Original Article

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Maitland Mobilization for Bruxism in Temporomandibular Disorder: Enhancing Pain Threshold, Function, Sleep, and Mouth Opening

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Abstract:

Objective: Although Maitland joint mobilization (MJM) of the cervical spine has been widely studied in the treatment of temporomandibular disorders (TMD), limited research exists on its direct application to the temporomandibular joint (TMJ), particularly in patients with bruxism. This study aimed to explore the effectiveness of TMJ-targeted MJM in improving pain pressure threshold (PPT), functional limitation (FL), sleep quality (SQOL), and maximal mouth opening (MMO) in individuals with myofascial TMD associated with bruxism.

Material and Methods: This is a single blind, quasi-experimental study with 40 participants allocated to either the control group (Group A; N=20), receiving only conventional exercises, or the experimental group (Group B; N=20), receiving MJM of TMJ with conventional exercises for 4 weeks; 10-cm metal scale was used to measure MMO, a dolorimeter to assess PPT of the masseter, the Mandibular Function Impairment Questionnaire to evaluate FL, and Pittsburgh Sleep Quality Index to assess SQOL.

Results: 35 out of the 40 who completed the 4-week intervention were included in the analysis. Baseline demographics were similar between the groups in gender and age (p-value>0.05). The experimental group showed significantly greater improvements in PPT (p-value<0.05), MMO (p-value=0.000), and FL (p-value<0.05) post-intervention. SQOL did not differ significantly between the groups (p-value>0.05). Strong positive correlations were found between PPT and MMO (r=0.873, p-value<0.05), and between FL and SQOL (r=0.715, p-value<0.05).

Conclusion: MJM in Bruxism with myofascial TMD effectively improved MMO, PPT (masseter), and FL, but the groups did not exhibit any significant differences in SQOL.

Keywords: bruxism, maitland joint mobilization, temporomandibular disorders

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Introduction

Temporomandibular disorders (TMD) comprise a collection of clinical illnesses that result in diminished functionality and pain by affecting the muscles and joints of the mandible[1]. The Diagnostic Criteria for TMD Axis I categorises TMD into Group I (muscle disorders), Group II (disc displacement), and Group III (arthralgia, arthritis, and arthrosis). Myofascial TMD, the most common type of TMD, is defined by muscle discomfort during chewing and accounts for 45.3% of TMD cases[2]. It is more prevalent in women and typically reaches its peak severity between the ages of 20 and 40[1,3]. In contrast to individuals with internal derangements of the temporomandibular joint (TMJ), those experiencing myofascial pain often exhibit more severe depressive symptoms. Additionally, facial asymmetry and dentofacial abnormalities may disrupt the forces involved in chewing, contributing to TMD. Correcting these abnormalities may alleviate symptoms associated with TMD[2]. The presence of occlusal or non-occlusal parafunctional habits, restricted jaw mobility, difficulties in mouth opening (MO), and painful jaw activities are all diagnostic signs for masticatory dysfunction[3]. Drugs like muscle relaxants, antidepressants, opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, anticonvulsants, and anxiolytics are frequently used as initial non-invasive therapies[2,4].

Around the globe, about 17.0% of people with bruxism also show signs of TMD, with North America reporting 70.0% and Asia just 9.0%. Intriguingly, for those with bruxism, TMD prevalence jumps to an average of 63.5%, peaking at 98.3% in North America and dropping to 53.9% in Asia[5]. Consistent grinding or clenching of teeth, known as bruxism, frequently causes an increase in muscle activity in the jaw. It can happen during sleep or while awake[2]. Approximately 5.9% to 49.0% of the population is affected by the condition, with a higher incidence among females under the age of 40[6,7]. Decline in the prevalence of bruxism is seen with age, in children 14.0–20.0%, 13.0% in adults between the ages of 18 and 29 years, and 3.0% in adults over the age of 60 years[8].

