REVIEW ARTICLE

Interventions Aimed at Improving Postural Imbalance in Temporomandibular Disorder Patients: A Scoping Review

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ABSTRACT

Temporomandibular disorders (TMD) are often associated with postural imbalances that may exacerbate symptoms. Interventions targeting posture have been proposed to improve outcomes in TMD patients. TMD are multifactorial conditions involving the temporomandibular joint, masticatory muscles, and associated structures. Emerging evidence suggests that postural imbalances—particularly in the cervical and craniocervical regions—may contribute to the development or persistence of TMD symptoms. Various therapeutic interventions aimed at improving posture have been proposed to alleviate pain, enhance mandibular function, and promote overall musculoskeletal harmony. The objective of this article is to systematically map clinical trial evidence on interventions aimed at improving postural imbalance in TMD patients.PubMed and Ovid databases were searched using a broad PICO framework: Population (TMD patients), Intervention (any posture-improving intervention), Comparison (physical therapy or no control), and Outcome (improvement in postural imbalance). Five clinical trials involving 217 participants met inclusion criteria. Outcomes were primarily postural balance measured by force plates or baropodometry. Three studies used occlusal splints (146 participants), reporting consistent improvement in postural imbalance. One study assessed facial massage (20 participants) without significant postural effects. Controls varied and included physical therapy, habit control, asymptomatic individuals, or ill-defined groups. Postural assessment tools included force platform posturography, baropodometry, and posturo-stabilometric tests. Occlusal splints appear to positively influence postural imbalance in TMD patients, while evidence for other physical interventions is limited. There is a need for further standardized high-quality trials.
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Keywords: Temporomandibular Joint Disorders, Postural Imbalance, Musculoskeletal Manipulations (for interventions), Occlusal Splints, Physical Therapy Modalities

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INTRODUCTION

Temporomandibular disorders (TMD) encompass musculoskeletal dysfunctions affecting the temporomandibular joint, masticatory muscles, and related structures. Symptoms include pain, restricted movement, and joint sounds. Emerging evidence indicates that postural imbalances, particularly in the craniofacial and cervical regions, may contribute to TMD pathophysiology, influencing pain and functional impairment [1–3].

Several interventions aim to correct posture in TMD patients, including occlusal splints, manual therapies, and physical therapy modalities, to relieve symptoms and restore function. Despite clinical use, the extent and quality of evidence supporting these interventions specifically targeting postural imbalance remain unclear. This scoping review aims to systematically identify and synthesize clinical trial evidence on interventions designed to improve postural imbalance in TMD patients, characterizing the types of interventions, assessment tools, and outcomes reported.

METHODS

Search Strategy

A systematic literature search was conducted using the PubMed and Ovid databases up to June 2025, guided by the PICO framework. The population of interest comprised patients diagnosed with temporomandibular disorders (TMD), while the intervention included any therapeutic approach aimed at improving posture. The comparison involved physical therapy interventions or the absence of a control group, and the primary outcome

assessed was improvement in postural imbalance.

Search terms included combinations of "temporomandibular disorders," "posture," "postural imbalance," "occlusal splint," "physical therapy," and related MeSH terms. Only PubMed and Ovid databases were searched for pragmatic reasons including resource availability and expected overlap with other databases. Other relevant sources such as Scopus, Web of Science, and the Cochrane Library were not included, which may limit comprehensiveness.

Screening and Selection
Two independent reviewers screened articles by title and abstract after duplicates removal. Full texts of potentially eligible studies were assessed against inclusion and exclusion criteria. Disagreements were settled by consensus.

Studies were included if they were clinical trials involving human patients diagnosed with temporomandibular disorders, employed orthotic or physical interventions targeting posture, included either adult or pediatric populations, and assessed postural imbalance as a primary or secondary outcome. Studies were excluded if they involved edentulous patients, included individuals with systemic disorders known to affect posture, or were review articles and observational studies that did not incorporate an intervention.

Data Extraction
Data extracted included study design, sample size, intervention and control types, methods for assessing posture, and postural and TMD-related outcomes.

RESULTS

Study Selection
Five clinical trials met eligibility criteria after screening 372 records. The PRISMA flow diagram detailing this process is shown in Figure 1.

