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Clear Aligners vs. Fixed Appliances in the Management of Mild to Moderate Malocclusion: A Review of Treatment Efficacy, Stability, and Patient-Centered Outcomes

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Abstract

Aim: To evaluate and compare clear vs fixed orthodontic appliances in the management of mild to moderate malocclusions with respect to the treatment efficacy, stability and patient centred outcomes.

Methods: Peer reviewed published articles between 2010 and 2025 were structurally searched across PubMed, Scopus and Google Scholar. The search strategy included cohort studies, clinical trials, systematic reviews and meta-analyses directly comparing fixed aligners and fixed appliances. Furthermore, utilising relevant keywords. Studies were assessed for quality, relevance, and outcome reporting on treatment effectiveness, duration, periodontal health, and patient experience.

Results: Favourable outcomes were reported with clear aligners, which included shorter treatment time, improved periodontal health, and higher reported patient satisfaction in terms of comfort and aesthetics. However, fixed appliances were occasionally superior in achieving occlusal control, management of torque, and precision of tooth movement. Some studies found no significant difference between the two appliances across various parameters, highlighting variability based on type of malocclusion, complexity of treatment, and patient adherence.

Conclusion: Clear aligners offer a promising alternative to traditional fixed appliances, especially for adults seeking discreet and comfortable treatment. While clear aligners are associated with improved oral hygiene and reduction in discomfort, fixed appliances may provide superior control in specific cases. The evidence remains moderate, and high-quality clinical trials are needed to further clarify comparative effectiveness and inform personalized orthodontic treatment planning.

Keywords: Clear aligners; Fixed appliances; Orthodontics; Malocclusion; Treatment outcomes; Patient satisfaction

Introduction

The current review aimed to compare the treatment efficacy, stability, and patient-centered outcomes of clear aligners and fixed appliances. As an alternative to traditional braces which have been used for over a century, clear aligners are a relatively recent innovation in the treatment of malocclusions. In recent years, clear aligner therapy (CAT) has become increasingly popular for treating malocclusions in orthodontics. The main difference between fixed appliances and clear aligners treatments is the biomechanics utilized in molar distalization to control tooth movements. Similar to any other novel

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intervention, assessing effectiveness and patient results is crucial to balance the pros and cons, and customize the optimal treatment for the patient based on their unique condition. A systematic review conducted by Ke, Zhu, and Zhu compared clear aligners with fixed appliance therapies in terms of effectiveness [1]. Clear Aligners were effective in treating malocclusion as the study revealed that individuals using clear aligners experienced a statistically significant reduction in treatment time compared to those with braces, in addition to providing segmented tooth movement [1]. In another recent study by Liu et al., periodontal condition indicators were compared between patients receiving traditional fixed appliances, and those receiving clear aligners treatment without brackets [2]. The results reported a significantly higher total effective ratio among clear aligners group [2]. Moreover, the results showed a statistically significant higher reduction in plaque index, debris index, and gingival bleeding index, as well as in serum inflammatory factors (CRP, IL-6 and TNF-α) among clear aligners group compared to fixed appliances group [2]. Additionally, the clear aligners group performed better in psychological assessments, mastication efficiency, sleep metrics, and the four aspects of quality of life [2]. A retrospective cohort study by Borda et al., which involved a group of adults with mild malocclusions, has examined the effects of utilizing clear aligners versus fixed appliances [3]. By utilizing the American Board of Orthodontics Discrepancy Index (DI) for initial records, and the Cast-Radiograph Evaluation (CRE) for final records, the study reported a significant reduction in discrepancies from ideal for the aligner group compared to the fixed appliance group, as well as fewer appointments, fewer emergency visits, and shorter treatment duration [3]. Borda et al. argued that clear aligners are more effective than fixed appliances in treating mild Malocclusion, and produce a significantly better patient health outcomes, as patients were finished treatment approximately 6 months sooner than the fixed appliance group [3]. Nevertheless, Borda et al. study reported no statistically significant difference in buccolingual inclination, interproximal contacts, marginal ridges, occlusal contacts, and root angulation between both treatments [3]. In another recent experimental study that assessed the periodontal aspects of both treatments, Giannini et al. emphasized that patients who used fixed appliances generally tended to accumulate more plaque, as well as having worse periodontal health and greater tissue inflammation than those who used clear aligners [4]. According to Giannini et al., those results were more noticeable among patients who did not maintain proper oral hygiene [4]. Thus, different supplementary approaches should be adopted based on the type of orthodontic appliance being used in order to manage plaque and minimize microbial colonization in saliva, according to Giannini et al. [4]. Irsheid et al. in their comparative assessment also reported superiority of clear aligners in different aspects [5]. According to Irsheid et al., clear aligners is a promising treatment as the patients had significantly shorter treatment duration, less number of visits, and a smaller post-treatment change in Incisor Mandibular Plane Angle (IMPA) [5].

