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Review Article

Clinical Outcomes of root canal retreatment in Patients with temporomandibular joint disorder

Diallo F[1*], Kamau K[2] and Mensah K[3]

[1]Department of Dental Sciences, Fraser Center for Oral Biology, Ghana

[2]Department of Dental Sciences, Parana Academy of Orthodontics, Zimbabwe

[3]Department of Clinical Periodontology, Euphrates Institute for Advanced Orthodontics, Nigeria

*Address for Correspondence: Femi Diallo, Department of Dental Sciences, Fraser Center for Oral Biology, Ghana; E-mail: femi.diallo@fraser.edu

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Abstract

Background: Temporomandibular joint disorder (TMD) is common among patients presenting for endodontic care, and root canal retreatment occurs in a population where the two conditions overlap more than chance predicts.

Objective: This review synthesizes evidence on TMD prevalence among endodontic patients, mechanisms linking temporomandibular and dental pain, benchmark retreatment outcomes, and modifiers specific to comorbid TMD.

Methods: We synthesized systematic reviews of retreatment outcome, prospective and retrospective cohorts, epidemiological studies using validated DC/TMD criteria, and studies of referred orofacial pain and occlusal factors.

Findings: Painful TMD affects 54% of endodontic pain patients versus a pooled global prevalence of 29.5% [5,6]; post-treatment pain is often nonodontogenic [7]; nonsurgical retreatment achieves healing in roughly 74-88% of cases [15,11]; comorbid TMD patients report higher early postoperative pain [8].

Conclusions: No cohort has stratified retreatment outcome by TMD status; screening before retreatment and reassessing the joint when symptoms persist after successful retreatment is the most defensible approach.

Keywords: temporomandibular disorder; root canal retreatment; orofacial pain; nonodontogenic toothache; TMD

1. Introduction

A patient returning to the endodontic chair for a second root canal procedure on the same tooth is, almost by definition, a patient whose first treatment did not resolve the problem it was meant to resolve. Nonsurgical retreatment is the default response when a previously treated tooth develops recurrent or persistent periapical disease: remove the prior filling material, re-instrument and disinfect a canal system that has usually harboured a persistent or reintroduced microbial community, and re-obturate to a standard the original procedure did not achieve [1,2,3]. Contemporary reviews of endodontic predictability note that both primary treatment and retreatment failure are shaped as much by restorative and maintenance factors as by the endodontic procedure itself [4]. Less often addressed is what happens when the tooth being retreated sits in a jaw that is itself a source of pain and dysfunction. Temporomandibular joint disorder (TMD) is common in exactly the population that also generates a disproportionate share of endodontic referrals, and the overlap is not incidental: Daline and colleagues, applying validated Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) protocols to patients presenting with tooth pain for endodontic evaluation, found that 54% met criteria for a painful TMD, nearly double the pooled global prevalence of 29.5% reported for the general population in a recent meta-analysis [5,6]. That gap is the starting point for this review.

The clinical stakes run in both directions. Masticatory-muscle or joint-derived pain referring into the dentition can masquerade convincingly as pulpal or periapical pain, and a systematic review by Nixdorf and colleagues found persistent pain after otherwise technically successful endodontic therapy is frequently nonodontogenic, meaning treatment and retreatment are sometimes performed on teeth that were never the actual pain source [7]. Conversely, a genuinely odontogenic problem requiring retreatment can be complicated or made more painful by comorbid TMD: patients with anterior disc displacement with reduction report significantly higher postoperative pain than patients without joint disease, and sessions long enough to require sustained wide mouth opening can themselves provoke temporomandibular symptoms [8,9]. Retreatment, frequently longer and more demanding than primary treatment, sits squarely inside this risk window. This review synthesizes the clinical evidence on retreatment outcomes in patients with comorbid TMD: the diagnostic overlap, benchmark retreatment outcomes, TMD-specific modifiers, and implications for a comprehensive, jaw-aware treatment approach.