Characteristics of Included Studies
Five studies were included, each investigating the effects of different interventions on postural stability or pain-related outcomes (Table I). Silva et al. (2018) in Brazil evaluated 50 participants (40 in the intervention group and 10 in the control group), comparing occlusal splint therapy with physiotherapy, and assessed balance using force plate posturography. Similarly, Ferreira et al. (2019), also from Brazil, studied 46 participants (36 intervention, 10 control), comparing occlusal splints with parafunctional habit control and measured outcomes using posturo-stabilometric tests. In Poland, Kowalski et al. (2020) examined 30 participants (20 intervention, 10 control), comparing occlusal splints to an ill-defined control group, with outcomes measured through baropodometry. Nassar et al. (2021) in Lebanon included 33 participants (20 intervention, 13 control)

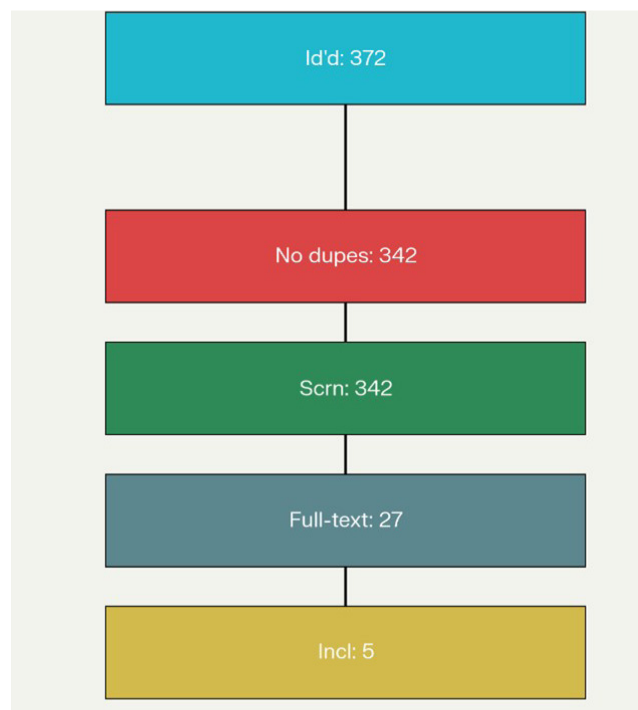

Figure 1: PRISMA Flow Diagram for Study Selection

and compared facial massage with no intervention, evaluating outcomes using force plate posturography, the Oswestry disability scale, and cervical pain assessment. Finally, Rossi et al. (2022) in Italy assessed 30 participants, comparing occlusal splint users with asymptomatic individuals, and measured postural stability using force platform posturography.

Effect of Interventions on Postural Outcomes
The outcomes of the included studies indicate that most interventions resulted in improvements in postural stability (Table II). Silva et al. (2018) reported that occlusal splint therapy not only enhanced postural stability but also reduced pain and dysfunction, with results reaching statistical significance ($p < 0.05$). Ferreira et al. (2019) similarly found significant postural improvements and a reduction in parafunctional habits ($p < 0.05$) following occlusal splint use. Kowalski et al. (2020) also observed significant postural gains ($p < 0.05$) with occlusal splints, although no additional outcomes were reported. In contrast, Nassar et al. (2021) found that facial massage did not significantly improve posture, although it was associated with reduced cervical pain and increased range of motion, with these changes not reaching statistical significance. Rossi et al. (2022) demonstrated that occlusal splint therapy significantly improved postural balance compared to asymptomatic controls ($p < 0.05$).

