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Diagnosis and management of crowding of teeth by clear aligners: A case report

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Abstract

A 22-years old male patient presented with the chief complaint of irregularly placed upper and lower front teeth. The patient had Class I canine relation in the left side and Class II canine relation in the right side, while molar relationship was Class I bilaterally. Cephalometric analysis indicated proclined upper and lower anterior teeth on skeletal class I jaw bases with normal growth pattern. The overjet was 2 mm, and the overbite was 3 mm. The maxillary midline had shifted 1 mm to the left from the facial midline and 1 mm to the left from the mandibular midline. Arch perimeter analysis showed 4 mm of tooth material excess in maxillary arch and 6 mm of tooth material excess in lower arch. Using Clear Aligners and interproximal enamel reduction (IER) was planned to correct the crowding of incisors and canines. Post-treatment results showed a correction of crowded upper and lower incisors, bilateral Class I canine relation was obtained, bilateral Class I molar relation was maintained, and inclination of incisors was improved. At the end of treatment, the patient showed pleased smile with improved smile arc.

Keywords: Clear aligners, interproximal enamel reduction (IER), Clin Check

Introduction

Influence of appearance in personal and orthodontist lives have led to a considerable interest among the adult population seeking orthodontic treatment in the last few years. Invisalign or Clear Aligners are the new age of aesthetic orthodontic treatment methods developed especially for adults who are very self-conscious of how they appear.

The frequency of malocclusions in adults is equal to or greater than that observed in children and adolescents^[1, 2].

Sometimes patients are hesitant about the pain and discomfort related to braces, as well as metallic smile is unpleasant for young adults who want straighter teeth but refuses traditional metal orthodontics. Clear Aligners are utilized to fix crooked teeth, and also close spaces and alter overbites. The treatment includes wearing clear, plastic plate that is custom made for the mouth, making Clear Aligners a less-recognizable treatment option.

While Clear Aligners method is regularly asked for its aesthetic advantages, numerous patients don't realize that it additionally has various oral health advantages^[3, 4].

The history of clear aligners is back to 1945, when Dr H. D. Kesling first proposed a clear, vacuum-formed tooth-positioning appliance for minor tooth movement. It was a labor-intensive process that required manually repositioning teeth reset in wax, and a clear vacuum-formed retainer was made for every tooth movement in a series of stages until the teeth were aligned. This technique was capable of minor tooth alignment. However, the amount of labor required for the task precluded its use on a wide scale, particularly for correction of more complex malocclusions^[5].

Another half-century went by until two graduate students at Stanford University in 1997 applied three-dimensional (3D) computer imaging graphics to the field of orthodontics and created the world's first mass-produced, customized clear aligner system. This new technology revolutionized the world of dentistry and orthodontics, launching it into the 21st century^[6, 7].

In the early days of clear aligners, most clinicians understood them to be an orthodontic appliance that was suitable for the treatment of Class I cases with minor crowding, resolved primarily with interproximal reduction^[8]. Today, clear aligners from Align Technology are made of a new triopolymer plastic and make use of optimized attachments. The teeth are moved according to sophisticated computer algorithms developed in the software program. There are

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many clear aligner systems being developed all over the world, and it is evident that this will be the future of orthodontics [9, 10].

It is important to understand that clear aligner treatment is a technique, not a product. There is a common misconception that clear aligners are a “compromise” orthodontic appliance that is only capable of minor tooth movement. However, the clear aligner system of today is a comprehensive orthodontic appliance, capable of treating a wide range of malocclusions [11].