Methods

This literature review was performed to compare the treatment efficacy, stability, and patient-centered outcomes of clear aligners and fixed appliances in the management of mild to moderate malocclusions.

A systematic search was performed utilising online databases including PubMed, Scopus, and Google Scholar. That included articles that were peer-reviewed and published between 2010 and 2025. The search strategy incorporated keywords such as "clear aligners," "fixed orthodontic appliances," "malocclusion," "orthodontic treatment outcomes," "periodontal health," and "patient satisfaction." Criteria for inclusion Clinical trials, cohort studies, systematic reviews, and meta-analyses that directly compare the two treatment methods. It did not include articles that were not in English, case reports, or studies that did not have direct comparisons or measurable outcomes.

Chosen studies were assessed for relevance, quality, and reported outcomes concerning treatment efficacy, duration, periodontal effects, patient experience, and stability. The data was then put together in a narrative form, focussing on findings that were similar, different, and missing from the literature.

The present review sought to evaluate the treatment efficacy, stability, and patient-centered outcomes of clear aligners versus fixed appliances. Clear aligners are a new way to treat malocclusions that are different from traditional braces, which have been used for more than a hundred years. In recent years, clear aligner therapy (CAT) has gained popularity as a method for treating malocclusions in orthodontics. The primary distinction between fixed appliances and clear aligners treatments lies in the biomechanics employed in molar distalization to regulate tooth movements. Like any other new treatment, it is important to weigh the pros and cons and find the best treatment for each patient based on their specific condition.

A number of studies with different designs were done to see how effective, stable, and beneficial each treatment was for patients. Most studies found that patients who used Clear Aligners had better health outcomes and higher efficacy than those who used Fixed Appliances.

Discussion

In recent years, the number of adult patients looking for orthodontic care has increased, along with a higher inclination for aesthetic and comfortable options over traditional fixed appliances Pain levels among patients were also assessed between clear aligners and fixed appliances groups, as

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orthodontic treatment with fixed appliances is known to cause discomfort and pain [6]. According to the systematic review study by Cardoso et al., the majority of papers found that patients treated with clear aligners felt less pain after the first few days of treatment compared to patients treated with fixed appliances, but these differences disappeared after 3 months, indicating a moderate level of certainty to support these results [6]. Another study by Lin at al. also assessed Oral Impacts on Daily Performance among patients receiving clear aligners and fixed appliances treatments [7]. According to Lin at al., clear aligners had less impact on the patients' daily life, as no significant changes in Oral Impacts on Daily Performance were observed [7]. Due to its aesthetics and removable nature, clear aligners tend to have less impact on daily life; patients can remove the appliance for special occasions [7]. On the other hand, fixed appliances were associated with a significant change in Oral Impacts on Daily Performance scores, as well as in the subscale scores of eating, cleaning teeth, smiling, and social relation especially in the first 6 months, which indicates higher level of discomfort among fixed appliances groups [7].

On the other hand, contradicting findings were reported in some studies, which found higher effectiveness, stability, and better patient outcomes when utilizing fixed appliance in specific malocclusion treatment aspects compared with clear aligners. The study by Ke, Zhu, and Zhu emphasized that clear aligners may be less effective than braces in achieving proper occlusal contacts and managing tooth rotation, enhancing cross-sectional breadth and stability, nevertheless, these differences in effectiveness were not reported to be statistically significant [1]. Similarly, Thimmaiah et al., who compared anterior teeth retraction in their study, showed that fixed appliances exhibited enhanced anterior torque management and increased security for the posterior anchorage teeth [8]. Moreover, occlusal outcomes in terms of contacts, overbite, buccolingual inclination and transverse expansion of the maxillary arch were compared, the results from Bowman et al. study reported clear aligners to attribute to an overall loss of posterior contact, accompanied by deficiencies in buccolingual inclination and transverse expansion of the posterior teeth, with a statistically significant result [9]. Additionally, Xia et al. conducted a comparative assessment of orthodontic clear aligner versus fixed appliance for anterior retraction [10]. According to Xia et al., tooth displacement was significantly higher among clear aligner models compared with fixed appliance model [10]. Despite the facts that the trend of teeth movement was consistent, there were variation in the amount of tooth displacement among groups using clear aligners, whereas the fixed appliance group showed superior torque control and enhanced protection for the posterior anchorage teeth [10]. When it comes to treatment duration and patient outcomes, three studies of moderate quality from the systematic review and meta-analysis conducted by Papageorgiou et al., found no significant in treatment duration between clear aligner and fixed appliance groups [11]. Furthermore, the application of orthodontic aligners links to inadequate and unsatisfactory occlusal results assessed by the American Board of Orthodontics (ABO) Objective Grading System [11].