Psychological factors, the structure of the jaw, and the nerves and muscles that regulate jaw movement can all contribute to bruxism. TMD risk factors are considered potential causes of bruxism, which can exacerbate symptoms such as jaw locking, difficulty opening and closing the mouth, audible noises originating from the jaw, and a fatigued or stiff jaw[9]. "Multiple-P" strategy for bruxism care usually includes physiotherapy, occlusal splints, counselling, medication, and psychology, all of which are conservative in nature[10]. Electrotherapy, relaxation techniques, and various other physical therapy interventions are employed to alleviate pain, enhance muscle activity, improve MO, dental wellness, anxiety, stress, depression, TMD, and head posture[3,10,11].

TMD presents with stiff joints, tense muscles, and altered biomechanics. Maitland Joint Mobilization (MJM) targets these symptoms by applying gentle, graded oscillatory movements, activating joint mechanoreceptors to modulate pain via the pain gate mechanism and striving to re-establish normal arthrokinematics. These techniques seek to loosen the synovial and capsular tissues, improve joint lubrication, and reflexively inhibit the overactive muscles, thereby enhancing mandibular mobility and overall functional capability[12,13].

Despite its established use in musculoskeletal rehabilitation, the application of physiotherapy in dentistry remains limited, particularly in conditions like Bruxism and TMD. Referrals from Dental professionals to physiotherapists are infrequent, often due to a lack of awareness regarding the role of physiotherapy in managing various dental and orofascial conditions. While several interventions exist for bruxism and TMD, the specific effects of applying MJM directly to the TMJ in patients with bruxism secondary to TMD are yet to be comprehensively explored. This gap

highlights the need for further research to evaluate the potential of MJM in alleviating bruxism and associated TMD symptoms.

Material and Methods

Institutional ethical clearance was obtained for the study from the Ethics Committee of Krupanidhi College of Physiotherapy (EC-MPT/23/PHY/002). Mathrusri Ramabai Ambedkar Dental College and Hospital along with a few other dental clinics in Bangalore were approached for data collection. The duration of the study was 12 months.

Study design

A single-blind, quasi-experimental study was conducted with participants (N=40), allocated by an independent researcher using a convenience sampling method at the Outpatient Department of Physiotherapy. Participants were assigned to 2 groups by the lottery method: a control group receiving conventional exercises (Group A) and an experimental group receiving MJM of the TMJ, along with conventional exercises (Group B). A baseline assessment included socio-demographic data, surgical history, pain history, and various outcome measures, including pain pressure threshold (PPT) of the masseter muscle, maximal mouth opening (MMO), and functional limitation (FL). Sleep quality (SQOL) was assessed by an outcome assessor blinded to the group allocation and the treatments received in both groups. The participant flow diagram for this study is presented in Figure 1.

Participants

The participants were recruited according to the eligibility criteria, which included both genders between the ages of 18 and 40 with bruxism associated with myofascial TMD, clinically diagnosed by a licensed dentist in accordance with the international consensus on bruxism assessment, corresponding to *probable bruxism* based on a self-reported history and comprehensive clinical examination. The inter-incisal range, as assessed with a metal scale, must be equal to or less than 40 mm. Additionally, the masseter muscle PPT must be less than 2.6 kg/cm^2, as determined by a dolorimeter. The study includes patients who are taking muscle relaxants and experiencing pain in the chewing muscles when palpated.

Patients with TMD that cause structural changes in the joint as a result of degeneration, dislocation, or inflammation (e.g., arthritis, rheumatoid arthritis, ankylosing spondylitis, disc degeneration, Bell's palsy, etc.) were ineligible. Patients awaiting surgery, or those who had cervical or TMJ surgery in the past, or with a particular pathological diagnosis, like cervical or TMJ malignancy, fracture, or systemic rheumatoid disease, were ineligible for this study. Furthermore, the study excluded individuals who were missing more than 2 teeth (excluding third molars), had a history of facial paralysis, were undergoing orthodontic treatment, had a neurological or psychiatric disease (excluding anxiety and depression), received physiotherapy within the past 3 months, had removable or total dentures, or were missing more than 2 teeth (excluding the third molars).

