

CLINICAL BURDEN AND PHYSIOTHERAPY MANAGEMENT OF TEMPOROMANDIBULAR JOINT DYSFUNCTION WITH COMORBID MIGRAINE: EVIDENCE FROM AN OBSERVATIONAL STUDY

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Abstract

Background: Temporomandibular Joint Dysfunction (TMD) and migraine often occur simultaneously and their combination is now recognised as producing a compounded clinical burden, greater than either TMD or migraine alone. Physiotherapy is well placed to address the musculoskeletal contributors of this comorbidity: TMJ mobility restriction, masticatory muscle dysfunction, and cervical postural involvement; however, evidence quantifying the burden that physiotherapy-led management must address is limited.

Objective: To quantify the clinical burden (pain, impact of headache, migraine disability) of comorbid TMD–migraine with each condition separately, and to outline the physiotherapy management implications of these findings

Methods: An observational study of 164 participants (20–60 years) was conducted at the Department of Physiotherapy, Pacific Medical College and Hospital, Udaipur, over nine months. The participants were divided into four groups: Group A – TMD Only (n=35); Group B – Migraine Only (n=40); Group C – TMD + Migraine (n=55) and Group D – Other Headache (n=34). The clinical burden was evaluated by TMJ symptom duration, headache frequency, VAS, HIT-6 and MIDAS. This is a secondary analysis of the same population that was reported in the paper by Prajapati et al, “Association Between Temporomandibular Joint Dysfunction (TMD) and Migraine in Patients Presenting with Headache: An Observational Study,” applying the existing dataset to a distinct clinical-burden and physiotherapy-management analysis not reported in that paper.

Results: Group C (TMD + Migraine) had the highest clinical burden on all measures including headache frequency 15.90 ± 4.40 days/month (approaching the threshold for chronic migraine), VAS 7.18 ± 0.97 (89.1% severe pain), HIT-6 64.72 ± 3.93 (94.5% severe impact), and MIDAS 27.45 ± 4.41 (94.5% Grade IV severe disability) which were significantly higher than all other groups (Groups A, B, and D) ($p < 0.001$). Symptom duration of TMJ also was significantly greater for the TMD-associated groups (17–18 months compared with 6 months, $p < 0.001$).

Conclusion: Comorbid TMD–migraine is a significantly higher and additive clinical burden in terms of the pain, functional and disability dimensions. The findings in this article support the use of physiotherapy-based screening and multimodal care – TMJ and cervical mobilization, masticatory muscle re-education, patient education and postural correction – as an essential element in the management of patients presenting with this comorbidity.

INTRODUCTION

Temporomandibular Joint Dysfunction (TMD) and migraine are among the most common pain conditions that are encountered in the clinical practice of headache and craniofacial disorders, and each is associated with significant burden of pain, functional limitations and reduced quality of life⁷.

TMD affects a significant proportion of the world's population. A recent systematic review and meta-analysis of 27 studies that included nearly 21,000 subjects found that the prevalence of TMD is estimated to be around 29.5% of the world's population, varying significantly according to sex (36.7% in females and 26.7% in males), age group, and geographic region¹. The highest prevalence was found in Europe (33.8%), followed by Asia (27.9%) and South America (27.3%) while the lowest in North America (19.4%)¹. Such widespread distribution and significant differences between diagnostic criteria and study populations highlight the importance of TMD as a condition of significant public health importance rather than a localised and minor orofacial complaint.

Migraine shows a comparably high global burden. It is estimated to affect about 15% of the world's population at any given time², and Global Burden of Disease (GBD) estimates suggest that more than 1.16 billion people now suffer from migraine worldwide, which has increased by over more than 58% since 1990³. Migraine is a primary headache disorder that disproportionately affects working age adults, with the highest prevalence in the 30–44 year age group, and which is consistently one of the most common primary headache disorders in community and clinical headache populations globally³.

