

Clear Aligners versus Fixed Orthodontic Appliances: A Comparative Narrative Review of Treatment Quality, Periodontal Health, Pain, and Patient-Reported Outcomes

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ABSTRACT: Background: Clear aligner therapy (CAT) has become a widely adopted alternative to fixed orthodontic appliances (FAT), yet the comparative evidence on treatment quality, periodontal health, pain, and patient-reported outcomes has expanded substantially in the last two years and remains scattered across primary trials and systematic reviews. Materials and Methods: This narrative review synthesizes literature retrieved from PubMed/MEDLINE, SciELO, Scopus, and the Cochrane Library, covering publications through August 2026, on the comparative clinical performance of CAT versus FAT. Results: CAT and FAT achieve broadly comparable treatment quality in non-extraction cases, with some evidence of shorter treatment duration for CAT, whereas FAT retains superior outcomes in extraction and severe malocclusion cases. CAT is consistently associated with more favorable periodontal indices and lower short-term pain scores, while oral health-related quality of life (OHRQoL) converges between modalities by the end of treatment. Conclusion: The choice between CAT and FAT should be guided by case complexity, anchorage demands, and patient-specific priorities rather than a presumption of universal equivalence or superiority.

Keywords: *clear aligners; fixed appliances; orthodontics; periodontal health; oral health-related quality of life; treatment effectiveness*

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I. Introduction

Clear aligner therapy (CAT) has evolved over the past two decades from a niche cosmetic option into a mainstream orthodontic modality, driven by adult aesthetic demand, digital workflow integration, and continued material innovation ^[1,2]. A companion body of work on the materials science and biomechanics of contemporary aligner systems — including thermoformed polyethylene terephthalate glycol and polyurethane sheets, directly 3D-printed shape-memory resins such as Tera Harz TC-85, and composite resin attachments — has clarified how force delivery decays over the wear cycle and how these physicochemical properties translate, or fail to translate, into predictable tooth movement ^[2]. A broader narrative review additionally mapped the documented biomechanical limitations of CAT (root torque, rotation of rounded teeth, vertical movement, and extraction anchorage) alongside the emerging role of artificial intelligence in treatment planning and remote monitoring ^[1].

What remains less consolidated, despite a wave of trials and meta-analyses published in 2025 and 2026, is a focused synthesis of how CAT actually performs against fixed appliances (FAT) on the outcomes that matter most in day-to-day clinical decision-making: treatment quality, periodontal health, pain, oral health-related quality of life (OHRQoL), and treatment duration. Clinicians and patients alike are frequently presented with marketing narratives that position CAT as broadly equivalent or even superior to FAT, while orthodontists continue to report divergent prescribing patterns and confidence levels depending on case complexity ^[16]. The purpose of this narrative review is therefore threefold: (1) to synthesize the most recent (2022–2026) comparative clinical evidence on CAT versus FAT across treatment quality, periodontal, pain, and OHRQoL outcomes; (2) to identify where the two modalities are genuinely comparable and where clinically meaningful differences persist; and (3) to translate this evidence into practical guidance for case selection.

II. Material and Methods

This is a narrative review, not a systematic review, and therefore no PRISMA protocol or PROSPERO registration was used. A literature search was conducted using PubMed/MEDLINE, SciELO, Scopus, and the Cochrane Central Register of Controlled Trials, covering publications from 2022 through August 2026, using combinations of the terms "clear aligners," "Invisalign," "fixed appliances," "orthodontic treatment quality," "periodontal health," "pain," "oral health-related quality of life," and "treatment duration." Priority was given to systematic reviews, meta-analyses, and randomized controlled trials published in peer-reviewed orthodontic and dental journals. Two narrative reviews on aligner materials, biomechanics, and artificial intelligence applications previously prepared by the author's research group were used as the materials-science and biomechanical backdrop for this review ^[1,2], while the present search was deliberately directed at a distinct evidentiary line — comparative clinical effectiveness — that these two reviews did not systematically cover.