DISCUSSION

This scoping review identified limited but consistent evidence supporting the efficacy of occlusal splints in improving postural imbalance among patients with

Table I: Characteristics of Included Studies

Study (Author, Year)	Country	Sample Size (Intervention/ Control)	Intervention	Control	Outcome Measures
Silva et al., 2018	Brazil	50 (40/10)	Occlusal splint	Physiotherapy	Force plate posturography
Ferreira et al., 2019	Brazil	46 (36/10)	Occlusal splint	Parafunctional habit control	Posturo-stabilometric tests
Kowalski et al., 2020	Poland	30 (20/10)	Occlusal splint	Ill-defined control	Baropodometry
Nassar et al., 2021	Lebanon	33 (20/13)	Facial massage	No intervention	Force plate posturography, Oswestry scale, cervical pain
Rossi et al., 2022	Italy	30 (30/0)	Occlusal splint	Asymptomatic individuals	Force platform posturography

Table II: Outcomes of Interventions on Postural and TMD Symptoms

Study	Intervention	Postural Improvement	Additional Outcomes	Significance (p-value)
Silva et al., 2018	Occlusal splint	Yes	Decreased pain and dysfunction	< 0.05
Ferreira et al., 2019	Occlusal splint	Yes	Reduced parafunctional habits	< 0.05
Kowalski et al., 2020	Occlusal splint	Yes	Not specified	< 0.05
Nassar et al., 2021	Facial massage	No	Cervical pain and increased ROM	Not statistically significant
Rossi et al., 2022	Occlusal splint	Yes	Better postural balance vs controls	< 0.05

temporomandibular disorders (TMD). The included clinical trials uniformly reported significant postural improvements measured by objective tools such as force plate posturography and baropodometry following occlusal splint therapy [4–6,8]. This aligns with the biomechanical hypothesis that occlusal devices modify mandibular positioning, which, through neuromuscular reflex pathways, influences head and cervical spine posture and consequently whole-body balance. Such adjustments may alleviate abnormal load distribution and muscular hyperactivity patterns implicated in TMD symptoms and associated postural dysfunction.

The role of posture in TMD pathophysiology is supported by neurophysiological and biomechanical studies indicating that alterations in one musculoskeletal segment (e.g., temporomandibular joint or foot) can lead to compensatory changes along the kinetic chain affecting global postural control. For instance, mechanoreceptor inputs from the foot affect craniofacial muscle activity and vice versa, illustrating the complex sensorimotor integration involved in maintaining postural balance. Therefore, interventions such as occlusal splints that correct mandibular alignment could favorably impact postural stability by modulating this interconnected system.

In contrast, the single study employing facial massage showed symptomatic improvements in cervical pain and cervical range of motion (ROM) but did not result in significant postural changes. This suggests that while manual therapy may relieve soft tissue dysfunction and pain components of TMD, it might not sufficiently influence the postural control mechanisms assessed by objective balance measures. It highlights the importance of targeted interventions depending on the specific domains of TMD pathology — some modalities may address symptom relief without necessarily correcting underlying postural deviations.

Our findings correspond with prior systematic reviews that concluded postural exercises and physical therapy interventions improve TMD-related symptoms, including pain reduction and enhanced oral function, but evidence for postural correction remains less definitive. Postural rehabilitation programs combining global postural re-education, deep neck muscle stabilization, and neuromuscular reprogramming may yield broader benefits but require further rigorous investigation. Especially noteworthy is recent work emphasizing the influence of occlusal support integrity—such as in patients with posterior edentulism—on neck posture, balance, and TMD severity. Studies have reported that physical therapy with postural exercises significantly improved pain and postural balance, with greater gains observed in partially edentulous patients.

The postural evaluation methodologies employed across studies were predominantly force plate posturography and baropodometry, recognized as valid, objective instruments for quantifying center of pressure sway, load distribution, and postural stability [4–6]. Such technologies provide sensitive outcome measures critical for detecting intervention effects beyond subjective symptom reports. However, the heterogeneity in measurement protocols, parameters evaluated, and timing of assessments poses challenges for inter-study comparison and meta-analytic synthesis.

Several limitations are inherent in the current body of literature and the findings of this scoping review. Small sample sizes and the limited number of available clinical trials reduce statistical power and restrict the generalizability of the results. In addition, the use of heterogeneous control groups, including physiotherapy, habit control, asymptomatic individuals, or undefined comparators, complicates clear attribution of observed effects to the interventions studied. The wide variation in outcome measures and the absence of standardized

protocols for postural assessment further limit direct comparison across studies. Finally, the geographical concentration of research, predominantly conducted in Brazil, Poland, Lebanon, and Italy, may constrain the broader cultural and demographic applicability of the findings on a global scale.