2. Methods

This review synthesizes clinical and epidemiological literature identified through structured searches of PubMed/MEDLINE, Scopus, and the Cochrane Library, supplemented by manual review of reference lists in recent systematic reviews. Search terms combined "temporomandibular disorder," "TMD," and "TMJ" with "root canal retreatment," "endodontic retreatment," "endodontic outcome," "nonodontogenic toothache," "occlusion," and "orofacial pain." Priority was given to systematic reviews and meta-analyses of retreatment outcome, prospective and retrospective cohorts with sufficient sample size and follow-up, epidemiological studies using validated TMD diagnostic criteria, principally the DC/TMD protocol or its RDC/TMD predecessor [10], and clinical studies addressing referred orofacial pain, occlusal factors, and postoperative pain in comorbid joint disease. Case reports without outcome data were excluded except where cited for background. Because no published trial has, to our knowledge, prospectively stratified retreatment outcome by baseline TMD status, this review is a narrative synthesis rather than a quantitative meta-analysis, juxtaposing the general retreatment-outcome literature against the TMD-comorbidity and referred-pain literature.

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3. Results

Prevalence of TMD among patients presenting for endodontic care

The population arriving for root canal retreatment is not a random cross-section of the general population with respect to temporomandibular status. Using validated case-history and examination criteria, Daline and colleagues found that just over half of patients presenting with tooth pain for endodontic evaluation met criteria for a painful TMD, a figure well above the 29.5% pooled global prevalence reported by Alqutaibi and colleagues' recent meta-analysis, and above that review's pooled prevalence of myalgia (37.2%) and arthralgia (16.8%) considered separately [5,6]. The same meta-analysis found prevalence highest among women (36.7% versus 26.7% in men) and patients under 18 (38.5%), patterns relevant to retreatment populations, which skew toward adults and, in several published cohorts, a female majority [6,11,12]. This enrichment is consistent with two non-exclusive mechanisms: patients with active TMD are more likely to present with pain complaints that trigger an endodontic work-up, and patients undergoing repeated, lengthy procedures are more likely to develop or exacerbate temporomandibular symptoms as a consequence of treatment itself.

Mechanisms linking temporomandibular and endodontic pain

The convergence of trigeminal afferents from the pulp, periodontal ligament, and temporomandibular joint and masticatory muscles onto shared second-order neurons in the trigeminal spinal nucleus provides the physiological basis for bidirectional referred pain, and it is this convergence, rather than any structural connection, that underlies most of the diagnostic confusion clinicians encounter [13]. Nixdorf and colleagues' systematic review found that a substantial proportion of patients reporting pain after an otherwise adequate root canal procedure have pain of nonodontogenic origin, meaning the treated tooth was never the true pain generator, a finding directly relevant to retreatment because a tooth retreated for persistent "endodontic" pain that is in fact myofascial or joint-referred will predictably fail to resolve symptomatically no matter how sound the retreatment is [7]. Yatani and colleagues' review of nonodontogenic toothache similarly catalogued myofascial pain and TMD as recurring, under-recognized causes of tooth pain severe enough to prompt endodontic referral, and offered recommendations for distinguishing these from genuine pulpal disease [14]. Evidence for the reverse influence, from treatment onto joint status, comes from Revi and colleagues' prospective study, which found patients with anterior disc displacement with reduction reported significantly higher pain at 6 and 12 hours after root canal therapy than patients without TMD, with procedure duration also longer, and from Wali and colleagues' study of 250 patients in sessions longer than two hours, which found prolonged mandibular opening produced measurable TMJ and masticatory muscle tenderness, most pronounced in older patients, women, and posterior tooth treatment [8,9].

