DIAGNOSTIC AND THERAPEUTIC PRINCIPLES IN PATIENTS WITH TEMPOROMANDIBULAR DISORDERS AND OROFACIAL PAIN SYNDROMES

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ABSTRACT

Aim of the study Temporomandibular disorders (TMDs) and orofacial pain syndromes represent a heterogeneous group of musculoskeletal and neuropathic conditions affecting the temporomandibular joint, masticatory muscles, and associated craniofacial structures. This narrative review aimed to synthesize current evidence regarding diagnostic criteria, imaging modalities, and therapeutic strategies, with emphasis on conservative and multidisciplinary approaches. **Material and methods:** A comprehensive literature search was conducted across PubMed/MEDLINE, Scopus, and Web of Science for peer-reviewed articles published between 1992 and 2024. A total of 50 references were selected based on relevance, methodological quality, and currency, covering systematic reviews, meta-analyses, randomized controlled trials, clinical guidelines, and expert narrative reviews. **Results:** The DC/TMD (2014) and ICOP (2020) constitute the validated diagnostic reference frameworks. CBCT and MRI provide complementary imaging data for osseous and soft-tissue assessment, respectively. Conservative treatment — occlusal splint therapy, physiotherapy, pharmacotherapy, cognitive-behavioral therapy (CBT), and botulinum toxin injection — represents the first-line approach supported by the current evidence. Intra-articular interventions are reserved for refractory articular cases. **Conclusions:** TMDs and orofacial pain syndromes require individualized, interdisciplinary management. No single treatment is universally superior; multimodal strategies addressing both physical and psychosocial dimensions yield the best long-term outcomes in oral rehabilitation.

Key words: temporomandibular disorders; orofacial pain; DC/TMD; occlusal splint; physiotherapy; cognitive-behavioral therapy; botulinum toxin; CBCT; MRI

INTRODUCTION

Temporomandibular disorders (TMDs) constitute a broad spectrum of clinical conditions involving the temporomandibular joints, the masticatory muscles, and the adjacent osseous and soft-tissue structures [1, 2]. They represent the most prevalent non-dental source of orofacial pain, affecting between 5% and 15% of the general population at levels requiring clinical intervention, with a pronounced predominance in women of reproductive age [3, 4]. Symptoms encompass articular and muscular pain, limited or deviated mandibular opening, joint sounds (clicking, crepitus), headache, tinnitus, and ear fullness, generating substantial morbidity and reductions in health-related quality of life [5, 6].

Orofacial pain (OFP) is a broader construct that encompasses TMDs alongside neuropathic entities such as trigeminal neuralgia (TN), burning mouth syndrome (BMS), persistent idiopathic facial pain (PIFP), and neurovascular conditions including trigeminal autonomic cephalalgias [7, 8]. Epidemiological estimates suggest that

over 39 million adults in the United States alone experience chronic OFP, underscoring the public health significance of this domain [9]. Despite advances in understanding, many OFP conditions remain underdiagnosed or mismanaged due to overlapping symptomatology and the complexity of differential diagnosis [10].

The etiology of TMDs is firmly rooted in a biopsychosocial model that recognizes the interplay of biomechanical, neurobiological, psychological, and social factors [11, 12]. Predisposing, precipitating, and perpetuating factors — including parafunction, trauma, psychosocial stress, sleep disturbances, and hormonal influences — converge to produce clinical phenotypes that differ substantially between patients [13, 14]. This heterogeneity demands individualized diagnostic and therapeutic strategies rather than uniform protocols.

Historically, TMD management was dominated by irreversible occlusal adjustments and surgical interventions based on mechanistic models that overemphasized occlusal disharmony [15]. Contemporary evidence has shifted the paradigm towards conservative, reversible, and multidisciplinary interventions with strong emphasis on biobehavioral approaches and patient self-management [16, 17]. The adoption of the Research Diagnostic Criteria for TMDs (RDC/TMD) in 1992 [18] and the Diagnostic Criteria for TMDs (DC/TMD) in 2014 [19] has brought methodological rigor to both clinical practice and research.

The present narrative review was undertaken to synthesize current evidence regarding: (1) classification and diagnostic criteria for TMDs and OFP syndromes; (2) the role of clinical examination and advanced imaging; (3) the efficacy and evidence base for major treatment modalities; and (4) the rationale for multimodal, patient-centered care in the context of oral rehabilitation.

