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Clear Aligners: strenghts and weaknesses

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Abstract

Clear aligners are orthodontic devices that use elastic thermoplastic material that applies pressure to the teeth to move into the alignerâ€™s position, which are an alternative to dental braces. They are esthetic, efficient, and comfortable compared to traditional fixed appliance for mild-to-moderate malocclusion. Clear aligners have many advantages principally for adult patient but also some disadvantages. The clinician should know strenghts and weaknesses of aligners for a correct use on the basis on clinical indications.

Introduction

Prior to the introduction of clear aligners, the most widely used appliance was an adjunct to fixed appliances, which was worn once the bands and brackets were removed.

The Positioner introduced by Kesling (1945) was originally made of vulcanite material and aided the settling- in process; but it was also useful in correcting certain tooth positions that could not be finished for one reason or another by fixed appliances[1].

Later, latex became the standard material to manufacture. But even earlier, Remmensnyder had introduced the Flex-O-Tite gum-massaging appliance in 1926 to aid in the treatment of gingival disease.[2] He reported that he was observing tooth movements as a side effect.

The first thermoformed plastic sheet to move teeth was invented by Nahoum in 1964[3]. He called it the Dental Contour Appliance.

Subsequently it was modified by Sheridan (1993) and called the Essix Appliance[4].

The Invisalign method is gaining an increasing interest as an alternative treatment option in adult patients to simplify the treatment plan.

Particularly since the introduction of Invisalign appliances (Align Technology) in 1998, clear aligners have become an increasingly common addition to the orthodontic armamentarium.

Methods

Aim of this review is the knowledge of advantages and weaknesses of clear aligners. Keywords used are: clear aligner, comparative effectiveness research, orthodontic appliances. PubMed and Scopus were used. 25 articles were selected.

Review

Several clinical papers[5-12] have been published throughout the last five years, showing the applicability of the technique in correcting various types of malocclusions.

The foremost frustration is with patient compliance. Changing aligners prematurely leads to loss of tracking.

The second most common performance problem is the extrusion of teeth, especially the maxillary lateral incisor. It may happen because of delayed movements of adjacent teeth, particularly the canines[13].

The third significant weakness is the alignerâ€™s inability to move the root apex, such as in torqueing or translational movements. The role of uncontrolled tipping and loss of anchorage complicates the progression of programmed aligners. Further evaluation of patient characteristics, such as age, bone quality, and tooth morphometrics could aid in aligner treatment planning[14].

Rossini et al[15] suggested that most studies had methodological problems: small sample size, bias and confounding variables, lack of method error analysis, blinding in measurements, and deficient or missing statistical methods. The quality level of the studies was not sufficient to draw any evidence-based conclusions.

Aligner is an effective procedure that is able to align and level the arches in non-growing subjects. The anterior intrusion movement achievable is comparable to that reported for the straight wire technique.

Aligner is not effective in controlling anterior extrusion movement. Contrasting results have been reported in relation to the posterior vertical control, and a definite conclusion cannot be drawn.

Â t is not effective in controlling rotations, especially of rounded teeth. Aligner is effective in controlling upper molar bodily movement when a distalization of 1.5 mm

has been prescribed.

It is not based on aligners alone. It requires the use of auxiliaries (attachments, interarch elastics, IPR, altered aligner geometries) to improve the predictability of orthodontic movement.

Therefore clinical cases such as extraction cases, monolateral crossbite, skeletal crossbite, movements of roots, presurgical cases, full-cusp Class II or III malocclusions (also subdivision malocclusions), rotations severe over 15Â°, vertical movements major of 2 mm can be very complex to challenge with aligner.Â

Despite claims about the effectiveness of clear aligners, evidence is generally lacking. Shortened treatment duration and chair time in mild-to-moderate cases appear to be the only significant effectiveness of clear aligners over conventional systems that are supported by the current evidence [16]. The retention to avoid the risk of relapse in particular crossbite, diastemas and open bite is necessary.Â Â Â

Patients experience esthetic improvement and comfort. Clear-aligner use have less impact on daily life during treatment than the use of fixed appliance and there are no significant changes at 12 months [17].

Aligners are also indicated in patients with amelogenesis imperfecta or prosthetic crowns with porcelain surfaces or bridge; the clinician doesnâ€™t worry about securing brackets onto such surfaces[18]. With the aligners, even some patients with less-than-perfect oral hygiene do not exhibit white enamel spots or decalcifications.

Some studies analyzed the entity of root resorption. Gay et al[19] investigated the incidence and severity of root resorption in adult patients treated with aligners during class I treatments. Every patient showed a minimum of one tooth with root length reduction. On average, 6.39 teeth per patient were affected. Overall, 41.81% of the measured 1083 teeth showed signs of apical root resorption, but only 3.69% a reduction of over 20% of the pre-treatment root length. Severe root resorption affected mostly the upper lateral incisors and lower lateral and central incisors.

Compared with fixed appliances and untreated control patients, the periodontal tissue health as measured by papillary bleeding score and periodontal pocket depth improves with use of clear aligners during orthodontic treatment.[20] Patients undergoing orthodontic treatment with the Invisalign®Â System show a superior periodontal health in the short-term when compared to patients in treatment with fixed orthodontic appliances. Invisalignshould be considered as a first-line treatment option in patients with risk of developing periodontal disease[21].Â

Routine follow-up dental checks are fast, such as instruments needed.

They can be used also for mild vertical correction because of clear aligners can intrude the posterior teeth and close the anterior openbite. Cases such as mild dentoalveolar open bite, which had previously been treated exclusively with fixed appliances, can be resolved efficiently, while simultaneously maintaining facial esthetics, using clear aligners[22].

The clinician can use ClinCheck such as diagnostic tool[23].

The amount of interproximal reduction (IPR) performed should be about the same as with fixed appliances. IPR should be limited for Boltonâ€™s discrepancy and need to alter the tooth morphology. IPR has not been shown to adversely affect dental or periodontal health[24-25].

Conclusions

The clinician may use clear aligners in clinical practical to facilitate some clinical cases. The knowledge of limits and advantages is fundamental. The treatment offered several advantages in terms of maintenance of oral hygiene and comfortable management of the removable appliance. Finally, patient satisfaction was recorded as very high, because they underwent an invisible orthodontic treatment and they reached optimal esthetics and, above all, their occlusion was functionally rehabilitated. In conclusion, for all the above-mentioned reasons, the principal indication for use of clear aligners is in adult patients with restorative and/or multidisciplinary concerns or needs such as patients with risk of developing periodontal disease, allergy to metals, mild malocclusions. The retention to reduce the risk of relapse in particular in crossbite, diastemas and open bite is necessary.Â Â Â

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