In addition to raw prevalence, migraine is recognized by the WHO and Global Burden of Disease Study as one of the leading causes of disability worldwide. In GBD 2023 data rank headache disorders are the sixth leading group of conditions in terms of years lived with disability (YLD), by age-standardised rate, of 541.9 per 100 000 population⁴. This burden is much higher for migraine than for tension-type headache as migraine has a significantly higher disability weight (0.441 compared with 0.037 for tension type headache) and is significantly more in women than in men. This places migraine not only as an important common

health condition, but also as a significant quantifiable contributor to disability in the world.

This disability burden translates directly into a significant economic cost. In the United States, the direct health care and indirect productivity loss costs associated with migraine have been estimated at \$36 billion per year, with the majority of indirect costs due to absenteeism and decreased work productivity⁵. The economic cost of TMD is not as well documented at a global level, but is estimated at around \$4 billion a year globally, with some national estimates reaching much higher when emergency department utilisation and associated chronic pain comorbidities are taken into account⁶. Combined, these statistics suggest that both TMD and migraine are not only a clinical problem for the individual patient, but are also a financial problem for health systems and employers.

TMD involves the temporomandibular joint, masticatory muscles and the associated neuromuscular and postural structures with symptoms ranging from intermittent joint clicking and mild discomfort to persistent myofascial pain, restricted mouth opening and chronic orofacial disability. In turn, migraine is a primary neurological headache

disorder characterized by recurrent moderate to severe headache attacks that are often disabling, typically accompanied by photophobia, phonophobia, and nausea, and is one of the most common causes of years lived with disability in the world, especially in working-aged adults. When considered individually both conditions have well established, although not optimal, management pathways: dental and orofacial approaches for TMD and pharmacological or neurological approach for migraine. However, a large group of patients have both conditions simultaneously, and emerging evidence suggest that this combination produces more than just an additive burden – that is more than TMD's burden plus migraine's burden, instead the two conditions appear to compound one another, amplify pain, functional impact and disability beyond what either would produce alone⁸.

This is believed to be due to the shared trigeminal convergence and central sensitisation mechanisms as activation of the trigeminal pathways from the TMJ joint and activation of the trigeminovascular pathway from migraine converge on a common set of central pain processing structures, such as

the trigeminal nucleus caudalis, instead of two parallel pain pathways.

Physiotherapists have a unique, and currently underutilized role, in management this comorbidity. Physiotherapy is the only treatment that can address the musculoskeletal substrate common to both conditions while concurrently supporting management of the neurovascular (migraine) or central (TMD) components of the headache. Purely pharmacological treatments and address the neurovascular and central mechanism of headache, and purely dental or occlusal treatments address the joint and bite, physiotherapy addresses the musculoskeletal substrate shared by both conditions.

This common biomechanical dysfunction involves an imbalance and overactivity of the masticatory muscles, restricted or asymmetric mobility of the temporomandibular joint (TMJ) and cervical postural dysfunctions such as forward head posture and upper cervical spine dysfunction. All of these factors have been directly linked to increased trigeminal nociceptive input which may in turn influence the frequency and severity of both TMD symptoms and migraine attacks⁹. In the systematic review of physiotherapeutic

approaches for TMD González-Sánchez et al. (2023) found that exercises, manual therapy and electrotherapy were among approaches with the most consistent results for reducing pain and improving function; they also found that a multimodal, structured programme combining these interventions was generally more effective than single intervention alone¹⁰. Dąbkowska and her colleagues (2025) in a recent narrative review argued that TMD should not be considered a standalone disease affecting the jaw joint but rather a multifaceted condition closely related to the function of the cervical spine. They noted, in particular that physiotherapy programs integrating post-isometric relaxation techniques, joint and soft tissue mobilisation and targeted therapeutic exercises can produce a significant reduction in pain and improvement in function¹¹.

Although the evidence base to support the role of physiotherapy in TMD management is reasonably well developed, in comparison, there has been relatively little research that quantifies the additional clinical burden that physiotherapists must manage when TMD coexists with migraine rather than when it occurs in isolation. This is a significant gap for two reasons. First,

physiotherapists and referring clinicians do not have any empirical evidence to guide the prioritisation of this subgroup of patients when compared with those with either comorbid presentation alone in their already resource constrained clinical caseload. Second, and more fundamentally, no published study to our knowledge has attempted an explicit, quantified argument for the role physiotherapy-led management should play within the overall care pathway for this comorbidity – whether it is an early, first contact care pathway intervention, or whether it is a downstream care pathway intervention, provisioned only after dental and neurological interventions have been exhausted. This sequencing question is indeed clinically significant — as TMJ symptom durations for comorbid patients will often be significant at the time of presentation, it is always being asked as a later-stage intervention to reduce an already consolidated symptom burden rather than to prevent symptom onset in the first place.