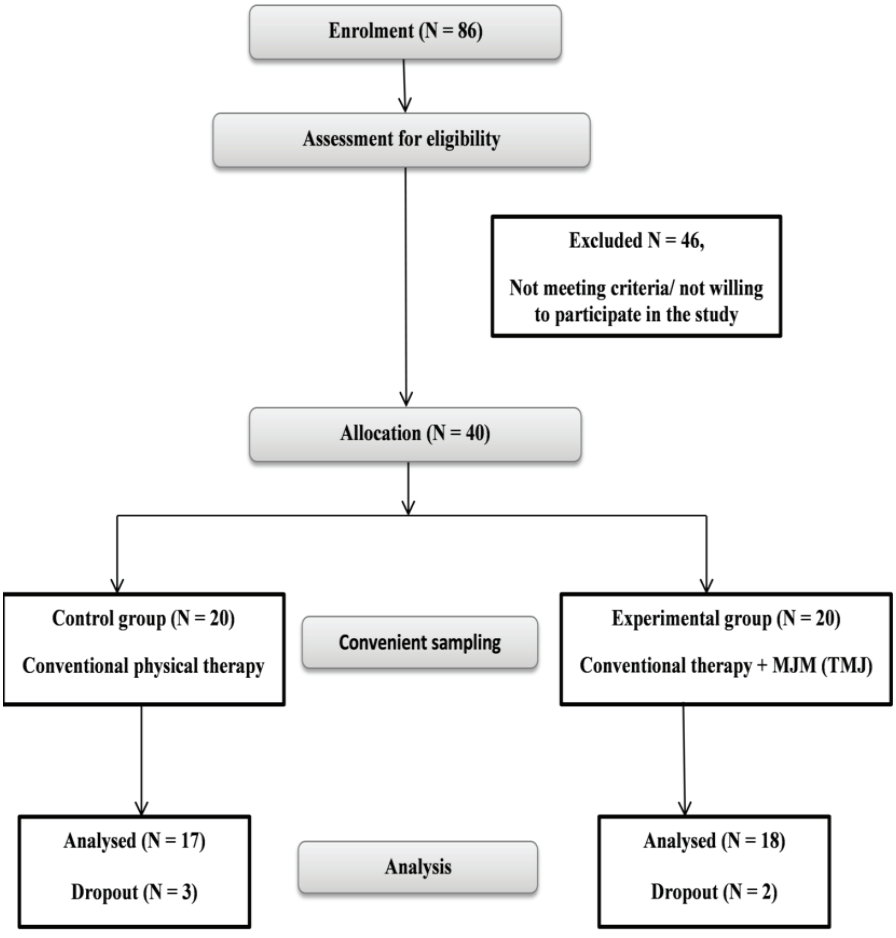
Outcome measures

The outcome measures included the use of a dolorimeter to determine the PPT of the masseter muscle[14]. A 10 cm metal scale was used to measure the TMJ range of motion, particularly MMO, which is a reliable method for diagnosing TMD and assessing TMJ mobility[13,15]. The Mandibular Function Impairment Questionnaire (MFIQ) was used to assess the effectiveness of treatments and individuals' perceptions of orofacial disabilities[16]. The Pittsburgh Sleep Quality Index (PSQI) was used to assess overall SQOL[17].

Procedure

Control group: The baseline treatment plan included patient education on protecting the joints of the jaw, avoiding difficult food to chew, not chewing on one side only, and maintaining good sleep hygiene practices. Participants performed a relaxed jaw position for 5 minutes, 5 days/week for 4 weeks, and stretching of the masseter and medial pterygoid muscle for 20–30 seconds with 3–5 repetitions, 5 sessions per week for a duration of 4 weeks. They also engaged in resisted isometric exercises of protrusors, extrusors, and lateral deviators for 15–30 seconds with 10 repetitions, 5 sessions per week for 4 weeks. Additionally, they received pulsed ultrasound for 5 minutes, 5 sessions a week, for a duration of 4 weeks, at a frequency of 3 MHz and 1.5 W/cm^2.

