Effectiveness of bonded and vacuum-formed retainers: A prospective randomized controlled clinical trial

Niamh O'Rourke,[a] Hussein Albeedh,[a] Pratik Sharma,[b] and Ama Johal[c]
London, United Kingdom

Introduction: The objective of this prospective trial was to compare the clinical effectiveness of bonded retainers with vacuum-formed retainers, in terms of maintaining the results of orthodontic treatment in the lower arch up to 18 months post debond. **Methods:** This was a hospital-based, prospective randomized controlled clinical trial in which a total of 82 subjects were randomly allocated using a computer-generated number sequence to 1 of 2 groups, receiving either a vacuum-formed retainer (Essix Ace plastic (120 mm; DENTSPLY Raintree Essix, Sarasota, Fla) or a bonded retainer (0.0175 coaxial archwire (Ortho-Care, UK, Shipley, United Kingdom) bonded in place with Transbond LR (3M United Kingdom, Brachnell, United Kingdom) for the mandibular arch. Each number was placed in an opaque, concealed envelope and chosen randomly by the study subject; this determined the allocation group. Eligibility criteria included patients nearing debond after treatment with 0.022 × 0.028-in slot size preadjusted edgewise fixed orthodontic appliances whose pretreatment records and study models were available to confirm pretreatment labial segment crowding or spacing and who had clinically acceptable alignment at the end of treatment. The main outcome was to investigate the clinical effectiveness of the 2 types of retainers in terms of changes in incisor irregularity at 6 months of retention. The following measurements were recorded at each time point (6, 12, and 18 months) with a digital caliper: Little's irregularity index, intercanine width, intermolar width, arch length, and extraction site opening. Blinding was applicable only at debond because of the permanence of 1 intervention. **Results:** The 2 groups were well matched with respect to age, sex, clinical characteristics, and treatment plans. There was a statistically significant difference between the groups for changes in Little's irregularity index at 6 months, with the vacuum-formed retainer group showing greater changes than the bonded retainer group ($P = 0.008$). There was no statistically significant difference between the groups for changes in Little's irregularity index at 12 and 18 months.There were also no statistically significant changes at any time for intercanine width, intermolar width, arch length, or extraction site opening. **Conclusions:** Some relapse is likely after fixed appliance therapy irrespective of retainer choice, and this is minimal in most patients at 6 months after debond. Bonded retainers have a better ability to hold the mandibular incisor alignment in the first 6 months after treatment than do vacuum-formed retainers. **Registration:** Not applicable. **Protocol:** The protocol was not published before trial commencement. **Funding:** There is no funding or conflict of interest to be declared. (Am J Orthod Dentofacial Orthop 2016;150:406-15)

[a]Specialty registrar in orthodontics, Centre for Oral Growth and Development, Barts and the London School of Medicine and Dentistry, London, United Kingdom; postgraduate student in orthodontics, Institute of Dentistry, Queen Mary University, London, United Kingdom.
[b]Senior clinical lecturer and consultant orthodontist, Centre for Oral Growth and Development, Barts and the London School of Medicine and Dentistry, London, United Kingdom.
[c]Reader, honorary consultant orthodontist, and academic lead in orthodontics, Institute of Dentistry, Queen Mary University, London, United Kingdom.
All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.
Address correspondence to: Ama Johal, Oral Growth & Development, Fourth Floor, Institute of Dentistry, Turner Street, Whitechapel London E1 2AD; e-mail, a.s.johal@qmul.ac.uk.
Submitted, March 2015; revised and accepted, March 2016.
0889-5406/$36.00

http://dx.doi.org/10.1016/j.ajodo.2016.03.020

The goal of orthodontic treatment is to produce an ideal occlusion that is morphologically stable, esthetic, and functional.[1] Despite proper diagnosis and carefully rendered treatment mechanics, the results achieved at the end of active treatment are not necessarily stable over the long term.

Posttreatment relapse is perhaps the most common risk of orthodontic treatment, and planning for postretention stability should be part of the initial treatment plan and discussed with the patient during the informed consent process before treatment, so that any relapse is not a disappointment for either the clinician or patient.