This paper addresses that specific gap using data from a observational cohort of patients with TMD, migraine or both, quantifying the magnitude of pain intensity, TMJ symptom duration, headache related functional impact and migraine specific

disability associated with TMD–migraine comorbidity relative to either condition alone - and translating these findings into a structured set of physiotherapy management priorities. This is a secondary analysis of the same cohort of 164 patients with headache who were also included in the accompanying paper, “Association between Temporomandibular Joint Dysfunction (TMD) and Migraine in Patients Presenting with Headache: An Observational study,” using the same dataset to address a distinct question – how large is the combined clinical burden of TMD and Migraine, and what does it mean for the structure and prioritization of physiotherapy services for these patients.

Aim: To evaluate the clinical burden of TMD associated with migraine and to outline the resulting physiotherapy management priorities

Objectives:

- To quantify the intensity of pain, the duration of symptoms in TMJ and the frequency of headaches in diagnostic subgroups.
- To quantify headache related functional impact and migraine

disability in patients with comorbid TMD–migraine and TMD alone.

- To determine physiotherapy management priorities, based on the observed burden pattern.

MATERIAL AND METHOD

Research Design: Observational study.

Study Setting: Department of Physiotherapy, Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan.

Sample Design: Purposive sampling;

Study Duration: 9 months

Sample Size: 164 participants (20-60 years), stratified as Group A: TMD Only (n=35); Group B: Migraine Only (n=40); Group C: TMD + Migraine (n=55); Group D: Other Headache (n=34).

Inclusion Criteria: TMJ pain/tenderness for at least 1 month, VAS 0-10, recurrent headache for at least 6 months, migraine according to the ICD-3 criteria (if present); age 20-60.

Exclusion Criteria: Recent fracture or surgery to the TMJ, cervical or dental region (Last 3 months); Active musculoskeletal injury of the shoulder, cervical and thoracic

region; Systemic inflammatory illness; Progressive neurological disorder; Malignancy; Fibromyalgia; Active dental and cervical infection; Spinal accessory nerve palsy; Pregnancy.

Procedure: Following institutional ethical clearance (Declaration of Helsinki 2013; ICMR 2017 guidelines) and informed consent, the participants underwent standardized clinical assessment which included the following: demographic and anthropometric data, duration of TMJ symptoms, frequency of headaches, and the three outcome measures below. This is a secondary analysis of the same population of 164 participants reported in Prajapati et al. “Association Between Temporomandibular Joint Dysfunction (TMD) and Migraine in Patients Presenting with Headache: An Observation Study,” applying the existing dataset to a distinct clinical burden and physiotherapy management analysis not reported in the primary paper.

Outcome Measures: VAS (pain intensity 0-10), HIT-6 (headache impact 36-78), and MIDAS (migraine-related disability, Grades I-IV based on 90 days disability days)^{12,13,14}.

Statistical Analysis: Continuous variables were presented as mean $\pm$ SD; categorical