Experimental group: This group was administered a four-week regimen of MJM for TMJ, which included distraction, anterior glide, medial/lateral glide, and caudal-anterior-medial (CAM) glide, in addition to the exercises given to the control group. The regimen consisted of 5 sessions/week for 4 weeks, with 30-second holds and 10 repetitions of distraction and all glides.



N=total number of participants, MJM=maitland joint mobilization, TMJ=temporomandibular joint

Figure 1 Consort flow diagram of the participants

For distraction, as shown in Figure 2, the therapist applied a force to the subject's lower molars on the same side, distracting them using the first finger while holding the subject's head with the other hand. The inferior portion of the mandible was subjected to counterforce by the second and third digits of the opposing hand.

For anterior glide, as shown in Figure 3, the therapist stabilised the subject's head with one hand and applied a forward-directing force to the lower molars on the same side with the first finger. The inferior portion of the mandible was subjected to counterforce by the second and third digits of the opposing hand.

For medial or lateral glide, as shown in Figure 4, the therapist placed one hand to support the contralateral mandible and the other hand to apply a force inwards or outwards on the same side of the mandible through the mandibular condyle.

For CAM glide, as shown in Figure 5, the therapist applied a combined downward, forward, and inward pressure on the same side of the mandible through the mandibular condyle while using one hand to support the contralateral mandible.

Both groups were given a home exercise program, comprising all the exercises performed twice per day by the control group.

Results

Sample size was determined with G*Power 3.1 for a one-tailed t-test, using a large effect size (Cohen's d=0.8), α=0.05, and power (1–β)=0.75, which indicated 18 subjects per group (N=36). Anticipating dropouts, enrollment was raised to 40 (20 per group). Following 5 dropouts (1 personal, 4 attendance), the final count was 17 and 18 subjects (N=35), preserving power near the

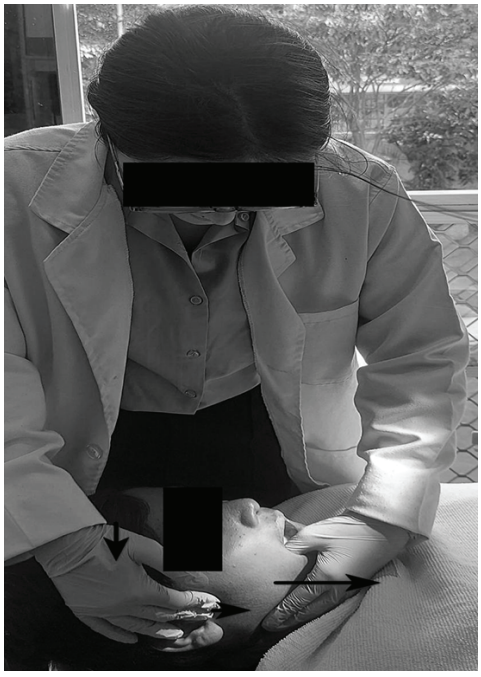


Figure 2 Distraction of the temporomandibular joint (TMJ)

Figure 3 Anterior glide of the temporomandibular joint (TMJ)

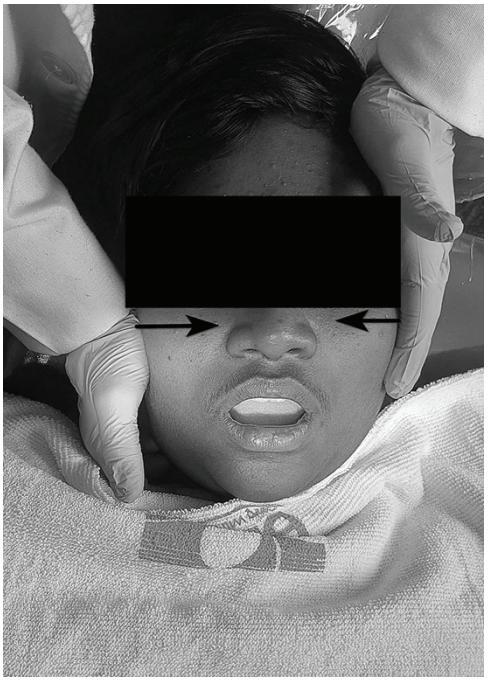


Figure 4 Medial or lateral glide of the temporomandibular joint (TMJ)

