Comparison of vacuum-formed and Hawley retainers: A systematic review

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Introduction: Hawley retainers (HRs) and vacuum-formed retainers (VFRs) are the 2 most commonly used retainers in orthodontics. However, the basis for selection of an appropriate retainer is still a matter of debate among orthodontists. In this systematic review, we evaluated the differences between VFRs and HRs. **Methods:** Electronic databases (PubMed, EMBASE, Cochrane Library, ISI Web of Science, LILACS, and Pro-Quest) were searched with no language restriction. The relevant orthodontic journals and reference lists were checked for all eligible studies. Two article reviewers independently screened the retrieved studies, extracted the data, and evaluated the quality of the primary studies. **Results:** A total of 89 articles were retrieved in the initial search. However, only 7 articles met the inclusion criteria. Some evidence suggested that no difference exists to distinguish between the HRs and VFRs with respect to changes in intercanine and intermolar widths after orthodontic retention. In terms of occlusal contacts, cost effectiveness, patient satisfaction, and survival time, there was insufficient evidence to support the use of VFRs over HRs. **Conclusions:** Additional high-quality, randomized, controlled trials concerning these retainers are necessary to determine which retainer is better for orthodontic procedures. (Am J Orthod Dentofacial Orthop 2014;145:720-7)

Retention is a critical phase of orthodontic treatment. After active orthodontic tooth movement, the teeth might be in an inherently unstable position and have a tendency to return to their pretreatment positions. Currently, the influences of the periodontal and gingival tissues, unstable positions of teeth, and continued skeletal growth are considered to be the major causes of relapse after removal of fixed appliances.[1] To address this problem, retainers are used to prevent the teeth from returning to their former positions until gingival and periodontal reorganization and skeletal growth are essentially completed.

Although many types of retainers are available, the Hawley retainer (HR) and the vacuum-formed retainer (VFR) are the 2 most commonly used clinical retainers. The HR was designed by Charles Hawley[2] in 1919, has been used for nearly a century, and has become the most popular removable retention appliance. The alternative removable retainer is an invisible retainer that was designed in 1971 and has been referred to by the following names: VFR, clear overlay retainer, and Essix retainer.[3] In this review, for simplicity, we considered any invisible retainer as a VFR, instead of the other names. The most compelling potential advantages attributed to this invisible retainer are not only its durability and esthetic qualities, but also its small size and cleanability. Consequently, the use of VFRs has increased exponentially in recent years. In the United Kingdom, VFRs have become the most commonly used retainers in National Health Service, hospital, and private practices.[4] However, there is little clinical evidence to support the use of VFRs over conventional HRs.

Several published studies have attempted to compare VFRs with HRs. Rowland et al[5] conducted a prospective, randomized clinical trial and showed that VFRs were more effective than HRs in retaining the correction of the maxillary and mandibular labial segments. In addition, Demir et al[6] also found that VFRs were more efficient in retaining the anterior mandibular teeth during a 1-year retention period. However, a recent retrospective, randomized, double-blind comparison study reported no statistically or clinically significant differences in the effectiveness of HRs and VFRs in maintaining specific arch-form features after orthodontic treatment.[7] Other studies have compared these 2 appliances in terms of their cost-effectiveness, patient satisfaction,[8,9] survival time,[10]

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and occlusal contacts during retention.[11,12] However, pertinent results were inconclusive, and some were unreliable; these studies could bias a clinician's understanding and mislead clinical practice. Thus, we conducted a critical systematic review to evaluate and compare the significant effects of VFRs and conventional HRs. This systematic review might provide clinical evidence to help an orthodontist decide which retainer is appropriate for a particular patient.

MATERIAL AND METHODS

Randomized or quasi-randomized, controlled clinical trials were included in this review.

Patients who had maxillary retainers, mandibular retainers, or both were included. There was no restriction regarding the type of active orthodontic treatment. The patients had to be followed for at least 6 months after completing their orthodontic treatment. However, patients with severe craniofacial deformities, cleft lip or palate, and poor periodontal status were excluded.

For this review, VFRs or HRs were selected as the final retainers for the patients after active orthodontic treatment. Additionally, the retainers had to cover the teeth, at least from first molar to first molar.

The primary outcomes included Little's index of irregularity,[13] intercanine width, intermolar width, and arch length related to the effectiveness of HRs and VFRs.

Secondary outcomes, including cost-effectiveness, patient satisfaction, survival time, and occlusal contacts for these 2 appliances, were extracted and collected.

Adverse effects on the periodontal health of the teeth, such as gingival and periodontal diseases, were also evaluated.

The following electronic databases were searched with no language restriction: Cochrane Central Register of Controlled Trials (CENTRAL; issue 1 of 12, January 2013), MEDLINE via PubMed (1960 to February 2013), EMBASE (1980 to February 2013), ISI Web of Science (1986 to February 2013), and LILACS (February 22, 2013). The search strategies are shown in Appendix I.

In addition, Pro-Quest Dissertation and Thesis database (http://pqdt.lib.sjtu.edu.cn/AdvancedSearch.aspx) and Pro-Quest Science Journals (http://search.proquest.com/sciencejournals/advanced?accountid=44440) were searched, with no limits set for the publication date.

A manual search was performed of these journals: *American Journal of Orthodontics and Dentofacial Orthopedics*, *Angle Orthodontist*, *European Journal of Orthodontics*, and *Journal of Orthodontics* (all from 1980 to 2012).

In addition, the conference proceedings and abstracts from the British Orthodontic Conference and the European Orthodontic Conference were searched. The reference lists of potential clinical trials were checked to identify any additional studies, and an additional search to update the results was undertaken in July 2013.

Two review authors (H.M. and Y.J.) independently screened the studies identified by the search strategies for relevance to this systematic review. Then the eligible studies were used independently for data extraction. Any disagreement between the 2 reviewers was resolved by discussion with another review author (J.H.) on the team.

Data extraction was also performed independently by 2 reviewers (H.M. and Y.J.), and disagreements were resolved by discussion with a third reviewer (J.H.). Data from the included studies were entered on a customized data collection form for details, including study design, study participants' characteristics, course of interventions, and outcome measures.

In addition, if any ambiguities or lack of data was discovered in the articles, we attempted to contact the authors by mail to obtain more information.

Two reviewers (C.H. and M.L.) assessed the risk of bias in each included study independently. Disagreements were resolved by discussion with a third review author (J.H.), so that a consensus could be reached. This assessment followed the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions (version 5.1.0).[14] Six specific domains were assessed: sample size calculation, random sequence generation, allocation concealment, blinding of measurement assessment, reporting of withdrawals, and the use of an intention-to-treat analysis. The overall risk of bias in each study was assessed using the following judgments: low, moderate, and high. Studies were categorized according to the following.

1. Low risk of bias (plausible bias unlikely to seriously alter the results), if 5 or more domains were considered adequate.
2. Moderate risk of bias (plausible bias that raises some doubt about the results), if 3 or more domains were recorded with "yes."
3. High risk of bias (plausible bias that seriously weakens confidence in the results), if the study recorded "yes" in less than 3 domains.

Statistical analysis

Clinical heterogeneity was assessed by examining the participant types, interventions, and outcomes of each study. Ideally, a meta-analysis would have been performed if studies with similar comparisons reported comparable outcome measures. Risk ratio values would have been calculated along with 95% confidence intervals (CIs)

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