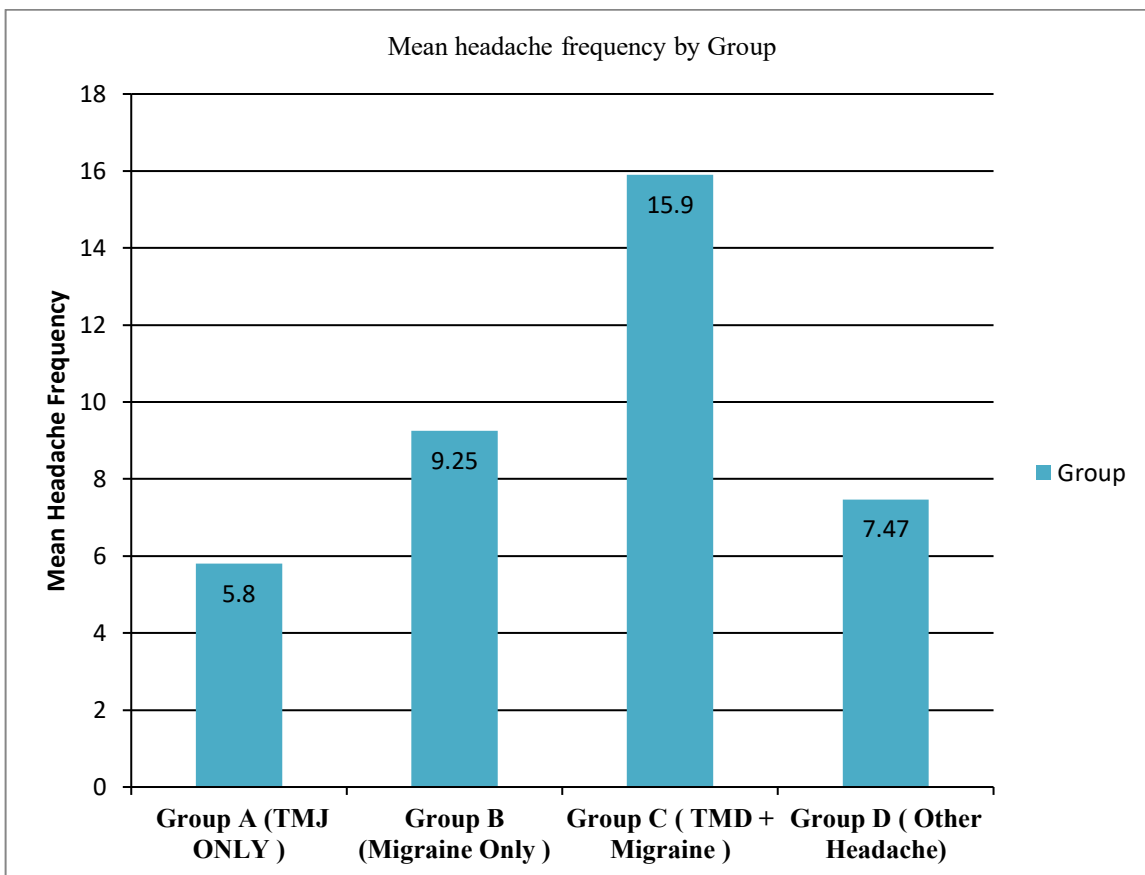
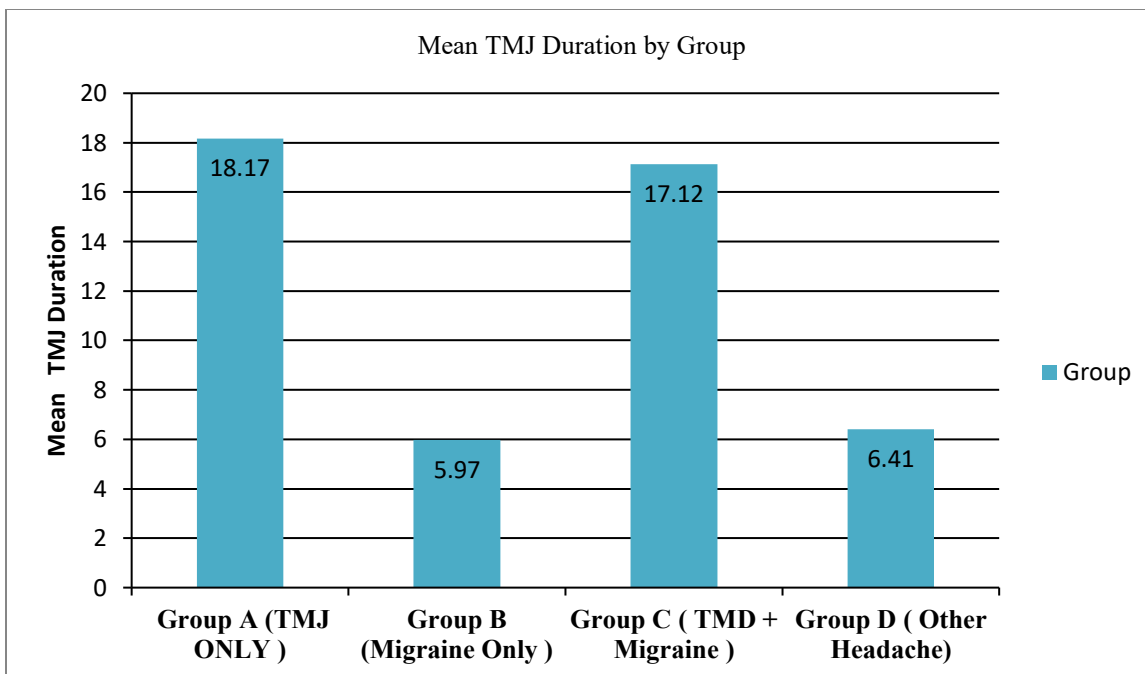
variables as frequency/percentage; and between-group comparisons for continuous variables were carried out using the Kruskal–Wallis test with Dunn's post-hoc pairwise comparisons, and for categorical variables were carried out using chi-square analysis (SAS); $p < 0.05$ (two-tailed) was considered statistically significant.