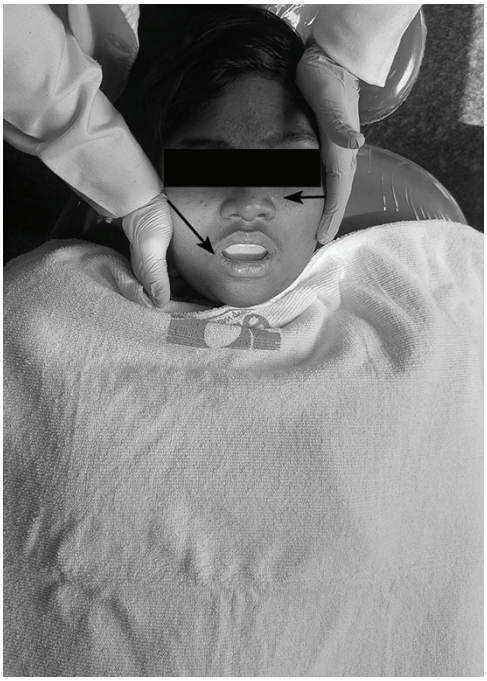


Figure 5 Caudal-anterior-medial (CAM) glide of the temporomandibular Joint (TMJ)

original 0.75. This strategy provided sufficient sensitivity to detect clinically relevant changes despite modest attrition, thus reinforcing the findings' credibility. At baseline, age, gender distribution, PPT, and MMO were comparable (p-value>0.05). Gender distribution was balanced between groups; the difference was not statistically significant (χ^2=0.048, p-value=0.825). The experimental group showed a mean age of (29.33±5.19 years), PPT of (2.26±0.45 kg/cm^2), and MMO of (3.55±0.41 cm); the control group presented (32.41±6.08 years), (2.16±0.26 kg/cm^2), and (3.39±0.54 cm), respectively. The control group had a higher baseline FL (40.59±10.36 vs. 25.44±5.66; p-value<0.001), while SQOL was higher in the control but not significantly (7.59±3.30 vs. 6.39±1.91; p=0.194). Cohen's d and 95.0% confidence intervals (CI) for between-group differences at post-test indicated large effects for PPT (d=1.13, 95.0% CI: 0.10-0.68), MMO (d=1.49, 95.0% CI: 0.29-1.01), and FL (d=1.15, 95.0% CI: 3.8-16.6), whereas SQOL showed a small, non-significant effect (d=0.20, 95.0% CI: -1.5-2.7).

Statistical analyses were performed using SPSS (v29.0). Descriptive statistics provided an overview of the baseline characteristics. Chi-square and unpaired t-tests for Groups A and B indicated no significant differences in gender (p-value=0.825) or mean age (p-value=0.141), confirming demographic comparability. Further, pre-test scores for all outcome measures were non-significant (p-value>0.05), verifying baseline equivalence. Within-group analyses using paired t-tests revealed significant pre–post gains in PPT and MMO for both groups (p-value=0.000). Wilcoxon test detected significant pre–post changes in FL and SQOL for Group A (p-value=0.000 for both) and for Group B (p-value=0.000 for FL; p-value=0.001 for SQOL).

Between-group post-test comparisons utilizing unpaired t-tests and Mann–Whitney U tests indicated significant differences in PPT (p-value=0.002), MMO (p-value=0.000), and FL (p-value=0.006), but no difference in SQOL (p-value=0.664). A positive Karl Pearson correlation was observed for PPT and MMO (r=0.873, p-value=0.001) and a Spearman correlation between FL and SQOL (r=0.715, p-value=0.001), suggesting that improvements in one measure were associated with enhancements in the other.