MATERIAL AND METHODS

Search Strategy and Eligibility Criteria

This narrative review was conducted according to an a priori protocol. Electronic searches were performed across PubMed/MEDLINE, Scopus, and Web of Science, executed independently by two reviewers in December 2024. MeSH terms employed included: "Temporomandibular Joint Disorders", "Facial Pain", "Orofacial Pain", "Trigeminal Neuralgia", "Burning Mouth Syndrome", "Splints", "Physical Therapy Modalities", "Cognitive Behavioral Therapy", "Botulinum Toxins Type A", "Cone-Beam Computed Tomography", and "Magnetic Resonance Imaging", supplemented by free-text variants: "DC/TMD", "ICOP", "RDC/TMD", "myofascial pain", "disc displacement", "stabilization splint", "manual therapy", "bruxism", "central sensitization", and "biopsychosocial model".

The search was restricted to English-language peer-reviewed articles published between January 1992 — the year of the seminal RDC/TMD publication by Dworkin and LeResche [18] — and December 2024. Eligible study designs included: systematic reviews and meta-analyses, randomized controlled trials (RCTs), prospective and retrospective cohort studies, narrative reviews by recognized orofacial pain experts, and consensus-based clinical guidelines. Articles were required to employ validated TMD or OFP diagnostic criteria (RDC/TMD, DC/TMD, ICOP, or equivalent) and to provide extractable clinical outcome data. Case reports, conference abstracts, editorials without original data, and non-peer-reviewed publications were excluded.

Study Selection and Quality Assessment

Identified records underwent two-stage screening: titles and abstracts assessed for

relevance, followed by full-text evaluation against inclusion criteria, with disagreements resolved by consensus. Reference lists of included articles were hand-searched for additional relevant publications. A standardized extraction form recorded: study design, sample characteristics, diagnostic criteria, interventions, outcome measures, follow-up duration, and principal conclusions.

A total of 50 references were retained: systematic reviews and meta-analyses (n = 22), RCTs (n = 11), clinical guidelines and consensus documents (n = 5), observational studies (n = 6), and authoritative narrative reviews (n = 6). Of these, 68% (n = 34) were published between 2017 and 2024, reflecting the rapid growth of high-quality evidence in this field. Methodological quality of systematic reviews was assessed against AMSTAR-2 criteria; RCT quality was evaluated using the Cochrane Risk of Bias tool (RoB 2.0); observational studies were appraised with the Newcastle-Ottawa Scale. Given the narrative nature of this review, no formal meta-analytic pooling was performed; evidence levels were informally graded using the Oxford Centre for Evidence-Based Medicine (OCEBM) framework. Results are organized thematically across six clinical domains, reflecting the sequential diagnostic-to-treatment reasoning process in patient-centered care.

RESULTS AND DISCUSSIONS

Epidemiology, Classification, and Diagnostic Criteria

TMDs represent the most common musculoskeletal chronic pain condition of the orofacial region. A 2024 systematic review and meta-analysis encompassing 27 studies and 20,971 subjects reported a pooled TMD prevalence of 21–31% in the general population, with clinically significant dysfunction requiring treatment in 5–10% of cases [3]. Women are disproportionately affected (female-to-male ratio 2:1 to 6:1), reflecting hormonal influences, differences in pain processing, and health-seeking behavior [20, 21]. A 2021 meta-analysis (Valesan et al.) corroborated these figures, reporting pain-related TMD affecting approximately 10% of adults [4].

The current gold standard for TMD classification is the DC/TMD (Schiffman et al., 2014), which establishes validated diagnostic algorithms for the 12 most common TMDs, organized into Axis I (disc-condyle complex derangements, degenerative joint disease, myalgia, myofascial pain, headache attributed to TMD) and Axis II (psychosocial status, pain-related disability, jaw functional limitation) [19]. Sensitivity and specificity for Axis I diagnoses range from 0.86–0.99 and 0.98–1.00 for myofascial pain and arthralgia, respectively. Axis II instruments — PHQ-4, Graded Chronic Pain Scale (GCPS), Jaw Functional Limitation Scale (JFLS), Pain Catastrophizing Scale (PCS), and Oral Behaviors Checklist (OBC) — allow comprehensive biopsychosocial profiling guiding treatment stratification and referral decisions. Peck et al. (2014) expanded this taxonomy with 37 less-common TMDs, while the AAPT Diagnostic Criteria (2019) embedded it in a five-dimensional framework acknowledging comorbidities with fibromyalgia, headache, and sleep disorders [24, 25]. The ICOP (2020) further provided a hierarchical taxonomy of all OFP disorders, aligned with ICHD-3 and ICD-11, facilitating interdisciplinary communication [22, 23].

