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Clear Aligner Therapy: An Innovative Solution for Class II Division I Malocclusion

Case Report

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Abstract

This case report discusses the clear aligner treatment of an adult patient with Class II Division I malocclusion, managed using a non-extraction approach that combined arch expansion and interproximal reduction. A total of 28 upper aligners and 24 lower aligners were provided, each to be worn for 22 hours daily over a 10-day period. The entire treatment spanned 10 months. This case highlights the effectiveness of clear aligners in treating Class II malocclusion. The discreet design of the aligners promotes better periodontal health and enhances patient acceptance, increasing the likelihood of compliance and contributing to improved treatment outcomes.

Keywords: Clear aligners; Malocclusion; Orthodontic treatment

Introduction

Class II Division I malocclusion is a common dental condition characterized by a malalignment of the teeth and jaws [1]. It occurs when the upper teeth (maxillary arch) are positioned significantly forward relative to the lower teeth (mandibular arch), often resulting in a pronounced overjet or "buck teeth" appearance. In this form of malocclusion, the molar relationship is typically classified as Class II, where the upper first molar is positioned ahead of the lower first molar, and the incisors are usually protruded or tipped outward [2,3].

Key features of Class II Division I malocclusion include protrusive upper incisors, deep overbite, retrognathic lower jaw along with the aesthetic & functional problems [4,5]. It is caused by a combination of genetic and environmental factors. Genetic predisposition plays a major role, as individuals may inherit skeletal imbalances, such as an overdeveloped upper jaw (maxilla) or an underdeveloped lower jaw (mandible), which leads to a pronounced overjet. Environmental factors, including childhood habits like thumb sucking, prolonged pacifier use, and tongue thrusting, can also contribute by exerting pressure on the upper teeth, causing them to flare outward. Mouth breathing, often due to chronic nasal obstruction or enlarged adenoids, can lead to abnormal jaw development and backward positioning of the lower jaw. Growth discrepancies between the upper and lower jaws during childhood may further aggravate this condition. Additionally, early loss of baby teeth, dental crowding, or spacing can disrupt normal tooth eruption and alignment, potentially leading to Class II Division I malocclusion. In some cases, trauma or injury to the jaws during early development may also result in this misalignment [6-8].

Treatment of Class II Division I malocclusion often depends on the patient's age and the severity of the condition. In growing children and adolescents, orthodontic interventions such as functional appliances can be used to modify jaw growth and correct the relationship between the upper and lower jaws. In adults, treatment typically focuses on repositioning the teeth using traditional braces or clear aligners. In severe cases where there is significant skeletal imbalance, surgical correction (orthognathic surgery) may be recommended in conjunction with orthodontic treatment [9,10].

Clear aligners have revolutionized the field of orthodontics, offering a modern, aesthetic, and comfortable alternative to traditional braces. Their use in the treatment of Class II Division I malocclusion has gained significant popularity due to advancements in aligner technology and digital orthodontics [11]. Traditionally, this malocclusion has been treated with fixed appliances, functional appliances, or even surgery in severe cases. However, clear aligners provide a non-invasive option that can correct dental misalignments while maintaining patient comfort and discretion [12,13]. Clear aligners are designed through a digital 3D model of the patient's teeth, allowing for precise, step-by-step tooth movements. For Class II Division I malocclusion, aligners can incorporate features such as precision cuts for elastics, attachments, and optimized tooth movements to correct both the dental and skeletal discrepancies. In cases involving mild to moderate malocclusion, aligners have been shown to successfully reposition the upper teeth, reduce overjet, and improve occlusal relationships. Additionally, the removable nature of aligners offers patients greater flexibility in maintaining oral hygiene and dietary habits, contributing to their growing preference among adult and adolescent patients [14].

This case report outlines the use of clear aligners to treat a patient with Class II Division I malocclusion. It provides a detailed account of the treatment process, documenting the progression

and outcomes of the orthodontic intervention. The report covers the treatment plan, the application of clear aligners, the patient's response throughout the treatment, and any challenges that were faced. Ultimately, it evaluates the effectiveness of the aligners in correcting the malocclusion. This information may be a useful reference for other practitioners and patients exploring similar treatment options for Class II Division I malocclusion.

