The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 20(4) 2234-2238, 2025 www.thebioscan.com

Systemic Effects of Temporomandibular Disorders on Posture and Plantar Biomechanics: A Narrative Review Aligned with Observational Findings

Authors:
Jafar Khan, Dr. Vinita Baghela, Dr. S. B. Nagar, Dr Rahat Khan Warsi, Dr. Usmaan Khan, Dr. Prashant Ramawat, Dr Saleem Akhtar Naqvi, Prof. Dr. Bhupesh Goyal

MPT Scholar, Department of Rehabilitation Sciences, Manikya Lal Verma, Shramjeevi Evening College, Janardan Rai Nagar Rajasthan Vidyapeeth (Deemed to be University)

Associate Professor, Department of Rehabilitation Sciences, Manikya Lal Verma, Shramjeevi Evening College, Janardan Rai Nagar Rajasthan Vidyapeeth (Deemed to be University)

Dean, Department of Rehabilitation Sciences, Manikya Lal Verma, Shramjeevi Evening College, Janardan Rai Nagar Rajasthan Vidyapeeth (Deemed to be University)

Assistant Professor, Department of Pharmacology, Pacific Medical College & Hospital, Pacific Medical Unversity, Udaipur

Professor, Department of Orthopedics, Pacific Medical College & Hospital, Pacific Medical University, Udaipur

Assistant Professor, Pacific College of Physiotherapy, Pacific Medical University, Udaipur, Rajasthan

Professor and Head, physiotherapy M G Physiotherapy college (MGUMST) Jaipur

Corresponding Author: Dr. Jafar Khan

Email: zafarkhan1984@gmail.com

DOI: https://doi.org/10.63001/tbs.2025.v20.i04.pp2234-2238

KEYWORDS

Temporomandibular Disorders,
Foot Biomechanics,
Plantar Pressure,
Posture,
Kinetic Chain,
Balance

Received on:30-10-2025
Accepted on: 19-12-2025

Published on: 29-12-2025

Abstract

Temporomandibular disorders (TMDs) are not limited to craniofacial symptoms; they may influence distal biomechanics, postural alignment, and plantar pressure distribution through the kinetic chain. This narrative review synthesizes evidence linking TMD to systemic postural and gait changes, contextualized with findings from an observational cross-sectional study of 40 male participants (aged 20–40 years). TMD patients exhibited predominantly hindfoot loading, left-sided sway patterns, and moderate-to-severe postural deviations. Evidence supports the role of compensatory mechanisms along the kinetic chain and underscores the importance of integrating postural and plantar pressure assessments into TMD rehabilitation. Limitations include the male-only cohort, modest sample size, and the cross-sectional design, which restricts causal inference. Future research should include female participants and longitudinal designs to enhance generalizability.

Introduction

Temporomandibular disorders (TMDs) are among the most common musculoskeletal conditions, affecting approximately 5–12% of the general population [1]. They are characterized by jaw pain, restricted mandibular motion, and joint sounds. While traditionally regarded as localized craniofacial conditions, TMDs can exert systemic effects through the kinetic chain, potentially altering spinal alignment, postural control, and foot biomechanics [2,3].

The kinetic chain theory suggests that dysfunction in one anatomical segment may lead to compensatory adjustments in connected structures. In the case of TMD, mandibular dysfunction may influence head and cervical posture, shoulder alignment, pelvic orientation, and ultimately lower limb loading, manifesting as altered plantar pressure distribution and lateralized sway [4,5]. Despite increasing recognition of these interrelationships, objective assessments using stabilometric platforms and plantar pressure analysis remain limited [6].

Our observational cross-sectional study of 40 male participants provides empirical evidence supporting this model, demonstrating significant associations between TMD, postural deviations, and plantar pressure alterations. This review integrates these findings with existing literature to highlight systemic implications of TMD.

TMD and Postural Deviations

Clinical and experimental studies consistently report postural deviations in individuals with TMD. In our observational cohort, 65% of patients demonstrated moderate postural changes, including forward head posture and asymmetrical shoulder alignment. These alterations may be linked to compensatory mechanisms triggered by pain, asymmetrical mandibular loading, and cervical spine dysfunction.

Tecco et al. (2009) and Sakai et al. (2011) reported increased body sway and impaired postural control in TMD patients [2,3]. Michelotti et al. (2010) experimentally confirmed that unilateral TMD negatively affects postural stability [7]. Cuccia and Caradonna (2009) also emphasized the systemic links between the stomatognathic system and global posture [8], while Kuroiwa et al. (2017) demonstrated that patients with TMD exhibit measurable postural instability compared to healthy controls [14].

Influence on Plantar Pressure and Foot Biomechanics

Our findings revealed that 80% of TMD patients exhibited predominantly hindfoot loading, often accompanied by left-sided sway. These results align with the work of Souza et al. (2014), who observed altered plantar pressure patterns in TMD patients [1]. Oliveira et al. (2018) further demonstrated a significant relationship between TMD and plantar pressure shifts in a young adult population [6].

Such hindfoot dominance and lateralized sway likely represent distal compensatory adaptations resulting from asymmetrical mandibular function or altered cervical posture. Pauletto et al. (2012) described similar biomechanical pressure redistribution in postural adaptations [5].

Gait and Functional Implications

Altered plantar pressure and postural sway contribute to gait modifications. In our cohort, follow-up assessments after TMJ-focused

interventions demonstrated improvements in hindfoot–forefoot balance, suggesting functional restoration through comprehensive rehabilitation.

Lee et al. (2014) reported changes in stride length, cadence, and balance in patients with TMD [4]. Garstka et al. (2022) highlighted systemic musculoskeletal changes associated with painful TMD, reinforcing its effect on locomotor control [7]. Manfredini et al. (2012) also reviewed the evolving evidence linking dental occlusion, posture, and gait alterations in TMD [15].

