

Effects of fixed vs removable orthodontic retainers on stability and periodontal health: 4-year follow-up of a randomized controlled trial

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Introduction: Our objectives were to compare the stability of treatment and periodontal health with fixed vs removable orthodontic retainers over a 4-year period. **Methods:** A 4-year follow-up of participants randomly assigned to either mandibular fixed retainers from canine to canine or removable vacuum-formed retainers was undertaken. Irregularity of the mandibular anterior segment, mandibular intercanine and intermolar widths, arch length, and extraction space opening were recorded. Gingival inflammation, calculus and plaque levels, clinical attachment level, and bleeding on probing were assessed. The outcome assessor was blinded when possible. **Results:** Forty-two participants were included in the analysis, 21 per group. Some relapse occurred in both treatment groups at the 4-year follow-up; however, after adjusting for confounders, the median between-groups difference was 1.64 mm higher in participants wearing vacuum-formed retainers ($P = 0.02$; 95% confidence interval [CI], 0.30, 2.98 mm). No statistical difference was found between the treatment groups in terms of intercanine ($P = 0.52$; 95% CI, $-1.07, 0.55$) and intermolar ($P = 0.55$; 95% CI, $-1.72, 0.93$) widths, arch length ($P = 0.99$; 95% CI, $-1.15, 1.14$), and extraction space opening ($P = 0.84$; 95% CI, $-1.54, 1.86$). There was also no statistical difference in relation to periodontal outcomes between the treatment groups, with significant gingival inflammation and plaque levels common findings. **Conclusions:** This prolonged study is the first to suggest that fixed retention offers the potential benefit of improved preservation of alignment of the mandibular labial segment in the long term. However, both types of retainers were associated with gingival inflammation and elevated plaque scores. (Am J Orthod Dentofacial Orthop 2018;154:167-74)

Prolonged and indeed indefinite retention is routinely prescribed following orthodontic treatment to mitigate against posttreatment change related to unstable positioning of teeth, physiological recovery and age-related changes^{1,2} Notwithstanding

this, there is a lack of high-quality evidence concerning the relative effectiveness of fixed and removable variants.³ Moreover, the long-term impact of fixed or removable retention on the periodontium has been the subject of little prospective analysis and compliance levels with prolonged removable retention is unclear⁴

Relatively few randomized controlled trials (RCTs) have involved comparisons of the effectiveness of fixed and vacuum-formed retainers (VFRs).^{5,6} Neither of these studies involved follow-ups in excess of 2 years. Thus, they reported little difference in terms of stability, with mean mandibular anterior irregularity scores less than 2.0 mm in both trials, indicating acceptable levels of stability in the short term. It is intuitive to expect that irregularity would increase over time, with important differences between these interventions conceivably only emerging over a more prolonged period. In particular, compliance with removable retainer wear may wane, leading to the development of posttreatment changes primarily due to unchecked maturational

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changes in the medium term. Failure of fixed retainers may also promote deterioration of the posttreatment outcome.⁴ Notwithstanding this, in view of the dearth of prolonged, prospective evaluation, the relative impact of these eventualities can only be speculated.

In terms of periodontal health, fixed retainers may hinder scrupulous oral hygiene measures; however, it is not known whether this necessarily leads to worsening of periodontal outcomes, particularly in the long term.⁷ A number of observational studies have involved assessment of periodontal integrity during the retention phase.⁷⁻¹⁰ The retrospective nature of these studies risks selection bias, and those with poorer hygiene may not be considered suitable for fixed retainers. Consequently, prospective analysis with random allocation to retainer types is preferable. It is important, therefore, to undertake a more holistic assessment of benefits and harms with prolonged use of orthodontic retainers.

Aims

The primary aim of this study was to compare the stability of orthodontic outcomes with fixed and removable retainers over a period of at least 4 years. The secondary aim was to investigate periodontal outcomes with fixed vs removable retainers over this period.

MATERIAL AND METHODS

Follow-up was undertaken in an RCT conducted at the Institute of Dentistry, Queen Mary University of London, which had involved assessment of stability at up to 18 months posttreatment.⁶ Ethical approval was obtained (10/H0713/57, Bloomsbury Research Ethics Committee), and all participants in the previous clinical trial were contacted for possible inclusion at least 48 months after withdrawal of active appliances with an appointment arranged at their convenience. In the previous RCT, 82 participants were randomly allocated by computer-generated random allocation with the allocations concealed from the treating clinician using an opaque, sealed-envelope system.⁶ Participants received either a mandibular VFR (Essix Ace Plastic, 120 mm in diameter; DENTSPLY, Islandia, NY) or a fixed retainer (0.0175-in coaxial archwire; Ortho-Care, Shipley, United Kingdom) bonded with Transbond LR composite material (3M Unitek, London, United Kingdom). Those in the removable retainer group were instructed to wear the mandibular VFR on a full-time basis for the first 6 months, nights only for the second 6 months, and alternate nights from 12 to 18 months after removal of active appliances. Thereafter, intermittent nights-only wear (1 to 2 nights weekly) was recommended. Of the 82 participants in the previous trial, data were obtained from 48 at the 18-month follow-up.⁶

An information sheet was given to patients willing to participate at a minimum of a 48-month follow-up after removal of active appliances, and oral and written consent was obtained. They were advised not to visit their dentist for scaling for 1 month before their appointment, and those taking medications known to have an effect on gingival health were excluded from the periodontal assessment.

Orthodontic stability was based chiefly on the irregularity of the mandibular incisors using Little's irregularity index¹¹ to assign a cumulative score for the contact point displacement in the mandibular intercanine region. Allied measurements including intercanine and intermolar widths, arch length, and extraction space opening were also recorded.⁶ Five clinical measures of periodontal health were scored: gingival inflammation,¹² calculus and plaque levels,^{13,14} clinical attachment level, and bleeding on probing (Appendix).

An impression of the mandibular arch was taken for all participants using hydrophilic vinyl polysiloxane (Virtual; Ivoclar Vivadent, Schaan, Lichtenstein). The impression was then cast in hard (type III gypsum) stone. Orthodontic stability was measured from the study models, adopting the same technique used in the previous study.⁶ The lingual surfaces of the mandibular labial segment were obscured on the study models using prosthetic dental wax (Ribbon Wax; Metrodent, Huddersfield, United Kingdom) to ensure assessor blindness. Measurements were performed by 1 researcher (D.A.-M.) using a digital caliper (150 mm DIN 862, ABSOLUTE Digimatic caliper, model 500-191U; Mitutoyo, Andover, Hampshire, United Kingdom) with a resolution of ± 0.01 mm. Periodontal measurements were recorded for the labial and lingual surfaces of the mandibular canines, and central and lateral incisors. Each tooth surface was divided into thirds using vertical lines based on the morphology and position of the dental papilla to demarcate mesial, middle, and distal surfaces. The periodontal measures were scored clinically by the same researcher (Appendix).

All participants were asked about frequency, duration, type of toothbrushing, and the time since the last visit to the dentist. Patients wearing mandibular VFRs were also asked to complete a retainer wear chart. The self-reported compliance levels were categorized as follows: compliant, reported wear of retainers was as advised; partially compliant, retainer wear instructions were not followed precisely; and noncompliant, not wearing retainers.

The status of the fixed retainer and the history of retainer repair and previous breakage were recorded in the fixed retainer group.

Interexaminer and intraexaminer reliabilities of clinical and study model measurements were tested by

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