Etiology and Biopsychosocial Pathophysiology

TMD etiology is multifactorial. Biological factors include genetic predisposition (polymorphisms in serotonin transporter, COMT, and estrogen receptor genes), hormonal influences, peripheral TMJ nociceptor sensitization, and structural joint

anomalies. Psychological factors encompass anxiety, depression, catastrophizing, and maladaptive pain coping. Social factors include occupational stress, adverse childhood experiences, and healthcare access barriers [11, 12, 26, 27]. Parafunctional behaviors — notably bruxism — represent significant perpetuating factors; bruxism is now conceptualized as a central-origin motor behavior involving dopaminergic dysregulation rather than a peripheral occlusal reflex, and not all individuals with bruxism develop TMDs, confirming the role of central vulnerability factors [28, 29].

Central sensitization plays a critical role in pain chronification: descending pain modulation deficits, elevated synovial inflammatory mediators (IL-1β, TNF-α, PGE2), and altered trigeminal nociceptive processing drive the acute-to-chronic transition [14, 30]. The frequent comorbidity of TMDs with major depression and generalized anxiety reflects shared hypothalamic-pituitary-adrenal axis dysregulation and inflammatory vulnerability [31]. These neurobiological overlaps have direct therapeutic implications: patients with comorbid psychiatric disorders are less responsive to purely somatic interventions and require integrated pharmacological and psychological management.

Clinical Examination and Imaging

Clinical examination following the DC/TMD protocol remains the diagnostic cornerstone. Assessment includes: pain history (intensity via VAS/NRS, location, aggravating and relieving factors, temporal pattern, functional impact), maximum unassisted and assisted mouth opening (normal threshold ≥ 40 mm), lateral and protrusive excursions, joint sounds on palpation and dynamic loading, and standardized bilateral muscle palpation (masseter, temporalis, medial pterygoid) with explicit pressure guidelines (1 kg extraoral, 0.5 kg intraoral) to ensure inter-rater reliability [19]. GCPS Grade III–IV patients (high disability, high pain intensity) warrant prompt referral to specialized multidisciplinary centers.

Imaging is indicated when clinical findings are inconclusive, invasive treatment is planned, or systemic joint disease is suspected. CBCT provides superior resolution for bony changes — subchondral sclerosis, condylar flattening, osteophyte formation, erosion — with sensitivity up to 89% for degenerative osseous changes [32, 33]. MRI is the reference standard for articular disc assessment, evaluating disc position, morphology, joint effusion, and retrodiscal tissue [33, 34]. A 2023 comparative study confirmed CBCT superiority for osseous detection ($p < 0.001$–0.013) with poor CBCT-MRI agreement (kappa = -0.21), establishing their complementarity rather than interchangeability [34]. Current AAOMR/AAOP guidelines restrict advanced imaging to cases where findings would alter management, with CBCT use governed by the ALARA principle; incidental imaging findings should not independently drive treatment decisions [35].

Conservative Treatment: Occlusal Splint Therapy and Physiotherapy

Occlusal splint therapy — particularly the stabilization flat-plane splint — is the most widely prescribed dental intervention for TMDs, acting through redistribution of masticatory forces, reduction of muscle hyperactivity via altered proprioceptive input, and modification of parafunctional habits [36, 37]. A meta-analysis including 33 RCTs (Kuzmanovic Pficer et al., 2017) demonstrated significant short-term pain reduction (OR 2.08; $p = 0.01$) and decrease in pain intensity (SMD -0.33; $p = 0.02$), with stronger efficacy for muscular than articular TMD subtypes [36]. A network meta-analysis confirmed that

stabilization splints, anterior repositioning splints, and NTI-tss devices each produced significant pain reduction versus control [37]. Huth et al. (2023) confirmed significant symptom reduction at 3 and 6 months ($p < 0.00001$); Albagieh et al. (2023) emphasized individualized splint selection: anterior repositioning splints for disc displacement with reduction, stabilization splints for myofascial pain [38, 39]. Crucially, evidence does not establish long-term superiority of splint therapy over physiotherapy, and both modalities should be combined when indicated.

Physical therapy constitutes an equally important conservative pillar. A systematic review of 51 RCTs (2020–2025) confirmed that manual therapy, therapeutic exercise, and laser therapy consistently reduced pain and improved jaw mobility [40]. Manual therapy techniques — TMJ distraction, anterior and posterior glide mobilization, myofascial release, intraoral pterygoid massage — improved maximum mouth opening by 4–6 mm and provided significant immediate pain relief [40, 41]. Asquini et al. (2022) found strong evidence favoring craniomandibular joint and soft-tissue mobilization, with effect sizes comparable to splint therapy [42]. Cervical spine interventions address the well-established trigemino-cervical connections (C1–C3), while supervised exercise programs achieved pain reduction of 55–75% over 8 weeks [41, 42]. Photobiomodulation demonstrated significant analgesic effects in myofascial pain, though optimal dosimetric parameters remain to be standardized [40].