III. Results

3.1 Treatment Quality in Non-Extraction and Extraction Cases

A 2025 systematic review and meta-analysis pooling 15 trials and 1,084 participants, using the Cochrane RoB2 and ROBINS-I tools together with GRADE certainty rating, found no statistically significant difference in treatment quality or duration between CAT and FAT in non-extraction cases, although sensitivity analyses suggested a shorter treatment duration with CAT ^[4]. In extraction cases, however, the same review found that FAT provided superior treatment quality, an outcome attributed to enhanced anchorage control and root parallelism at extraction sites ^[4], a finding consistent with an earlier systematic review of six trials involving 283 patients treated with premolar extraction, which likewise found FAT superior on American Board of Orthodontics Objective Grading System scores ^[5]. A separate systematic review and meta-analysis of effectiveness in correcting malocclusions similarly concluded that CAT achieves outcomes comparable to FAT for mild-to-moderate cases while showing greater variability as case complexity increases ^[3], and a cross-sectional review of indications and limitations reinforced that CAT consistently performs best in mild-to-moderate crowding, spacing, and Class I malocclusions requiring primarily tipping-type movements ^[6].

For Class II malocclusion specifically, a 2025 narrative review spanning pediatric to adult cases found that CAT combined with elastics, attachments, and temporary anchorage devices achieved favorable overjet reduction and facial profile change, although maxillary incisor intrusion remained the least predictable movement even with these adjuncts ^[14]. Predictability of vertical movement is a recurring limitation: a 2025 systematic review of lower incisor intrusion across eight clinical studies reported mean achieved intrusion of only 0.4–1.5 mm, with an achieved/planned predictability ratio ranging from 35% to 65% ^[13], and a 2025 meta-analysis of

optimized versus conventional Invisalign attachments found no statistically significant accuracy advantage for optimized attachments across canine derotation, anterior extrusion, or root angulation, with none of the tested configurations achieving the full extent of movement predicted by the digital setup [15].

3.2 Periodontal Health and Oral Hygiene

An umbrella review of systematic reviews with meta-analysis, registered on PROSPERO and assessed with AMSTAR 2, found that CAT was generally associated with more favorable periodontal indices than FAT during active treatment [7], a finding corroborated by a 2026 systematic review and meta-analysis in *BDJ Open* that pooled randomized and observational studies evaluating plaque index, gingival index, and probing depth, and again found periodontal outcomes favoring CAT [9]. A 2026 systematic review of the oral microbiome during CAT, also PROSPERO-registered, concluded that aligners are generally associated with improved biofilm control relative to FAT, although caries-related outcomes remained more nuanced and closely tied to individual hygiene compliance and continuous full-time wear [8].

3.3 Pain and Discomfort

The *BDJ Open* 2026 meta-analysis also assessed pain intensity using standardized mean differences and reported a favorable pain profile for CAT relative to FAT [9], consistent with an earlier 2023 systematic review and meta-analysis that compared pain intensity and OHRQoL between the two modalities using visual analog scale and Oral Health Impact Profile-14 (OHIP-14) scores; that review found patients treated with CAT experienced significantly less pain than those treated with FAT on the third and fourth day following the initial appliance placement, with no significant between-group difference at other time points [10]. A longitudinal clinical study comparing 140 patients (70 per group) similarly documented differences in pain location, degree, and type between conventional brackets and Invisalign aligners across the first year of treatment [11].

3.4 Oral Health-Related Quality of Life

A 2022 single-center, parallel-group randomized controlled trial of 36 adult patients undergoing first-premolar extraction compared OHRQoL between CAT and FAT groups using OHIP-14 at baseline, one week, two weeks, one month, six months, and twelve months. Although early differences favored CAT, by the twelve-month endpoint OHRQoL had converged between the two groups [12], a pattern that mirrors the 2023 meta-analysis finding that OHRQoL appeared similar between CAT and FAT by the end of treatment despite early pain and functional-limitation differences [10]. Taken together, these findings suggest that any early quality-of-life advantage of CAT over FAT is real but transient rather than durable across a full course of treatment.