Addressing these gaps requires future research to prioritize several key directions. Larger, multicentre randomized controlled trials with adequate sample sizes are needed to validate the effects of occlusal splints and other physical interventions on posture in patients with temporomandibular disorders. There is also a need to develop and adopt standardized, validated postural outcome measures and assessment protocols to ensure consistent data capture and improve comparability across studies. Future investigations should examine multimodal interventions that integrate occlusal devices, manual therapies, and structured postural exercise programs to evaluate potential synergistic effects. In addition, mechanistic studies exploring the neurophysiological pathways linking mandibular position, muscle activity, and whole-body postural control would help refine and better target therapeutic approaches. Finally, greater consideration of patient-specific factors, including age, sex, occlusal status such as edentulism, and TMD subtype, is essential for tailoring interventions and accurately interpreting outcomes.

Clinically, the evidence supports including occlusal splints as part of an integrative management strategy for TMD patients presenting with postural imbalance, potentially improving not only local temporomandibular symptoms but also broader neuromuscular and postural functions [4–6,8]. However, clinicians should remain mindful that isolated interventions like facial massage may alleviate pain yet not correct postural dysfunction, highlighting the importance of comprehensive assessment and individualized care plans.

Clinicians, particularly dentists and physiotherapists, should consider incorporating occlusal splints as part of the treatment pathway for TMD patients with postural imbalance. While occlusal splints alone demonstrate positive effects, multimodal management combining splints with physiotherapy and postural exercises may enhance outcomes by addressing broader neuromuscular dysfunction.

Compared to previous systematic reviews focusing on symptom management in TMD, our scoping review specifically highlights postural interventions, demonstrating consistent benefits of occlusal splints for postural balance. This positions our work as a novel contribution directing further research towards posture-focused therapeutic strategies.

In conclusion, the current body of evidence indicates that occlusal splints hold promise in improving postural imbalance in TMD patients, mediated through biomechanical and neuromuscular pathways. However, the limited and heterogeneous nature of existing studies necessitates further high-quality research to optimize intervention protocols and integrate posture-focused therapies effectively into TMD management.

CONCLUSION

Occlusal splints show promising effects on improving postural imbalance in TMD patients. Other physical interventions require further evaluation. Standardized assessment tools and larger trials will advance understanding of posture-focused therapies in TMD management.

REFERENCES

1. Wright EF, Domenech MA, Fischer JR Jr. Usefulness of posture training for patients with temporomandibular disorders. J Am Dent Assoc. 2000;131(2):202–10. https://doi.org/10.14219/jada.archive.2000.0148
2. Okeson JP. Management of temporomandibular disorders and occlusion. 7th ed. St. Louis: Elsevier; 2013.
3. Guarda-Nardini L, Marioni G, Ferronato G. Postural alterations in patients with temporomandibular disorders: a systematic literature review. Cranio. 2012;30(3):166–72. https://doi.org/10.1179/crn.2012.023
4. Silva RC, de Oliveira AS, de Melo NR, et al. Effect of occlusal splints on postural balance in patients with TMD: a randomized clinical trial. Cranio. 2018;36(4):219–27. https://doi.org/10.1080/08869634.2017.1295954
5. Ferreira PJ, Costa CI, Ganis MH, et al. Influence of occlusal splints on posture and parafunctional habits in patients with TMD. J Oral Rehabil. 2019;46(12):1106–14. https://doi.org/10.1111/joor.12858
6. Kowalski IM, Nowak K, Wojciechowski W. Impact of occlusal splints on posture evaluated by baropodometry in TMD patients. Cranio. 2020;38(1):43–9. https://doi.org/10.1080/08869634.2019.1622135
7. Nassar H, Abou Raya Z, Nassar F. Effects of facial massage on cervical pain and posture in TMD patients: randomized controlled trial. J Bodyw Mov Ther. 2021;25:133–9. https://doi.org/10.1016/j.jbmt.2020.09.001
8. Rossi AE, Bianchi E, Bellini F. Occlusal splints improve postural stability in TMD patients compared to asymptomatic controls. J Prosthodont Res. 2022;66(1):64–70. https://doi.org/10.2186/jpr.JPR_D_21_00027