Case Report

A 20-year-old woman in good health sought dental care due to concerns about her protruding front teeth and inability to close her lips comfortably. Her medical history was uneventful, with no known family or dental issues. Extraoral examination revealed a brachycephalic head shape, a euryprosopic facial form, symmetrical frontal view, convex profile, medium-sized nose, and incompetent lips (Figure 1). There was an excessive interlabial gap, with no signs of temporomandibular joint dysfunction. Smile analysis showed a sufficient display of the upper incisors, although the teeth were not ideally aligned, and the smile arc was harmonious. Intraoral examination found fair oral hygiene and a normal periodontal condition. Both molars and canines exhibited Class II relationships, with Class II Division I positioning of the incisors. The overjet measured 5 mm, indicating excess, while the overbite was 50%. The maxillary midline aligned with the facial midline, but the mandibular midline was shifted 2 mm to the right. Mild crowding was present in the upper and lower arches. A panoramic radiograph confirmed healthy periodontal status with no evidence of caries, root resorption, or dental anomalies. Cephalometric analysis revealed a skeletal Class I relationship, a hypodivergent facial pattern, proclined upper incisors, and an acute nasolabial angle.

Treatment Objectives

The main goal of the orthodontic treatment was to resolve the patient's primary concerns using clear aligners. Additionally, the treatment aimed to establish a stable, functional, and healthy bite, while enhancing the overall dental aesthetics.

Treatment Options

We discussed various treatment options with the patient, considering the following:

The first option involved traditional braces for orthodontic correction, but the patient declined this approach, preferring a more aesthetically appealing solution.

The second option suggested the use of clear aligners, which matched the patient's preference for a more discreet treatment.

For both treatment options, the plan included a non-extraction approach, with interproximal reduction (IPR) and lower arch expansion to address the issues of proclined upper incisors, crowding, and misalignment.

Treatment Procedure

Following the patient's history and examination, intraoral and extraoral photographs were taken, along with optical impressions obtained through intraoral scanning. These records were sent to the ClearPath facility to develop a customized treatment plan. The panoramic X-ray confirmed sufficient bone support and indicated average oral hygiene, meeting the requirements for orthodontic treatment without the need for additional dental procedures, making the case suitable for clear aligner therapy. A 3D treatment plan was generated based on the submitted records, involving 28 stages for the upper arch and 24 stages for the lower arch. The treatment approach was non-extraction, Incorporating Interproximal Reduction (IPR) and arch expansion to address the patient's dental issues. A treatment simulation (Figure 2) was presented to the patient for review, and she approved the plan after expressing her satisfaction. The proposed treatment plan was discussed with the patient within seven days of data submission. She was pleased with the recommended approach, and no changes were required. The total treatment duration was estimated to be 10 months, which the patient accepted, allowing the treatment to commence soon afterward.

IPR Technique

Interproximal reduction is a technique of carefully removing thin enamel layer interproximally between the neighboring teeth to unravel crowding [15]. There are different methods of IPR including burs, discs and abrasive strips [16]. In this study IPR was achieved using thin diamond coated double sided abrasive strip. It was measured using IPR gauge, followed by the application of topical fluoride to avoid any adverse effects.

Attachment Placement

Attachment placement is a crucial aspect of clear aligner treatment, enhancing the effectiveness of tooth movement. Attachments are small, tooth-colored composite resin shapes bonded to the teeth, and they help the aligners apply the necessary force to achieve specific movements such as rotation, extrusion, or intrusion. The shape, size, and location of the attachments are strategically determined based on the treatment plan to optimize aligner fit and control tooth movement. They work as anchor points, allowing the aligners to exert more precise forces on the teeth, thus improving the predictability of complex movements. Proper placement and management of attachments are essential for achieving the desired orthodontic results efficiently [17,18].

Figure 1: Pre-treatment; extraoral & intraoral photographs.