Additionally, several studies showed no statistical differences in effectiveness and outcomes, or minor differences between both treatment methods [5,12-17]. For instant, a study by Dianiskova et al. compared the effects of intermaxillary elastics on the correction of mild Angle's Class II division 1 malocclusions using clear aligners versus fixed multibrackets [12]. According to Dianiskova et al., neither group showed any statistically significant differences in the correction of the sagittal intermaxillary relation, nor in the analysis of vertical skeletal changes, which did not affect mandibular inclination [12]. Dianiskova et al. emphasized that clear aligners can be an effective alternative to repositioning lower incisors than fixed multibrackets if proclination is not required. Yassir et al. also conducted a comprehensive literature search of systematic reviews that assessed the clinical effectiveness of clear aligner treatment [12]. The study reported clear aligner treatment to be effective for mild to moderate malocclusions, however, Clear Aligners were associated with increased relapse, and conflicting results were found regarding treatment duration [12]. Yassir et al. also argues the need for high-quality randomized clinical trials as the level of evidence regarding clear aligners treatment effectiveness is moderate [13]. Similarly, the study by Di Spirito et al. showed that differences were observed in the plaque index, gingival index, and bleeding on probing between subjects with clear aligners and those with fixed appliances during short and medium follow-ups, along with periodontal probing depth variations at long-term follow-ups, and gingival recession noted at short-term follow-ups [13]. Di Spirito et al. further emphasized that although a better control of biofilm accumulation and a gingival inflammatory status was observed among clear aligners groups, these differences were noticeable during short-term follow-ups only, and no differences were found during the long-term follow-up [14]. This indicates that clear aligners might be linked to a somewhat improved periodontal health, nevertheless, Di Spirito et al. argued that these differences would be minimal in a clinical environment [14]. Additionally, and when demographic variables where compared, the study by Wang et al. showed that fixed appliances and clear aligners groups had no significant differences in skeletal, dental, or soft tissue measurements with the different patients' demographics like age, gender, facial type, and severity of malocclusion [14]. Furthermore, Wang et al. study found that both groups' lips retracted significantly, and their interincisal angles increased, however, these changes were not significant differences between them [15]. Moreover, Peer Assessment Rating (PAR) index scores utilized to assess the outcome

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of orthodontic treatment were compared between fixed appliances and clear aligners groups in the recent study by Irsheid et al. [5]. The study results showed no statistically significant differences in PAR scores between the two groups [5]. Similar to Irsheid et al. study, a prospective clinical study was also conducted by Pango Madariaga et al. to assess the periodontal health of orthodontic patients after a period of three months, by measuring the probing depth, plaque index bleeding on probing, and gingival recession [16]. According to Pango Madariaga et al., linear regression model results showed no statistically significant differences in periodontal variables between multibracket fixed appliance and clear aligners when followed by a dental hygienist [16]. Zheng et al. in their systematic review and meta-analysis also argues that the evidence supporting the effectiveness of clear aligners is generally lacking despite claims and positive results from some studies [17]. In mild-to-moderate cases, clear aligners appear to have a significant advantage in terms of chair time and treatment duration compared to conventional braces, but no differences were observed between the two systems regarding stability and occlusal characteristics after treatment, according Zheng et al [17].

Conclusion

To conclude, the use of clear aligners without brackets may result in improved treatment outcomes for patients with malocclusion, as well as enhanced periodontal health and chewing function, as well as reducing inflammation. The studies showed that clear aligners are effective in reducing treatment duration, however, there are some contradicting findings that showed no significant differences in probing depth, plaque index bleeding on probing, and gingival recession between both treatments, while others reported better results and stability from conventional fixed appliance. By incorporating innovative materials and technologies, bracket-free clear aligners are anticipated to be more effective and comfortable, shorten treatment periods, reduce discomfort, and diminish patient resistance, resulting in an improved treatment experience. Nevertheless, the level of evidence is still considered moderate, and some of the studies show no statistically significant differences between both treatments, while others showed superiority of fixed appliances in specific aspects, which argues the need for high quality experimental studies to further assess the effectiveness and outcomes of both treatments.

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