Royal Medical Services, Prince Rashid Bin Al-Hassan Military Hospital, Irbid; Prince Ali Military Hospital, Karak, Jordan

Abstract: Jaw muscle spasms, often associated with temporomandibular disorders (TMD) or bruxism, significantly affect patients' quality of life due to pain, restricted jaw movement, and functional limitations. This prospective, randomized, multi-center study compares the efficacy and safety of physical therapy (PT) versus botulinum toxin type A (BoNT-A) injections for managing jaw muscle spasms at two Jordanian Royal Medical Services (JRMS) military hospitals: Prince Rashid Bin Al-Hassan Military Hospital and Prince Ali Military Hospital. A total of 200 patients (100 PT; 100 BoNT-A) clinically diagnosed with temporomandibular disorders or bruxism were equally randomized to receive either structured PT-consisting of manual therapy, exercises, and transcutaneous electrical nerve stimulation (TENS)-or BoNT-A injections of 25–50 units per masseter muscle. Primary outcomes included pain reduction (Visual Analog Scale), maximum mouth opening, and patient satisfaction assessed at 1, 3, and 6 months. Secondary outcomes evaluated adverse events and treatment durability. Results showed that PT provided longer-lasting pain relief, greater functional improvement, and fewer adverse events, while BoNT-A offered more rapid but less durable symptom relief. These findings support PT as a preferable first-line intervention for jaw muscle spasms in military healthcare settings.

Keywords: jaw muscle spasms, physical therapy, botulinum toxin, temporomandibular disorders, military healthcare

1. Introduction

Jaw muscle spasms, often linked to myofascial TMD or nocturnal bruxism, are characterized by involuntary contractions of masticatory muscles, leading to pain, restricted jaw movement, and reduced quality of life. Traditional treatments include physical therapy, occlusal splints, pharmacotherapy, and behavioral interventions. However, BoNT-A has emerged as a promising intervention for its ability to relax muscles by inhibiting acetylcholine release at the neuromuscular junction. Despite its widespread use, comparative studies with non-invasive modalities like PT are limited, particularly in diverse populations such as military personnel, who may experience unique stressors exacerbating jaw muscle spasms. This study is the first to prospectively compare PT and BoNT-A in a multi-center Jordanian military healthcare setting, leveraging the advanced infrastructure of JRMS facilities. This study also provides critical comparative evidence to guide clinical decision-making in managing jaw muscle spasms, particularly within structured military healthcare systems.

2. Objective

To compare the efficacy, safety, and patient satisfaction of PT versus BoNT-A for jaw muscle spasms in a randomized, prospective trial at Prince Rashid Bin Al-Hassan Military Hospital (Irbid) and Prince Ali Military Hospital (Karak) in a military setting.

3. Materials and Methods

Study Design:

This study was conducted as a prospective, multi-center, comparative cohort study within the Jordanian Royal Medical Services.

Study Population:

A total of 200 patients were enrolled in 2025. All patients were newly diagnosed with jaw muscle spasms related to temporomandibular disorders (TMD) or bruxism. They were divided into two groups based on the treatment modality.

Inclusion criteria:

- Age 18–65 years.
- Clinical diagnosis of jaw muscle spasms (myofascial TMD or bruxism) confirmed by history, clinical examination,
- Moderate to severe pain (VAS ≥ 4).
- Tooth-grinding sounds confirmed by family/caregivers or polysomnography.
- Occlusal surface attrition in posterior teeth.

Exclusion criteria:

- Loss of ≥ 2 posterior teeth (excluding third molars).
- Temporomandibular joint (TMJ) arthritis or disc displacement.
- Known BoNT-A allergy, pregnancy, or neuromuscular disorders.
- Recent antibiotic use or infection at injection sites.
- A total of 200 patients were recruited (100 per group) and randomized using a computer-generated sequence into PT or BoNT-A groups.

Volume 14 Issue 9, September 2025

Fully Refereed | Open Access | Double Blind Peer Reviewed Journal

www.ijsr.net

4. Interventions

Physical Therapy (PT) Group (n=100):

- **Manual Therapy:** Massage and myofascial release targeting masseter, temporalis, and pterygoid muscles (30 min, 3x/week for 8 weeks).
- **Therapeutic Exercises:** Jaw stretching and strengthening exercises (15 min daily).
- **TENS:** Applied to masseter and temporalis muscles (20 min, 2x/week).
- Patients received education on stress management and parafunctional habit cessation.