The document counters potential confounding factors by securing equivalent baseline characteristics between the control and experimental groups. Analyses using chi-square tests and unpaired t-tests showed no statistically significant variation in gender, age, or pre-test outcome measures, confirming balanced characteristics prior to the intervention. This minimizes the risk that pre-existing differences could skew the post-test findings. The study design, by securing baseline equivalence in critical demographic and outcome measures, aimed to isolate the intervention's specific impact.

Discussion

This study sought to determine the effectiveness of MJM of TMJ in reducing bruxism symptoms in subjects with TMD. Our results demonstrate that MJM, when combined with conventional therapy, significantly improves clinical outcomes. Significant improvements were observed in PPT and MMO, indicating enhanced muscle function and reduced discomfort. Additionally, the reduction in MFIQ scores highlights improved FL, which contributes to enhanced quality of life (QOL). Correlation analyses revealed a strong, positive relationship between PPT and MMO, and between FL and SQOL, suggesting that gains in muscle function and pain reduction closely align with functional capacity and overall SQOL.

The MJM proves effective in reducing TMD symptoms in bruxism patients through multiple physiological mechanisms. Its controlled oscillatory movements activate joint mechanoreceptors, particularly type I and type II afferents, leading to central nociceptive inhibition and consequent pain alleviation[13]. Furthermore, MJM counters the hyperactivity and protective guarding of masticatory muscles that often accompany bruxism, fostering muscular relaxation and enhancing the mandibular range of motion[8,18]. In addition, the re-establishment of normal joint arthrokinematics achieved through MJM lessens stiffness and promotes smoother jaw movement[13]. The resulting biomechanical and neuromuscular adaptations translate into greater MMO, reduced PPT, and improved SQOL. Clinical trials reinforcing these correlations have noted marked gains across MMO, PPT, SQOL, and QOL measurements after MJM interventions[8,13]. These outcomes support our hypothesis that MJM with conventional exercises enhances the clinical course of bruxism-related TMD.

The results align with another investigation reporting that a regimen of manual therapy and home exercises lowered pain scores, improved MMO, and positively impacted both subjective SQOL and cumulative QOL[8]. Although that trial did not isolate MJM, the overlapping results support the technique's pivotal role in a multimodal strategy. Notably, while SQOL scores improved within groups, the difference between the groups failed to reach significance, mirroring Kadıoğlu et al.'s findings. This suggests that MJM's influence on SQOL may be indirect and potentially influenced by factors such as chronic pain and psychological stress. Although a positive correlation was observed between FL and SQOL, the lack of significant between-group differences in SQOL infers that improvements in FL alone may not be sufficient to elicit measurable changes in sleep. This complexity is echoed in the literature, where studies have shown varied results regarding the influence of manual therapy on SQOL in individuals with bruxism[19-22]. The multifaceted nature of SQOL, its link to TMJ function, and other factors, including emotional stress, central sensitization, and comorbid sleep-

disordered breathing, may limit the perceived efficacy of MJM alone.

One report found that a specific respiratory physiotherapy, which trains both the inspiratory and expiratory muscles to target upper airway mechanics, reduced masseter activity, lessening any nighttime arousals linked to bruxism and sleep apnea[23]. These results indicate a possible enhancement in bruxism care when MJM is paired with airway-focused therapies, particularly in patients where the respiratory system or central nervous system influences the grinding. In terms of mandibular movement and discomfort, MJM and post-isometric relaxation (PIR) achieve similarly positive results. One earlier investigation positioned PIR ahead of Bowen's in relieving pain, increasing MMO, reducing lateral deviations, and enhancing functional activity in TMD. Yet both PIR and MJM brought analogous improvements in MMO and pain within the same four-week span. Despite their different approaches, both methods harness neurophysiological reflex arcs (Golgi tendon organ inhibition and mechanoreceptive feedback), revealing a common neurophysiological pathway for re-establishing musculoskeletal balance. Further evidence continues to affirm respiratory training's role in reducing masseter contractions and stabilizing awakening levels, underscoring the web of interactions between SQOL, the nature of bruxism, TMJ dysfunction, and airway function[25].