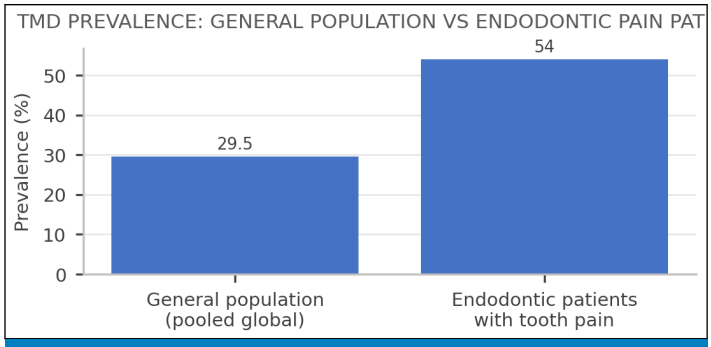

Figure 1: Prevalence of temporomandibular disorder in the general population compared with painful TMD among patients presenting with tooth pain for endodontic evaluation, drawn from a global systematic review and meta-analysis and a validated DC/TMD case-history and examination study [6,5].

Benchmark outcomes of nonsurgical root canal retreatment

Before considering how comorbid TMD might modify retreatment outcome, it is necessary to establish what outcome looks like in the broader literature. A 2024 systematic review of contemporary nonsurgical

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retreatment reported pooled periapical healing of 78.8% under strict criteria and 87.5% under loose criteria, with clinical success of 78.0% strict and 86.4% loose; meta-regression identified smaller preoperative lesions, absence of preoperative apical radiolucency, adequate apical extent of the root filling, and longer follow-up as significant positive prognostic factors [15]. These figures are broadly consistent with the earlier review by Ng, Mann, and Gulabivala, which established secondary root canal treatment as favourable but less predictable than primary treatment, with preoperative apical periodontitis, obturation quality, and post-retreatment coronal restoration among the strongest determinants of success [16]. Two recent cohorts extend these findings. A retrospective cohort of 408 retreated teeth followed for a mean 78.5 months found a combined survival-and-success rate of 73.5%, with restoration type and obturation quality independently associated with outcome, and root or crown fracture accounting for two-thirds of extractions among failures [12]. A prospective cohort of 100 patients reported an 88% success rate at follow-up and a significant improvement in oral health-related quality of life among successfully treated patients, from a baseline score of 32.13 to 19.40 at six months, with no comparable improvement among failed cases [11]. Practice-based network data reinforce the durability question: in a National Dental PBRN cohort of over 71,000 root-canal-treated teeth, median survival was 11.1 years overall, and teeth restored with both a filling and a crown survived a median of 5.3 years longer than teeth left without a crown, underscoring that coronal restoration, not endodontic technique alone, is a major determinant of whether a tooth avoids retreatment in the first place [17].

Table 1: Selected retreatment and endodontic-outcome cohort studies, sample size, follow-up, and principal outcome findings.

Study	Sample	Follow-up	Outcome
[15]	Systematic review, retreatment cohorts	2->4 yr	Healing 78.8% strict / 87.5% loose
[12]	408 teeth, 376 pts (retrospective)	78.5 mo	Survival-success 73.5%
[11]	100 pts (prospective)	6 mo	88% success; QoL 32.1->19.4
[17]	71,283 teeth (PBRN)	11.1 yr median	Crown+filling: +5.3 yr survival

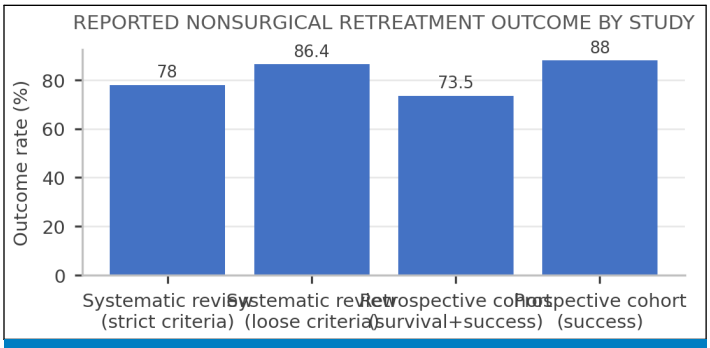

Figure 2: Reported success, survival, or clinical-success rates for nonsurgical root canal retreatment across a systematic review and three contemporary cohort studies, illustrating the general benchmark range against which retreatment outcomes in TMD-affected patients must currently be extrapolated [15,12,11,17].