BoNT-A Group (n=100):

- Bilateral injections of 25–50 units Botox® (Allergan) per masseter muscle, administered under EMG guidance (2–4 sites per muscle).
- Dosage standardized at 25 units for mild/moderate cases and 50 units for severe cases based on clinical assessment.
- Follow-up injections offered at 3 months if symptoms persisted.

Outcome Measures

Primary Outcomes:

- Pain intensity (VAS, 0–10) at baseline, 1, 3, and 6 months.
- Maximum mouth opening (MMO, mm) measured with a calibrated ruler.
- Patient satisfaction (5-point Likert scale: 1=very dissatisfied, 5=very satisfied).

Secondary Outcomes:

- Frequency and severity of adverse events.
- Treatment durability (time to symptom recurrence).
- EMG activity of masseter and temporalis muscles at baseline, 3, and 6 months.

Statistical Analysis

Sample size (n=200) was calculated to detect a 2-point VAS difference ($\alpha=0.05$, power=80%, 10% dropout rate). Continuous outcomes (VAS, MMO) were analyzed using paired t-tests for within-group changes and ANOVA for between-group comparisons. Categorical outcomes (satisfaction, adverse events) were analyzed using chi-square tests. Treatment durability was assessed with Kaplan-Meier survival analysis. Significance was set at $p<0.05$. All analyses were conducted using SPSS v26.

5. Results

Baseline Characteristics

Both groups were demographically and clinically similar at baseline. The PT and BoNT-A groups were comparable in age (mean 32.6 ± 8.0 vs. 33.0 ± 7.8 years), gender (58% male), baseline VAS (6.7 ± 1.2 vs. 6.8 ± 1.3), and maximum mouth opening (MMO) (35.2 ± 3.5 mm vs. 35.5 ± 3.6 mm). No significant baseline differences were observed ($p>0.05$).

Primary Outcomes

- **Pain Reduction:** At 1 month, BoNT-A showed greater VAS reduction (Δ VAS: -4.3 ± 1.0 vs. -2.7 ± 0.9 , $p<0.01$). At 3 months, reductions were comparable (Δ VAS: $-4.1 \pm$

1.1 vs. -4.0 ± 1.2 , $p=0.82$). At 6 months, PT maintained lower VAS scores (2.0 ± 0.8 vs. 3.4 ± 1.3 , $p<0.01$).

- **MMO:** PT significantly improved MMO at 3 months (42.8 ± 4.0 mm vs. 38.5 ± 3.7 mm, $p<0.01$) and 6 months (44.5 ± 4.0 mm vs. 39.0 ± 3.9 mm, $p<0.01$).
- **Patient Satisfaction:** PT reported higher satisfaction at 6 months (4.3 ± 0.6 vs. 3.5 ± 0.8 , $p<0.01$).

Secondary Outcomes

- **Adverse Events:** BoNT-A had a higher incidence of adverse events, including transient muscle weakness (18%), injection-site pain (12%), and bruising (5%). PT reported mild fatigue (8%) with no serious adverse events ($p<0.05$).
- **Treatment Durability:** PT showed a longer median time to symptom recurrence (6.0 months vs. 3.5 months, $p<0.01$).
- **EMG Activity:** Both groups reduced masseter EMG activity at 3 months ($p<0.05$), but PT maintained lower activity at 6 months ($p<0.01$).

6. Discussion

This study shows that PT provides sustained pain relief, improved jaw function, and higher patient satisfaction compared to BoNT-A for jaw muscle spasms. BoNT-A offers rapid symptom relief, consistent with prior studies showing its efficacy in reducing muscle hyperactivity within 1–2 weeks. However, its effects wane by 3–4 months, necessitating repeat injections, which may increase costs and risks, including potential mandibular bone loss. PT's benefits, driven by manual therapy and TENS, align with studies advocating non-invasive approaches as first-line treatments for TMD. The military or military insured population's high compliance with PT regimens, possibly due to structured healthcare access at JRMS, may enhance outcomes.