Case report
Diagnosis

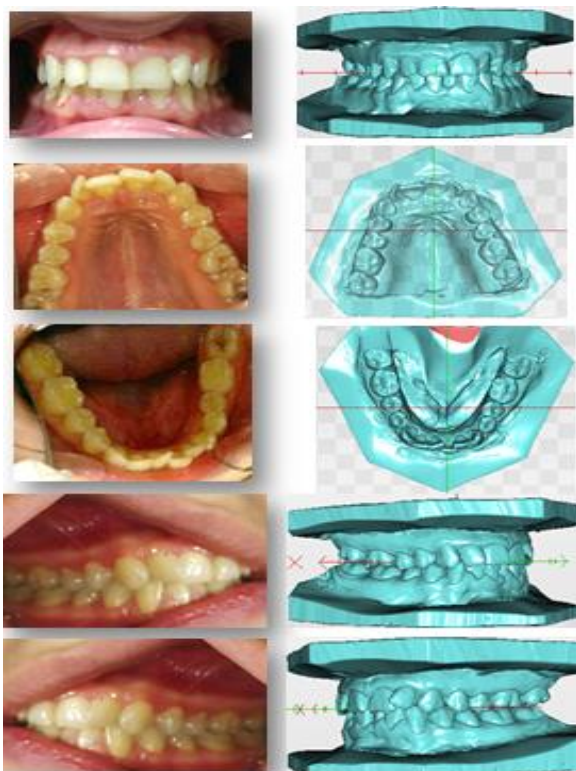


Fig 1: Pre-treatment intraoral photographs

A 22-years-old male patient in the permanent dentition presented with the chief complaint of irregularly placed upper and lower front teeth. The patient had mesocephalic head type, with a mild convex profile, and competent lips (Fig. 3). The patient had Angle's class I molar relationship. Cephalometric analysis indicated a normal maxilla and mandible with proclined upper and lower anterior teeth on skeletal class I jaw bases with normal growth pattern (ANB = 4) (Fig. 2). The overjet was 2 mm, and the overbite was 3 mm. The maxillary midline had shifted 1 mm to the left from the facial midline and 1 mm to the left from the mandibular midline. Arch perimeter analysis showed 4 mm of tooth material excess in maxillary arch and 6 mm of tooth material excess in lower arch (Fig. 1).

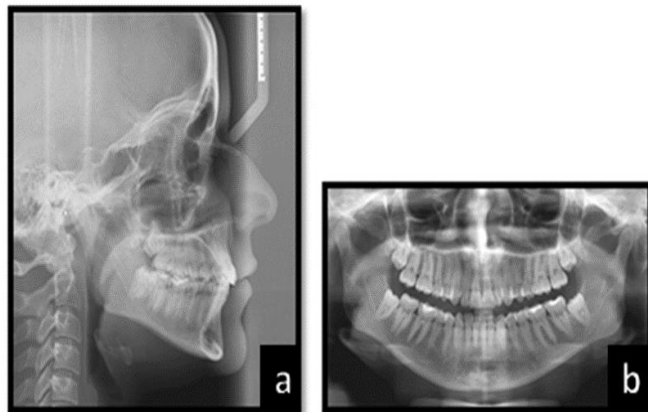


Fig 2: Pre-treatment radiographs
(a) Cephalometric view showed normal growth pattern (ANB = 4) with proclined upper and lower incisors
(b) Panoramic view showed complete permanent dentition with impacted upper and lower third molars

Treatment plan



Fig 3: Pre-treatment facial photographs

Therefore we treated for the purpose of improvement of crowding in upper and lower arches, and molar relationship was maintained. The treatment plan included using Clear Aligners combined with interproximal enamel reduction (IER).

Clear Aligners Clin Check software (Computational tooth movement simulation software) can be used for diagnosis, visualization of treatment results, and sharing of information with the patient and dental colleagues throughout treatment. [7].

Treatment progress

Twenty two aligners were used for the maxillary and mandibular arches (Ten aligners were used for the maxillary arch and twelve aligners were used for the mandibular arch). Each aligner was applied for 14 days on teeth (22 hours a day).