Group-wise demographic characteristics for this cohort are reported in full in Prajapati et al. (companion paper), Tables 1–2. TMJ symptom duration, headache frequency, and migraine subtype distribution — the variables most relevant to the clinical-burden analysis below — are presented in Table 1.

DATA ANALYSIS AND RESULTS — CLINICAL BURDEN PROFILE

Table 1 — Clinical Characteristics of the Study Population

Variable	Group A	Group B	Group C	Group D	Total	p-value
TMJ duration, mean $\pm$ SD (months)	18.17 $\pm$ 7.55	5.97 $\pm$ 3.04	17.12 $\pm$ 8.22	6.41 $\pm$ 3.50	12.40 $\pm$ 8.44	<0.001
Headache frequency, mean $\pm$ SD (days/month)	5.80 $\pm$ 2.80	9.25 $\pm$ 2.92	15.90 $\pm$ 4.40	7.47 $\pm$ 3.61	10.37 $\pm$ 5.44	<0.001
Migraine without aura, n (%)	NA	24 (60.0%)	38 (69.1%)	NA	62 (37.8%)	—
Migraine with aura, n (%)	NA	16 (40.0%)	17 (30.9%)	NA	33 (20.1%)	—

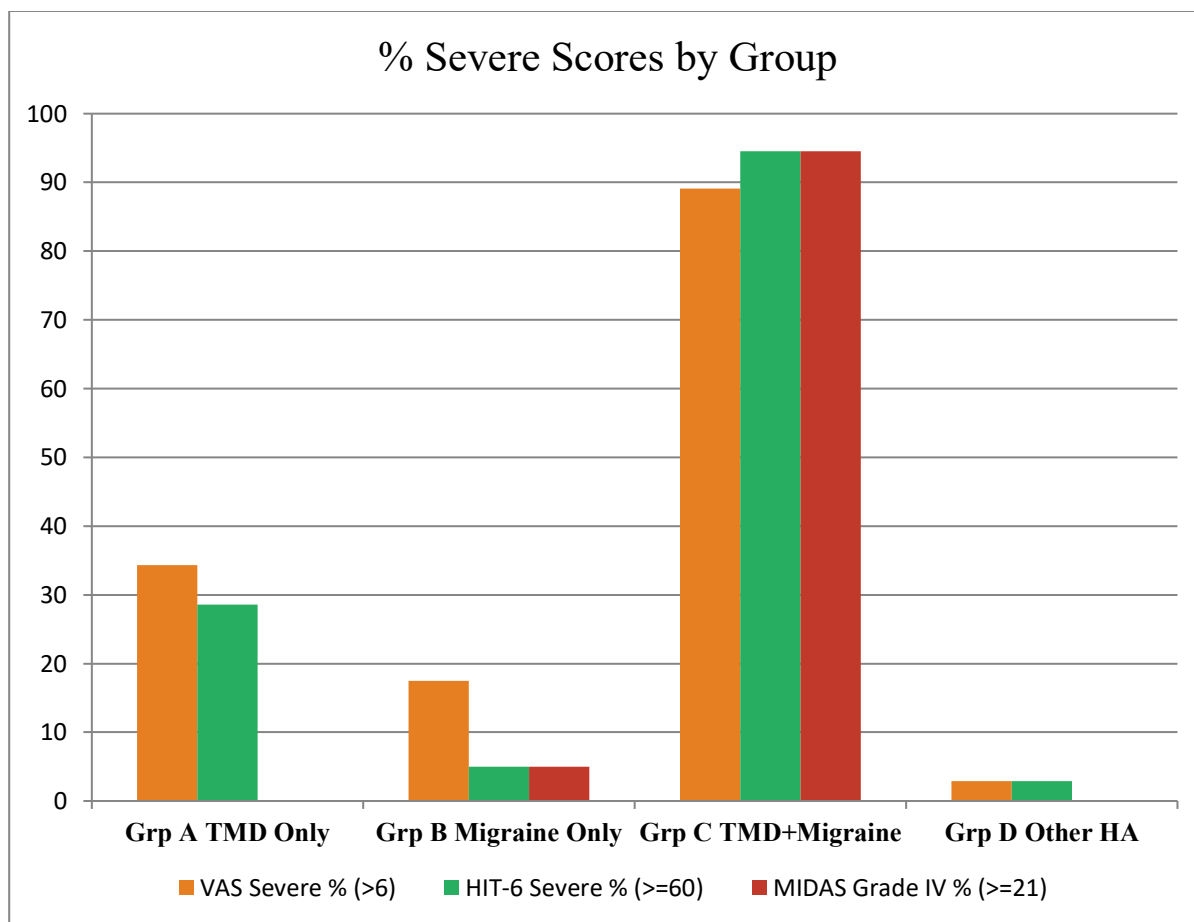


Note: This table is reported here in full; demographic characteristics for each group and tables of the distribution of the outcome-scores can be found in companion paper (Prajapati et al., "Association Between Temporomandibular Joint Dysfunction (TMD) and Migraine in Patients Presenting with Headache: An Observational Study").

The duration of the TMJ symptoms was significantly longer for TMD associated groups (Groups A and C, 17–18 months) compared to Groups B and D (~6 months, $p < 0.001$ by Kruskal–Wallis test) and the headaches frequency was highest in Group C (15.90 ± 4.40 days/month, $p < 0.001$).

Table 2 — Severe-Category Burden Across Outcome Measures