Clinical Relevance

Evaluation of TMD should extend beyond localized jaw function to include posture, balance, and plantar biomechanics. An integrated rehabilitation approach may optimize outcomes, incorporating:

- Articular mobilizations of the TMJ,
- Myofascial release targeting masseter and cervical musculature,
- Postural correction strategies,
- Balance and proprioceptive training, and
- Foot strengthening and, where indicated, orthotic interventions.

Evidence shows that multimodal management can improve systemic outcomes. Rodrigues-Bigaton et al. (2012) demonstrated that TMD treatment significantly improved posture [11], while Gomes et al. (2014) confirmed functional benefits of combined occlusal splint and physiotherapy interventions [12].

Limitations

- **Sample limitations:** Only males were included due to sociocultural constraints, limiting generalizability.
- **Design limitations:** The cross-sectional design prevents causal inferences.
- **Statistical power:** Modest sample size restricts robustness of subgroup analysis.

Photogrammetry studies (Chaves et al., 2008) suggest that future research using standardized posture assessment tools may enhance reliability [10].

Future Directions

- Conduct **longitudinal studies** to assess progression of postural and plantar adaptations over time.
- Include **female participants** to account for gender-based differences.
- Explore the **mechanistic pathways** linking TMD dysfunction with distal biomechanical alterations, as suggested by Cephalometric and postural studies [13].

Conclusion

Temporomandibular disorders influence systemic biomechanics, including postural alignment and plantar pressure distribution. Findings from our observational study, supported by a growing body of literature, confirm the kinetic chain model, emphasizing the need for holistic evaluation and rehabilitation. Integration of postural and plantar pressure assessments into TMD management may enhance clinical outcomes and promote long-term functional recovery.

References

1. Souza JA, Pasinato F, Corrêa ECR, da Silva AMT. Global body posture and plantar pressure distribution in individuals with and without temporomandibular disorder: A preliminary study. *J Manipulative Physiol Ther.* 2014;37(6):407–414. doi:10.1016/j.jmpt.2014.07.003

2. Tecco S, Gallo S, Di Nardo D. Postural effects of temporomandibular joint disorders: a review. *J Oral Rehabil.* 2009;36(9):625–631. doi:10.1111/j.1365-2842.2009.01960.x

3. Sakai T, Yamashita K, Oishi K. The effect of temporomandibular dysfunction on body posture: a review. *J Prosthodont Res.* 2011;55(1):5–11. doi:10.1016/j.jpor.2010.08.004

4. Lee JH, Lee HS, Lee MS. Evaluation of gait and postural changes in patients with temporomandibular disorders: a case-control study. *J Craniofac Surg.* 2014;25(5):1781–1785. doi:10.1097/SCS.0000000000000931

5. Pauletto A, Rossi G, Neve A. Biomechanical changes in foot pressure patterns related to postural adjustments. *Clin Biomech.* 2012;27(5):521–526. doi:10.1016/j.clinbiomech.2012.01.003

6. Oliveira ABB, de Araújo CC, Del Antonio TT, Folster NM, Silva JKM. Prevalence of temporomandibular disorder and its relation with plantar pressures in university students of health-related courses. *Man Ther Posturol Rehabil J.* 2018;16:1–6. doi:10.17784/mtprehabjournal.2018.16.832

7. Garstka M, Majcher P, Skomro P, et al. Cause–effect relationships between painful temporomandibular disorders and postural and functional changes in the musculoskeletal system: a preliminary report. *Pain Res Manag.* 2022;2022:1429932. doi:10.1155/2022/1429932

8. Michelotti A, Buonocore G, Manzo P, Pellegrino G, Farella M. Postural stability and unilateral temporomandibular disorders: an experimental study. *Gait Posture.* 2010;31(3):349–354. doi:10.1016/j.gaitpost.2009.12.001

9. Cuccia A, Caradonna C. The relationship between the stomatognathic system and body posture. *Clinics.* 2009;64(1):61–66. doi:10.1590/S1807-59322009000100011

10. Chaves TC, Oliveira AS, Grossi DB. Reliability of craniocervical posture assessment by digital photogrammetry. *Braz J Phys Ther.* 2008;12(4):286–292. doi:10.1590/S1413-35552008000400012

11. Rodrigues-Bigaton D, et al. Effects of temporomandibular disorder treatment on body posture: a randomized controlled trial. *Man Ther.* 2012;17(6):556–561. doi:10.1016/j.math.2012.05.009

12. Gomes CAF, Politti F, Andrade DV, et al. Effects of massage therapy and occlusal splint therapy on mandibular range of motion in individuals with temporomandibular disorder. *J Phys Ther Sci.* 2014;26(7):1079–1082. doi:10.1589/jpts.26.1079

13. Fujimoto M, Hayakawa L, Kawagishi S, et al. Relationship between temporomandibular joint osteoarthritis/osteoarthrosis and head posture: a cephalometric study. *Cranio*. 2008;26(3):194–201. doi:10.1179/crn.2008.030

14. Kuroiwa Y, Takenami Y, Komiyama O, et al. Body posture and postural stability in patients with temporomandibular disorders: a controlled study. *J Oral Rehabil.* 2017;44(9):729–736. doi:10.1111/joor.12536

15. Manfredini D, Castroflorio T, Perinetti G, Guarda-Nardini L. Dental occlusion, body posture and temporomandibular disorders: where we are now and where we are heading for. *J Oral Rehabil.* 2012;39(6):463–471. doi:10.1111/j.1365-2842.2012.02291.x