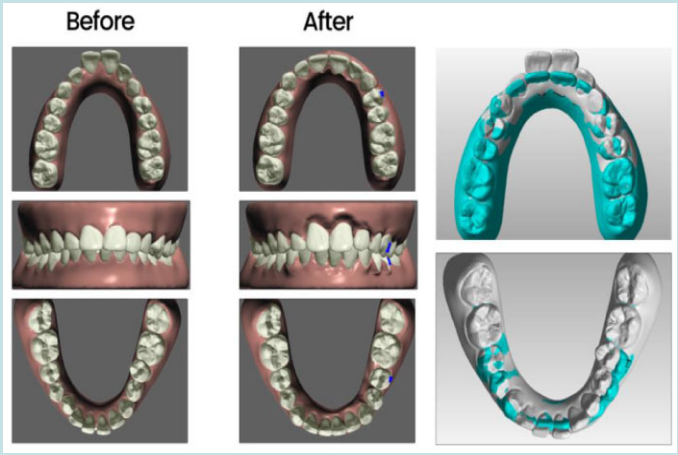


Figure 2: 3D treatment plan (a) Before & After, (b) Superimpositions.

Treatment Progress

After the treatment simulation was approved, we received instruction forms (Figures 3 and 4) from the aligner provider, along with 28 sets of upper aligners and 24 sets of lower aligners. The recommended wear time for each set was 22 hours per day over a ten-day period. The patient was thoroughly instructed on maintaining oral hygiene and periodontal health. Initially, two derotation attachments were placed using a transfer tray—one on the upper left first premolar and another on the lower left second premolar. The first set of aligners was then provided, and the patient was scheduled for an Interproximal Reduction (IPR) appointment before transitioning to the second set.

IPR was performed in the upper arch at three locations, with 0.7 mm of reduction carried out bilaterally between the canines and first premolars, as well as 0.7 mm between the left first and second premolars. The patient then proceeded with the next sets of aligners and was monitored every three months for periodontal health and aligner tracking, which showed satisfactory progress. The patient exhibited good compliance throughout, leading to the successful completion of treatment.

Upon completion, two sets of retainers were issued. Instructions were given to wear them full-time for the first six months, followed by night-time wear for three months, and then every other night for the remaining three months.

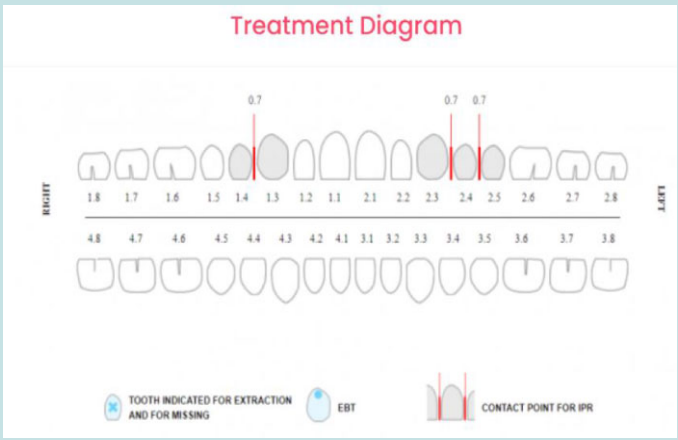
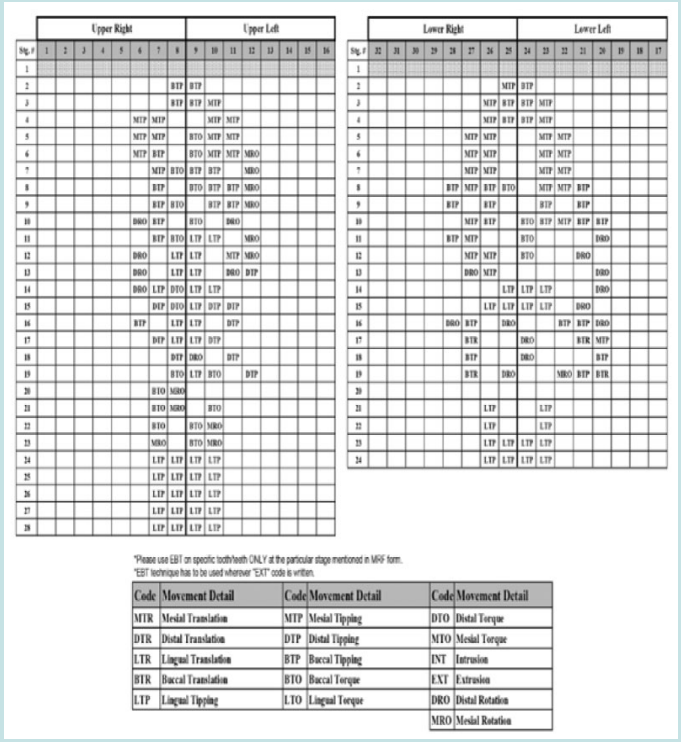