Group	Severe pain, VAS >6 (%)	Severe impact, HIT-6 ≥60 (%)	Grade IV disability, MIDAS ≥21 (%)
A — TMD Only	34.3%	28.6%	0.0%
B — Migraine Only	17.5%	5.0%	5.0%
C — TMD + Migraine	89.1%	94.5%	94.5%
D — Other Headache	2.9%	2.9%	0.0%



This “triple – severe” pattern in Group C – near universal severe pain, severe headache impact, and severe disability occurring together in the same patients – is the clearest quantitative signal of compounded clinical burden in the dataset and is the central finding motivating the physiotherapy management case.

PHYSIOTHERAPY MANAGEMENT IMPLICATIONS

The burden pattern documented above (generalized severe pain, severe headache

impact and severe disability as seen in the TMD + Migraine group) directly supports a physiotherapy-led, multimodal approach to both disorders that focuses on the shared musculoskeletal and neuro-physiological substrate between the two disorders.

1. TMJ & cervical spine manual therapy.

González-Sánchez et al., (2023) found that manual therapy, therapeutic exercise and electrotherapy are among the most effective physiotherapy treatments for TMD, and combined modalities generally more effective than a single modality¹⁰. In this

cohort, TMD-associated groups also had significantly longer duration of TMJ complaints (17-18 months versus about 6 months, $p < 0.001$) underscoring the need to address chronic TMJ complaints directly. Graded TMJ joint mobilisation should therefore be prioritized as a core component of management rather than treated as an adjunct.