Stability and relapse, in both treated and untreated malocclusions, have been studied intently over many years,[2-10] and the long-term results have been similar and not hugely optimistic. Sadowsky and Sakols[6] followed patients on average for 20 years postretention and found that 9% had an increase in mandibular crowding when compared with pretreatment, and 73% had dental relationships "outside the norm." Similarly, Little et al[10] noted that only 10% of patients had maintained satisfactory mandibular incisor alignment at 20 years postretention.

This previous research demonstrates that the only apparent guarantee of long-term stability is long-term retention. This is due to the variety of factors that are reported to affect tooth positions in both treated and untreated malocclusions. These include skeletal and soft tissue growth[11-13]; dental factors[14-16]; treatment mechanics such as changes in arch form,[17] length,[18] width,[19] and treatment plan[20-26]; final interdigitation[27,28]; and functional occlusion,[29] as well as elements of the pretreatment malocclusion.[30]

Retention is necessary to allow reorganization of the gingival and periodontal tissues affected by orthodontic tooth movement, to prevent unwanted movement as a result from growth changes, and to prevent the relapse tendency of teeth that have been moved to an inherently unstable position.[31]

In the United Kingdom, the most common types of retention appliances are vacuum-formed retainers, Hawley retainers, and bonded retainers, with the latter the most frequently used by private practitioners; the former are more commonly prescribed by the National Health Service.[32] A similar study in the United States found that a maxillary Hawley and a mandibular bonded retainer were the most popular.[33] In a trial carried out in a specialist practice in the National Health Service, Hichens et al[34] reported that a vacuum-formed retainer was preferred by the patients over Hawley retainers. Cerny eta al[35] identified a patient preference for bonded retainers in private practice. More recently, social perceptions of intellectual ability and attractiveness have also been found to be influenced by retainer design and appearance.[36]

Previous prospective research evaluating the clinical effectiveness of removable retention is limited. In a trial reported by Rowland et al,[37] a statistically significant difference was found between the clinical effectiveness of vacuum-formed retainers and Hawley retainers, with the vacuum-formed group more successful in maintaining posttreatment alignment of the anterior teeth after 6 months.

Previous research involving bonded retention has been mainly retrospective,[38-41] and the few available prospective studies have investigated failure rates and dental health associated with fixed retainer types as opposed to their clinical effectiveness.[42-46] It was noted in 1 study that thin multistranded wires were superior for maintaining mandibular incisor positions compared with a thicker wire and a prefabricated wire.[44]

There is 1 prospectively designed trial comparing bonded and vacuum-formed retainers up to 24 months after debond.[47,48] In these studies, it was reported that a prefabricated positioner used as a retainer showed a statistically significant difference in its inability to maintain incisor positions after treatment (measured with Little's irregularity index) compared with a vacuum-formed retainer or a bonded retainer after 6 months,[47] but no statistically significant difference was found after 2 years.[48]

Retention type and duration of wear are also ongoing contentious issues in the specialty.[49-52] Two Cochrane reviews have been published on relapse; the latest reviewed the management of relapse and found no study to include in the review.[53,54] The former review identified limitations to previous research on retention type including short follow-up periods, inappropriate or no controls, retrospective designs, and insufficient or irrelevant data. Thus, both highlighted the need for randomized controlled trails in this area to aid in determining the most effective and safe method for managing the relapse of alignment of the mandibular front teeth.

The purposes of this study were to quantify and compare the changes in a number of intra-arch variables with vacuum-formed retainers and bonded retainers from debond to 6, 12, and 18 months and to determine whether 1 type of retainer is superior to the other in terms of maintaining the orthodontic results. These particular retainers have to date not been directly compared in a randomized controlled trial.

SPECIFIC OBJECTIVES AND HYPOTHESES

The main aim of this randomized controlled trial was to compare the clinical effectiveness of 2 types of orthodontic retainers in the mandibular arch in terms of retention of the treated results at 6 months after debond. More specifically, our aim was to determine whether there are any differences in the clinical effectiveness of vacuum-formed retainers compared with bonded retainers in maintaining alignment in the mandibular labial segment (Little's irregularity index) at 6 months after debond. Also, we aimed to investigate whether there are any differences in the clinical effectiveness of vacuum-formed retainers compared with bonded retainers in maintaining arch width (intercanine width)