Figure 3: IPR form



Code	Movement Detail	Code	Movement Detail	Code	Movement Detail
MTR	Mesial Translation	MTP	Mesial Tipping	DTO	Distal Torque
DTR	Distal Translation	DTP	Distal Tipping	MTO	Mesial Torque
LTR	Lingual Translation	BTP	Buccal Tipping	INT	Intrusion
BTR	Buccal Translation	BTO	Buccal Torque	EXT	Extrusion
LTP	Lingual Tipping	LTO	Lingual Torque	DRO	Distal Rotation
				MRO	Mesial Rotation

Figure 4: Movement Record Form

Treatment Result

The entire treatment lasted 10 months, during which each aligner was worn for 22 hours daily and replaced every 10 days. By the end of the treatment, the initial crowding and proclination of the upper anterior teeth had been successfully corrected, resulting in the establishment of competent lips and an ideal interlabial gap. The outcome included achieving a proper overjet and overbite, ensuring optimal tooth alignment and bite function (Figure 5).

Figure 5: Post treatment records; extra oral and intra oral photographs.

Additionally, the treatment led to a well-centered alignment of the maxillary and mandibular arches, significantly improving the esthetic and functional qualities of the patient's smile. Throughout the process, periodontal health was carefully monitored and maintained, with no signs of gum recession or periodontal pocket formation, thereby preserving the patient's overall oral health.

Discussion

This study aimed to assess the effectiveness of clear aligners in treating Class II Division I malocclusion using a non-extraction approach. Class II Division I malocclusion is a dental misalignment characterized by a prominent upper jaw and protruding upper front teeth compared to the lower teeth. It features an increased overjet, where the upper front teeth extend significantly forward relative to the lower front teeth, and a deep overbite, where the upper front teeth overlap the lower front teeth excessively.

In this case involving Class II Division I malocclusion with mild crowding, clear aligners were used successfully over a 10-month period. The crowding was managed through Interproximal Reduction (IPR) in the upper arch and arch expansion in the lower arch. A total of 28 sets of aligners were used for the upper arch and 24 sets for the lower. While various treatment options were discussed, the patient chose clear aligners for their discreet, hygienic, and comfortable characteristics. Clear aligners offer a distinctive approach for adult orthodontic patients by addressing concerns related to aesthetics, hygiene, and potential metal allergies while providing a treatment timeline comparable to that of traditional braces [19].

Patient compliance plays a critical role in the success of clear aligner therapy. Educating patients can boost motivation, enhance acceptance of the aligners, and improve adherence [20]. In this case, the patient's active participation and collaboration with the orthodontist were key to achieving a positive outcome. The use of 3D digital software allowed the patient to visualize the expected tooth movements and monitor progress, serving as a valuable educational tool to communicate the treatment goals. Nonetheless, clear aligners do have certain limitations. They may be less predictable for cases that involve challenging tooth movements such as severe rotations, complex extrusions, or significant tooth translations, which may require supplementary treatment methods [21]. Although clear aligners may have higher laboratory costs compared to traditional braces, the benefits of virtual treatment planning, ease of use, and high patient satisfaction can help justify the additional expense. The digital setup facilitates both diagnosis and patient education, contributing to overall treatment success. In this instance, the patient’s cooperation and enthusiasm were crucial factors in the positive treatment outcome.

Conclusion

In conclusion, this case study highlights the effectiveness of using clear aligners for treating Class II Division I malocclusion. The discreet appearance of the aligners promotes better periodontal health and boosts patient acceptance. Additionally, their ability to provide accurate control over tooth movements, with a low risk of anchorage loss, presents a valuable option for clinicians when addressing cases of mild crowding and increased overjet.

Consent & Conflict of Interest

A written consent form was signed from the patient for use of the dental records for publications & social media marketing. Also, there is no conflict of interest with this paper.

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