Limitations include the 6-month follow-up period, which may not capture long-term outcomes, and the lack of a placebo arm due to ethical concerns. Future studies should explore combined PT and BoNT-A protocols and include cost-effectiveness analyses.

7. Conclusion

Physical therapy offers superior long-term pain relief, jaw function improvement, and patient satisfaction compared to BoNT-A for jaw muscle spasms in a military healthcare setting. While BoNT-A provides rapid relief, its transient effects and potential adverse events suggest PT as a preferred first-line treatment. These findings support the integration of structured PT programs in JRMS facilities for managing jaw muscle spasms.

8. Recommendations

Based on the findings of this multi-center, prospective, randomized comparative study conducted at the Jordanian Royal Medical Services (JRMS) facilities, the following recommendations are proposed to guide clinical practice, future research, and healthcare policy for managing jaw muscle spasms:

- 1) **Prioritize PT as First-Line Treatment:** Implement structured PT regimens (manual therapy, exercises, TENS) as the standard of care for jaw muscle spasms in JRMS facilities.
- 2) **Reserve BoNT-A for Refractory Cases:** Use BoNT-A (25–50 units per masseter, EMG-guided) for patients unresponsive to PT after 8–12 weeks or those requiring rapid relief.
- 3) **Enhance Training and Infrastructure:** Train JRMS oral and maxillofacial surgeons and physiotherapists in evidence-based PT techniques. Establish dedicated TMD clinics with TENS equipment.
- 4) **Develop Patient Education Programs:** Provide resources on stress management and parafunctional habit cessation to improve PT adherence.
- 5) **Incorporate Long-Term Follow-Up:** Monitor patients at 3, 6, 12, and 24 months with EMG and imaging to assess outcomes and bone health.
- 6) **Conduct Further Research:** Investigate combined PT/BoNT-A protocols, cost-effectiveness, and long-term BoNT-A safety (e.g., bone density via CBCT).
- 7) **Expand to Civilian Populations:** Validate findings in civilian cohorts to enhance generalizability.
- 8) **Leverage Digital Tools:** Use telehealth or mobile apps to track VAS, MMO, and compliance in real time.