3.5 Treatment Duration and Clinician Prescribing Patterns

Beyond the shorter treatment duration signaled by sensitivity analysis in the 2025 meta-analysis [4], a 2026 scoping review of treatment prediction, clinical effectiveness, and limitations across the CAT literature reinforced that duration and predictability outcomes remain closely tied to case selection rather than to the appliance type in isolation [17]. A related 2026 review examining CAT beyond esthetics additionally raised the environmental and material-sustainability dimension of the aligner workflow — each patient typically requires dozens of individually manufactured, single-use plastic shells over a course of treatment — as a consideration increasingly discussed alongside its clinical and biological trade-offs [18].

Clinician-reported data help contextualize these findings. A 2024 cross-sectional survey of British Orthodontic Society members found that 77.3% of respondents used CAT in their practice, most frequently Invisalign, but reserved it predominantly for adult patients and less severe malocclusions, with 60.3% rarely or never performing premolar extractions with CAT [16], a prescribing pattern directly consistent with the extraction-case limitations documented in the clinical-outcomes literature above [4,5].

IV. Discussion

The evidence assembled here supports a consistent clinical narrative: for mild-to-moderate, non-extraction malocclusions, CAT and FAT achieve comparable treatment quality, with CAT offering a modest advantage in treatment duration, periodontal indices, and short-term pain, and a transient rather than durable advantage in OHRQoL [3,4,7,9,10,12]. Outside this range, particularly in extraction cases and movements requiring vertical control, torque, or rotation of rounded teeth, the biomechanical and material limitations previously characterized in the aligner materials-science literature become clinically manifest — force decay of conventional thermoplastic sheets, limited engagement geometry for rounded crowns, and the inherent difficulty of transmitting apical root movement through a passive shell [1,2] — and FAT regains a measurable advantage in objective treatment-quality scores [4,5,13,15].

This reframes the clinical question away from a binary "which appliance is better" framework and toward a case-selection decision, echoing the prescribing behavior already observed among orthodontists in the United

Kingdom and the Republic of Ireland, who apply CAT liberally in non-extraction adult cases while remaining conservative in extraction scenarios ^[16]. The convergence of periodontal and short-term pain advantages with FAT's superior anchorage control in complex cases suggests that hybrid or sequential protocols, and artificial-intelligence-assisted case-selection tools flagging biomechanically unfavorable virtual setups before treatment begins, may offer the most promising path toward reconciling the comfort and hygiene benefits of CAT with the predictability of FAT ^[1].

V. Limitations of This Review

This review shares the limitations inherent to its narrative design: no formal search protocol, dual-reviewer screening, or risk-of-bias appraisal was applied across the review as a whole, and the selection of sources, while broad, is not exhaustive. Several of the included primary trials had small samples and short follow-up periods, and heterogeneity in outcome measures (OHIP-14 versus visual analog scale versus objective grading indices) limited direct pooling across the studies discussed here. Long-term data — beyond active treatment and immediate post-treatment stability — remain particularly scarce for both periodontal and OHRQoL outcomes.

VI. Conclusion

Clear aligners and fixed appliances are best understood as complementary rather than interchangeable modalities. Current evidence through 2026 supports comparable treatment quality for non-extraction, mild-to-moderate malocclusions, with clear aligners offering advantages in periodontal health and short-term pain and fixed appliances retaining superiority in extraction cases and movements demanding high anchorage and root control. Appliance selection should therefore be guided by case complexity and specific movement requirements rather than by a presumption of universal equivalence, and future prospective, standardized trials are needed to validate these findings over longer follow-up periods.

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