Alternative interventions, such as deep-stripping massage, have been shown to enhance SQOL, jaw mobility, and PPT in chronic sleep bruxers[26]. Moreover, a randomized clinical trial found that low level laser therapy outperformed the Michigan splint in reducing pain, improving mandibular movements and muscle activity in patients with myofascial TMD[27]. Manual therapy, combined with kinesio taping, also showed significant improvements in muscular stiffness, thickness, and PPT among bruxers[28]. Similarly, MJM was discovered to improve the QOL, SQOL, kinesiophobia, MO, and pain in TMD patients following cervicofacial burns[13]. These interventions, aimed at neuromuscular normalization, have shown moderate-to-large effect sizes in pain and MMO improvement. Our results confirm the clinical value of incorporating MJM into a comprehensive treatment plan, especially for patients unresponsive to conservative or exercise-only therapies. Accordingly, conservative physiotherapy worked better than occlusive splinting in reducing pain and improving TMJ movement in myofascial TMD[29]. Combining home exercises with stabilization splints or ultrasound therapy has shown greater benefits than exercise alone, particularly in improving pain, distress, and MMO[30,31]. These insights reinforce the application of MJM as a critical component in the management of bruxism and TMD.

This study has various limitations, including inadequate information on bruxism stage and type, and the administration of muscle relaxants during treatment, which restricted our ability to gain a deeper understanding of the condition and compromised the efficacy of the intervention. To create a more uniform group, we excluded patients who experienced jaw pain as a result of joint dislocation, degeneration, and inflammation, potentially limiting the findings' applicability. The quasi-experimental design, rather than a randomized-controlled trial, introduces the possibility of selection bias. The absence of randomization may have led to baseline group differences that affected the results. Due to the absence of random assignment, it is challenging to attribute the observed effects exclusively to the intervention, as other potentially confounding variables may have influenced the outcomes. While convenience sampling facilitated recruitment, it may have introduced selection bias, as the sample might not fully represent the target population, differing systematically from individuals less readily accessible. This affects the generalizability of the findings. Although group allocation was randomized

using a lottery method to balance baselines, the initial non-random sampling approach limits overall methodological rigor. The four-week duration may have been insufficient to identify significant long-term benefits, and the lack of follow-up data further limits understanding of the treatment durability. Moreover, the outcome assessor and the principal investigator were blinded, whereas the patients were not blinded due to the nature of the intervention, which makes it a single-blind study. The authors acknowledge that the study implemented assessor blinding only, potentially introducing expectations and reporting biases. This is especially relevant for self-reported metrics, including SQOL and FL, where participant awareness of the intervention could have influenced responses. Furthermore, such biases may have indirectly affected performance-based outcomes, like MMO and PPT.

To overcome these limitations, upcoming research should implement randomized controlled trials to mitigate selection biases and improve internal validity. Replacing convenience with probability sampling will further enhance the generalizability of the findings. By including participant blinding through sham interventions and ensuring the blinding of outcome assessors, distortions in self-reported measures can be significantly reduced. Standardizing muscle relaxant use with comprehensive participant data on bruxism subtypes and the relevant psychosocial variables will sharpen the interpretability of the results. Longitudinal investigations with sufficiently large cohorts remain essential for assessing long-term effects. Studies involving older adults and bruxism cases without TMD will also expand the applicability and relevance of treatment.

Conclusion

This investigation shows that conventional therapy and MJM are both effective in the treatment of bruxism. Nevertheless, conventional therapy is more effective when the MJM of the TMJ is combined. The PPT, MMO, and FL in individuals with bruxism and myofascial TMD are significantly improved by MJM. However, it does not have a significant effect on SQOL. These findings emphasise the advantages of including manual therapy approaches in the treatment plans for bruxism and myofascial TMD regimens, which have substantial implications for clinical practice.

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Conflict of interest

There are no potential conflicts of interest to declare.

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