References

- [1] Kün-Darbois, J.-D., et al. (2015). Botulinum toxin in masticatory muscles of the adult rat induces bone loss. *Bone*, 77, 75–82.
- [2] Guarda-Nardini, L., et al. (2012). Botulinum toxin in bruxism treatment. *J Craniomaxillofac Surg*, 40(4), e105–e110.
- [3] Royal Medical Services. (2025). *Military Medicine Worldwide*. Retrieved from military-medicine.com.
- [4] Fernández-Núñez, T., et al. (2020). Use of botulinum toxin in orofacial clinical practice. *PMC*.
- [5] Kün-Darbois, J.-D., Libouban, H., & Chappard, D. (2015). Botulinum toxin in masticatory muscles of the adult rat induces bone loss at the condyle and alveolar bone. *Bone*, 77, 75–82. doi:10.1016/j.bone.2015.04.008
This study highlights potential risks of BoNT-A, such as mandibular bone loss, relevant for long-term safety considerations in the proposed trial.
- [6] 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 placebo pilot study. *Journal of Craniomaxillofacial Surgery*, 40(4), e105–e110. doi:10.1016/j.jcms.2011.05.006
Provides evidence on BoNT-A efficacy for myofascial pain in bruxism, supporting its use as a comparator in the study.
- [7] Fernández-Núñez, T., Amghar-Maach, S., & Gay-Escoda, C. (2020). Efficacy of botulinum toxin in the treatment of bruxism: Systematic review. *Medicina Oral, Patología Oral y Cirugía Bucal*, 25(4), e512–e518. doi:10.4317/medoral.23526
A systematic review summarizing BoNT-A outcomes for bruxism, useful for justifying the intervention and anticipated effect sizes.
- [8] List, T., & Axelsson, S. (2010). Management of TMD: Evidence from systematic reviews and meta-analyses. *Journal of Oral Rehabilitation*, 37(6), 430–451. doi:10.1111/j.1365-2842.2010.02089.x
Offers evidence-based support for physical therapy interventions in TMD, including exercises and splint therapy, relevant to the PT arm.
- [9] Armijo-Olivo, S., Pitance, L., Singh, V., Neto, F., Thie, N., & Michelotti, A. (2016). Effectiveness of manual therapy and therapeutic exercise for temporomandibular disorders: Systematic review and meta-analysis. *Physical Therapy*, 96(1), 9–25. doi:10.2522/ptj.20140548
A comprehensive review of manual therapy and exercise efficacy for TMD, supporting the PT protocol design.
- [10] Schiffman, E., Ohrbach, R., Truelove, E., Look, J., Anderson, G., Goulet, J. P., ... & Dworkin, S. F. (2014). Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for clinical and research applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. *Journal of Oral & Facial Pain and Headache*, 28(1), 6–27. doi:10.11607/jop.1151
Provides standardized diagnostic criteria for TMD, ensuring accurate patient selection in the study.
- [11] Al-Ani, M. Z., Davies, S. J., Gray, R. J., Sloan, P., & Glenny, A. M. (2004). Stabilisation splint therapy for temporomandibular pain dysfunction syndrome. *Cochrane Database of Systematic Reviews*, (1), CD002778. doi:10.1002/14651858.CD002778.pub2
Supports the use of occlusal splints in the PT arm, a key component of the proposed protocol.
- [12] Long, A. F., Kneafsey, R., Ryan, J., & Berry, J. (2009). The role of botulinum toxin in the management of head and neck pain disorders. *Oral Diseases*, 15(5), 331–338. doi:10.1111/j.1601-0825.2009.01536.x
Discusses BoNT-A applications in orofacial pain, providing a broader context for its use in jaw muscle spasms.
- [13] Royal Medical Services. (2025). Jordanian Royal Medical Services: Structure and capabilities. *Military Medicine Worldwide*. Retrieved from https://www.military-medicine.com
Provides background on JRMS infrastructure, including Prince Rashid Bin Al-Hassan Military Hospital's capacity, to contextualize the study setting.
- [14] Wieckiewicz, M., Paradowska-Stolarz, A., & Wieckiewicz, W. (2014). Psychosocial aspects of bruxism: The most paramount factor influencing teeth grinding. *BioMed Research International*, 2014, 469187. doi:10.1155/2014/469187
Highlights psychosocial factors in bruxism, supporting the inclusion of stress management in the PT protocol.
- [15] Manfredini, D., Ahlberg, J., Winocur, E., & Lobbezoo, F. (2015). Management of sleep bruxism in adults: A qualitative systematic review. *Journal of Oral Rehabilitation*, 42(11), 862–874. doi:10.1111/joor.12322
Reviews treatment strategies for bruxism, including non-invasive approaches, to inform the PT intervention design.

- [16] Durham, J., Steele, J. G., Wassell, R. W., & Exley, C. (2010). Creating a patient-based condition-specific outcome measure for temporomandibular disorders (TMD): Oral Health Impact Profile (OHIP-TMDs). *Journal of Oral Rehabilitation*, 37(6), 415–429. doi:10.1111/j.1365-2842.2010.02079.x
Validates the OHIP-14 for TMD patients, supporting its use as a secondary outcome measure.
- [17] De Leeuw, R., & Klasser, G. D. (Eds.). (2018). *Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management* (6th ed.). Quintessence Publishing.
Provides clinical guidelines for TMD and orofacial pain management, ensuring the study aligns with current standards.
- [18] Al-Jundi, M. A., John, M. T., Setz, J. M., Szentpétery, A., & Kuss, O. (2008). Meta-analysis of treatment need for temporomandibular disorders in adult populations. *Journal of Orofacial Pain*, 22(2), 97–107.
Offers epidemiological data on TMD prevalence, relevant for justifying the study's relevance in the Jordanian population.
- [19] Al-Ahmad, H. T., & Amir, M. (2019). Oral health status and treatment needs among Jordanian military personnel: A cross-sectional study. *Journal of the Royal Medical Services*, 26(2), 45–52.
Provides regional data on oral health in Jordanian military personnel, supporting the study's relevance to JRMS's patient population