Modifiers of outcome in patients with comorbid TMD

No retreatment trial identified in this review prospectively stratified outcome by baseline TMD status, and this remains the central evidence gap. What the literature does establish is a set of plausible and, in several cases, directly demonstrated modifiers. First, diagnostic misattribution risk is elevated: a tooth retreated on the assumption that persistent postoperative pain reflects inadequate initial treatment, when the true source is comorbid TMD, will show radiographic healing without symptomatic resolution, an outcome frequently misclassified as endodontic failure rather than a diagnostic error upstream of the procedure [7,14]. Second, procedural burden is higher: retreatment runs longer than primary treatment on average, and prolonged mandibular opening can provoke or exacerbate TMJ and muscle symptoms even without preexisting joint disease, a risk that compounds in patients who already have disc displacement or myalgia [9,8]. Third, postoperative pain trajectories differ: Revi and colleagues' finding of significantly elevated pain at 6 and 12 hours in patients with anterior disc displacement with

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reduction shows the early recovery experience is measurably worse in this population even when endodontic prognosis is unaffected, a distinction that matters for counselling patients not to mistake this for treatment failure [8]. Fourth, and more speculatively, chronic centrally sensitized pain states associated with TMD, characterized in the OPPERA case-control cohort, may plausibly blunt the correlation between objective periapical healing and patient-reported success, since OPPERA's phenotyping work established that painful TMD clusters with broader somatic symptom burden and altered pain processing rather than existing as an isolated joint problem [18].

Table 2: Documented or plausible modifiers of root canal retreatment experience and outcome in patients with comorbid temporomandibular joint disorder.

Modifier	Evidence	Implication
Diagnostic misattribution	Post-treatment pain is often nonodontogenic [7,14]	Screen for TMD before retreatment
Procedural burden	Prolonged opening provokes TMJ/muscle symptoms [9]	Bite props, rest breaks, staged visits
Early postoperative pain	Higher pain at 6-12 h with disc displacement [8]	Counsel on expected recovery course
Central sensitization	Painful TMD clusters with somatic burden (OPPERA) [18]	Symptomatic success may lag radiographic healing

Occlusal and comprehensive management considerations

A recurring theme across the occlusion-TMD literature is that occlusal factors are neither the dominant cause of TMD earlier clinical dogma assumed nor entirely irrelevant to it. Michelotti and colleagues' review for the World Federation of Orthodontists concluded that occlusal characteristics show, at most, a weak and inconsistent association with TMD onset, and that orthodontic treatment does not appear to cause TMD in properly conducted longitudinal studies [19]. Dodi and colleagues similarly found the occlusal factor to be one contributor among several rather than a sufficient cause, and Baldini and colleagues' analysis of occlusion time found a measurable association with TMD symptoms even though static occlusal relationships alone were not strongly predictive [20,21]. Kriau i nas's review reached a comparable conclusion, describing the relationship as real but modest and cautioning against occlusal adjustment as a standalone TMD treatment [22]. Bruxism sits alongside occlusion as a frequently implicated but imperfectly correlated factor: Manfredini and Lobbezoo's systematic review found a positive but inconsistent association between bruxism and TMD signs and symptoms, strong enough to warrant screening but not to support bruxism as a standalone causal marker [23]. Taken together, this evidence argues against occlusal or restorative overcorrection in a retreatment patient with comorbid TMD, and toward a comprehensive approach in which endodontic technique, restorative planning, and conservative TMD management, chairside accommodations such as bite props, jaw rest breaks, and referral for splint therapy when indicated, are coordinated rather than treated as unrelated problems [9,24].