2. Masticatory muscle re-education and soft – tissue technique. Dąbkowska et al. (2025) found that post-isometric relaxation, myofascial techniques and dry needling were evidence-supported techniques to decrease hyperactivity and pain of the masticatory muscles in people with TMD¹¹. The high prevalence of severe pain in Group C (89.1%) with highest headache frequency reducing peripheral masticatory nociceptive inputs is a plausible route to reducing central sensitization load.

3. Cervical postural correction. Forward-head posture and cervical spine misalignment have been associated with an increase in TMJ loading⁹. Postural retraining is a low-risk, evidence-based component that can be added to TMJ-directed treatment without interfering with pharmacological migraine treatment.

4. Patient education and behavioural modification. Because parafunctional habits (clenching, bruxism) and psychological stress have been established as two contributors to TMD chronicity¹⁶, structured patient education of habit awareness and stress-related muscle tension is a low cost, high value component of any physiotherapy plan for this comorbidity.

5. Screening as an entry point to care. Because the severe-category burden in Group C occurred almost exclusively among patients with both conditions ,early bidirectional screening – for TMD in migraine clinics and headache screening in TMD clinics – is the mechanism most likely to detect and treat this compounded burden early, before symptoms durations reaches 17+ month range seen in this group.

Together this support a management algorithm, where physiotherapists are considered as the first contact or co-managing clinician for patients with combined craniofacial and headache issues, rather than only consulted when dental or neurological management has been exhausted.

DISCUSSION

The clinical burden reported in this cohort is not merely addictive but appears compounded Group C severe category proportions (89 -95 % across all three measure) substantially exceed the sum of the Group A and Group B individual burden would predict. This is consistent with the central sensitization model, in which concurrent peripheral nociceptive input from the TMJ and trigeminovascular activation from migraine converge within the trigeminal nucleus caudalis, enhancing (summing) pain signals¹⁷.

This has a specific implication for physiotherapy sequencing : by the time these patients were assessed it was already a substantially elevated (17–18 months) and later stage physiotherapy intervention is being asked to reduce an already consolidated burden rather than to prevent its development. Speciali and Dach (2015) suggested that TMD should be regarded as a neurological condition had implications for the quality of life of the patient, not merely a dental condition¹⁸ This suggests that physiotherapists should consider an active and early role in the treatment of TMD, rather than a role purely as a referral specialist.

The 16-point MIDAS gap between Group C and Group B — the largest inter-group difference of all the measures studied — is perhaps the strongest argument for the importance of this comorbidity in physiotherapy caseloads; it represents disability accumulating in areas (work, household, social/leisure function) that lie well within physiotherapy's functional-outcome mandate, rather than an isolated measure of pain.

It is important to note that this is an observational design – it establishes the burden that physiotherapy management needs to address but does not measure the effect of any particular physiotherapy protocol on that burden. This represents an important direction of future controlled, interventional follow-up studies.

CONCLUSION

The clinical burden of comorbid TMD and migraine — in terms of pain intensity, headache-related functional impact and migraine disability — is significantly superimposed on both disorders, and severe category involvement is seen in approximately nine out of ten patients with comorbid TMD and migraine in all three outcome measures. This burden pattern

provides strong evidence-based rationale for physiotherapy-led, multimodal management with TMJ and cervical manual therapy, masticatory muscle re-education, postural correction and patient education as early and as bidirectionally-screened as possible.

Clinical implications: Physiotherapists should screen for TMD in patients present with recurrent headache or migraine and conversely, should consider multimodal, multidisciplinary management (physiotherapy, dentistry, neurology) for patients presenting with this comorbidity.

Limitations: Observational design without a physiotherapy intervention arm; purposive (non-probability) sampling, may limit generalizability, and introduce selection bias ; limited sample size; self-reported outcome measures; no long term follow up.

Recommendations for Future Research: Controlled interventional trials using specific physiotherapy interventions (manual therapy, exercises, postural correction) on VAS, HIT-6 and MIDAS outcomes in this comorbid population and a longer follow up to evaluate chronification prevention.

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