

Original Contributions

Systematic Review

Periodontal health during orthodontic treatment with clear aligners and fixed appliances

A meta-analysis

Qian Jiang, MDS; Jialing Li, MDS; Li Mei, PhD; Jing Du, MDS; Luca Levrini, MD; Gian Marco Abbate, DDS; Huang Li, PhD



Supplemental material
is available online.

ABSTRACT

Background. Clear aligners have become increasingly popular because of their esthetics and comfort. The authors' aim in this systematic review was to compare periodontal health in patients undergoing orthodontic treatment with clear aligners with that of those undergoing orthodontic treatment with fixed appliances.

Types of Studies Reviewed. The authors systematically searched the PubMed, Web of Science, Cochrane Library, and Embase databases to collect related studies. After extracting data and assessing quality, the authors performed a meta-analysis and trial sequential analysis. The authors used the Grading of Recommendations Assessment, Development and Evaluation system to assess the quality of the evidence.

Results. The authors included 9 studies in the quantitative synthesis analysis. Clear aligners were better for periodontal health, including plaque index (mean difference [MD], -0.53 ; 95% confidence interval [CI], -0.85 to -0.20 ; $P = .001$), gingival index (MD, -0.27 ; 95% CI, -0.37 to -0.17 ; $P < .001$), and probing depth (MD, -0.35 ; 95% CI, -0.67 to -0.03 ; $P = .03$), than were fixed appliances. However, the trial sequential analysis outcome indicated a false-positive meta-analysis result for probing depth. The authors downgraded the level of the evidence because of the risk of bias and inconsistency.

Conclusions and Practical Implications. Clear aligners were better for periodontal health than fixed appliances and might be recommended for patients at high risk of developing gingivitis. However, high-quality studies still are required.

Key Words. Gingivitis; orthodontic appliances; literature review.

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The demand for orthodontic treatment has increased in both adult and young patients.^{1,2} Fixed appliances are the most common and traditional treatment method used in contemporary orthodontics.³ However, the placement of orthodontic brackets and bands usually makes proper plaque removal more challenging. The increases in food deposits and dental plaque often lead to enamel demineralization and gingival inflammation if patients cannot maintain good oral hygiene.⁴⁻⁶ In contrast, clear aligners have had advantages such as esthetics, comfort,^{7,8} and convenience for oral hygiene because they are removable.⁹

Clear aligners, which have been available since 1999,⁹ have become increasingly popular.¹⁰ Clinicians have considered them to be safe, esthetic, and comfortable orthodontic appliances for patients.¹¹ The advantage of clear aligners over traditional fixed appliances on periodontal conditions, however, is still under debate. Investigators have reported that clear aligners allowed adequate oral hygiene and reduced the risk of developing negative periodontal complications compared with fixed appliances.^{12,13} Investigators in other studies have found that

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clear aligners cover the whole dentition and the marginal gingiva nearly the entire day and lead to inferior periodontal health.^{14,15} Although authors of a 2015 systematic review compared the effect of fixed appliances and clear aligners on periodontal health, their inclusion and exclusion criteria were ambiguous, and they included only 5 heterogeneous studies, which precluded quantitative synthesis.¹⁵ Our aim in this systematic review was to compare periodontal health in patients undergoing orthodontic treatment with clear aligners and those undergoing orthodontic treatment with fixed appliances with an updated and expanded literature database search through August 14, 2017.

METHODS

Types of studies and participant characteristics

We included human randomized controlled trials (RCTs) and human cohort studies. Participants included healthy humans. We excluded studies in which participants had systemic diseases (for example, advanced periodontal disease or Sjögren syndrome) or a history of long-standing antibiotic therapy.

Intervention, comparison, and outcome

We included studies in which the investigators used clear aligners and fixed appliances as intervention and control. The primary outcome was the effect on periodontal health. We implemented no restrictions regarding the follow-up time, the type of fixed appliances, or the number of participants.

Search strategy

We developed detailed search strategies for MEDLINE and adapted them for the other databases (eTables 1-4, available online at the end of this article). The search strategies included a combination of controlled vocabulary and free terms. We searched PubMed, Web of Science, Cochrane Library, and Embase. We manually searched the references of included articles to capture any other relevant studies. We restricted searches to trials in human participants with the full text published in English. We first performed the literature search in December 2016 and updated it on August 14, 2017.

We also searched unpublished literature in ClinicalTrials.gov, OpenGrey, the World Health Organization's International Clinical Trial Registry Platform, the Database of Abstracts of Reviews of Effects, Health Technology Assessment, the Turning Research Into Practice database, the International Federation of Pharmaceutical Manufacturers & Associations clinical trials portal, the International Standard Randomised Controlled Trial Number registry, the UK National Research Register, Eli Lilly and Company Clinical Study Registration and Results, OpenSIGLE, and the Pharmaceutical Industry Clinical Trials Database. We identified 1 article on ClinicalTrials.gov. We contacted the corresponding authors of this article to obtain the missing data, but there was no response at the time we wrote this review.

Data collection and analysis

Two independent investigators (Q.J., J.L.) assessed the articles and extracted data according to the inclusion and exclusion criteria. These 2 independent investigators (Q.J., J.L.) assessed the methodological quality of the trials included in this review. They resolved any discrepancies through discussion and consultation with a third investigator (H.L.). We assessed RCTs by using the evaluation method described in the Cochrane Handbook for Systematic Reviews of Interventions 5.1.0.¹⁶ We assessed the methodological quality of the cohort studies by using the Newcastle-Ottawa Scale for cohort studies.¹⁷ We used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system to assess the quality of evidence in relation to review questions via software (GRADEprofiler 3.6, McMaster University).

Statistical analysis

We also used software (RevMan 5.0, The Nordic Cochrane Centre) to perform the meta-analyses. We used the random-effects model to synthesize results to accommodate heterogeneity across studies.

ABBREVIATION KEY

API:	Approximal plaque index.
BOP:	Bleeding on probing.
GI:	Gingival index.
GRADE:	Grading of Recommendations Assessment, Development and Evaluation.
MeSH:	Medical Subject Headings.
NA:	Not applicable.
NBP:	Nonbleeding papillae after probing.
OHI-S:	Simplified Oral Hygiene Index.
PBI:	Papillary bleeding index.
PD:	Probing depth.
PI:	Plaque index.
RCT:	Randomized controlled trial.
SBI:	Sulcus bleeding index.
TSA:	Trial sequential analysis.

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