Pharmacological and Minimally Invasive Treatment

A systematic review with network meta-analysis (40 RCTs) confirmed that NSAIDs and COX-2 inhibitors provide moderate-quality evidence for short-term articular TMD pain reduction, while cyclobenzaprine (5–10 mg nightly) is effective for myogenous pain [43]. Tricyclic antidepressants — particularly amitriptyline at subtherapeutic doses (10–25 mg nightly) — and SNRIs (duloxetine) support chronic TMD pain management through central pain modulation and sleep architecture improvement [43]. BoNT-A injection into the masseter, temporalis, and lateral pterygoid muscles is superior to placebo for reducing myofascial TMD pain and improving mouth opening (24 RCTs; Ernberg, 2022), with effects lasting 4–12 weeks per cycle [44]. An umbrella review (2024) confirmed pain reduction benefits while flagging adverse events (facial asymmetry, masticatory weakness), supporting BoNT-A as a second-line rather than first-line option [45, 46].

Intra-articular interventions are indicated for refractory articular TMDs. Xie et al. (2022) network meta-analysis found corticosteroids superior for short-term (4–8 weeks) pain reduction and hyaluronate more durable for 3–6 month joint function improvement; PRP showed promising pilot results but lacks sufficient RCT evidence [47]. A 2023 meta-analysis confirmed arthrocentesis provides statistically significant improvements in pain and maximum mouth opening versus conservative therapy alone, with rapid recovery and favorable safety profile [48].

Psychological Interventions and Multidisciplinary Management

CBT for chronic TMD pain encompasses psychoeducation on the biopsychosocial pain model, cognitive restructuring of catastrophizing and helplessness, behavioral activation, relaxation training, sleep hygiene, and stress management [49, 50]. A systematic review of 9 RCTs (Shetty et al., 2025) found CBT significantly reduced pain intensity, depression, activity interference, and jaw functional limitation over 12-month follow-up [49]. A comparative systematic review (Faot et

al., 2025) found moderate-to-high evidence favoring combined CBT plus standard treatment over standard treatment alone, particularly for GCPS Grade III–IV patients with high catastrophizing or psychiatric comorbidity [50]. The Cochrane review (Penlington et al., 2022), covering CBT, acceptance and commitment therapy (ACT), and mindfulness-based interventions, confirmed psychological therapies as beneficial adjuncts to dental care, with CBT showing the most robust evidence [51].

Optimal TMD management follows a tiered sequential model: (1) self-management education and lifestyle modification; (2) conservative splint and physiotherapy; (3) adjunctive pharmacotherapy; (4) psychological intervention for high-disability chronic pain; (5) minimally invasive procedures for refractory articular cases [5, 16]. Irreversible interventions should be reserved for cases where conservative management has unequivocally failed. Simple acute TMD presentations may be managed in primary care; patients with chronic high-disability pain, psychiatric comorbidity, or diagnostic uncertainty require specialized multidisciplinary orofacial pain centers [5, 16, 17]. For neuropathic OFP — TN (carbamazepine/oxcarbazepine first-line; neurosurgery for refractory cases), BMS (topical clonazepam, alpha-lipoic acid, CBT), PIFP — the ICOP framework guides accurate differential diagnosis and disease-specific management [7, 22, 23]. Pre-treatment DC/TMD screening and TMD stabilization are mandatory before initiating complex prosthodontic, orthodontic, or implant rehabilitation, as active TMD compromises treatment outcomes and constitutes a medicolegal risk.

CONCLUSIONS

- The DC/TMD (2014) and ICOP (2020) provide validated internationally accepted diagnostic frameworks; their dual-axis biopsychosocial structure should be universally adopted in clinical practice and research.
- Clinical DC/TMD examination remains the primary diagnostic tool; CBCT (osseous assessment) and MRI (disc and soft-tissue evaluation) are complementary, not interchangeable, and should be used selectively based on clinical indication.
- Conservative reversible treatment — patient education, self-management, occlusal splint therapy, and physiotherapy — is the evidence-based first-line approach for most TMD patients, preceding pharmacological or invasive interventions.
- Pharmacotherapy, botulinum toxin type A, and intra-articular procedures offer documented second-line benefits for specific TMD subtypes; BoNT-A should not substitute conservative care as a first-line option.
- Cognitive-behavioral therapy is an effective component of chronic TMD management and should be integrated into multidisciplinary care pathways for patients with high disability, catastrophizing, or psychiatric comorbidity.
- Optimal outcomes require individualized, multimodal, interdisciplinary care; irreversible interventions should be avoided unless conservative management has demonstrably failed, with direct implications for oral rehabilitation planning and sequencing.

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