4. Discussion

The evidence assembled here supports three linked conclusions. First, TMD comorbidity in the retreatment population is not a marginal consideration: a prevalence of painful TMD approaching double the general-population rate means that a substantial minority of patients being evaluated for retreatment carry an active temporomandibular condition contributing to their presenting complaint or affected by the procedure itself [5,6]. Screening for TMD with a brief validated instrument is a low-cost addition to the standard endodontic history that could reduce retreatment performed on teeth whose pain is substantially or entirely nonodontogenic, addressing the misattribution risk documented by Nixdorf and Yatani and colleagues [7,14]. Second, in the absence of TMD-stratified trials, the field currently extrapolates outcome expectations from a general literature, periapical healing in the 73-88% range depending on criteria and cohort, restoration and obturation quality as dominant

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prognostic factors, onto a subpopulation whose pain trajectories and quality-of-life response plausibly differ in ways existing metrics were not designed to capture [15,16,12,11]. The quality-of-life instrument used by Gupta and colleagues, which showed clear divergence between successful and failed cases, is a promising template that could be extended with a TMD-status covariate to test whether comorbid joint disease attenuates the symptomatic benefit of radiographically successful retreatment [11]. Third, because prolonged mandibular opening provokes TMJ and muscle symptoms and retreatment sessions run longer than primary treatment, simple intraoperative accommodations, bite blocks, scheduled rest breaks, and staged appointments for complex cases, are a reasonable, low-risk response to this procedural burden even before formal TMD management is considered [9,8].

None of this argues for withholding indicated retreatment from a patient with comorbid TMD; the biological rationale, addressing persistent intraradicular or extraradicular infection, does not change because a patient also has joint disease [1,3]. It argues for a comprehensive approach that treats the dentition and temporomandibular apparatus as interacting systems: confirming an odontogenic pain source before committing to retreatment, using validated TMD screening to identify patients whose pain may not resolve with endodontic intervention alone, counselling TMD-affected patients about an expected higher-intensity early postoperative pain trajectory, applying procedural accommodations to limit joint and muscle loading, and treating persistent post-retreatment symptoms in a radiographically healed tooth as a signal to reassess the temporomandibular apparatus rather than pursue further intervention on a tooth that has already met objective success criteria [13,19,24].

5. Conclusion

Root canal retreatment and temporomandibular joint disorder intersect in a population that is neither small nor adequately characterized by the existing outcome literature. Painful TMD is present in roughly half of patients seeking endodontic care for tooth pain, nearly double the general-population rate, and the shared trigeminal pain pathways behind this overlap mean that some pain attributed to endodontic failure, and some attributed to TMD, is in fact misassigned between the two conditions [5,6,7]. General retreatment benchmarks, periapical healing broadly in the high-70s to high-80s percentage range and success closely tied to preoperative lesion size, obturation quality, and coronal restoration, remain the best available reference point, but no published cohort has tested whether these figures hold, or how patient-reported outcomes diverge, in patients with comorbid TMD [15,16,12,11,17]. Until TMD-stratified outcome data exist, the most defensible approach is a comprehensive one: screen for TMD before retreatment, accommodate the procedural burden that prolonged endodontic sessions place on the joint and masticatory muscles, and treat persistent symptoms after objectively successful retreatment as an indication to reassess the temporomandibular apparatus rather than the tooth.

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8. Conflict of Interest

The authors declare no conflict of interest.

9. Author Contributions

Diallo F conceived the review and drafted the manuscript. Kamau K conducted the literature search and contributed to data synthesis. Mensah K critically revised the manuscript for intellectual content. All authors read and

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approved the final manuscript.

10. Ethics Statement

This article is a narrative literature review of previously published, publicly available data and did not involve human participants, patient records, or animal subjects requiring institutional ethics board review.

11. Data Availability

No new datasets were generated for this review. All data discussed are available in the cited publications.

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