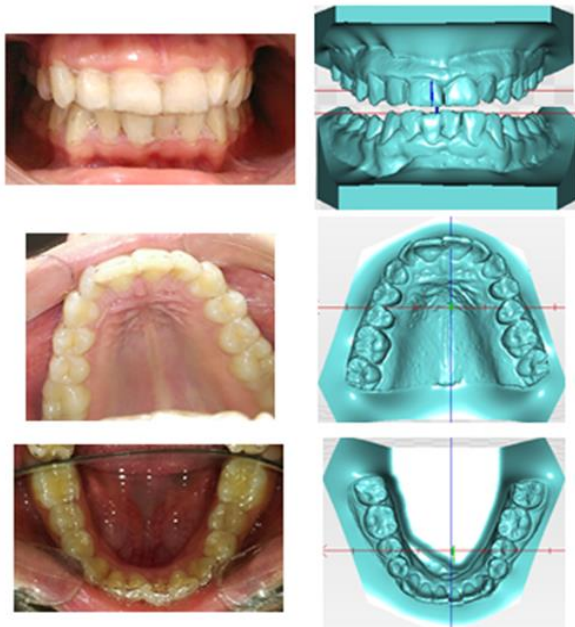


Fig 4: Mid-treatment intraoral photographs while Clear Aligners applied in the mouth

Interproximal enamel reduction (IER) was applied every dental appointment on specific proximal teeth surfaces before applying a new aligner.

In total, we have reduced 2 mm from enamel in the upper arch and 3 mm from enamel in the lower arch divided on 12 proximal surfaces of 6 teeth (incisors and canines), the enamel reduction amount was 0.16 mm on each proximal surface of upper incisors and canines, while it was 0.25 mm on each proximal surface of lower incisors and canines.

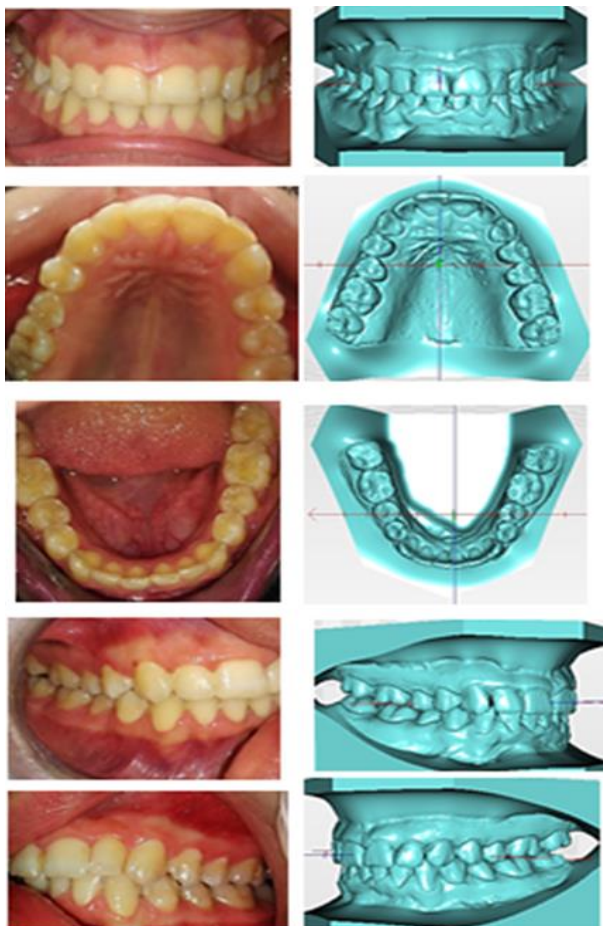


Fig 5: Post-treatment intraoral photographs

The remained tooth material excess (2 mm in the upper arch and 3 mm in the lower arch) was solved by correcting incisors inclination.

A moderate anterior expansion in the upper and lower arches was applied with effective retraction of the maxillary anterior teeth.

A selective intrusion of upper incisors and correction of canines rotations were achieved (Fig. 4).

The all treatment period was 5 months for maxillary and 6 months for mandibular.

Fluorinated toothpaste and rinse were used by the patient throughout the period of orthodontic treatment in order to ensure the re-mineralization of the dental surfaces which subjected to enamel reduction.

Treatment results

The post-treatment results for the patient showed excellent improvement in smile. Maxillary and mandibular anterior teeth proclination and crowding were corrected with good maintenance of the

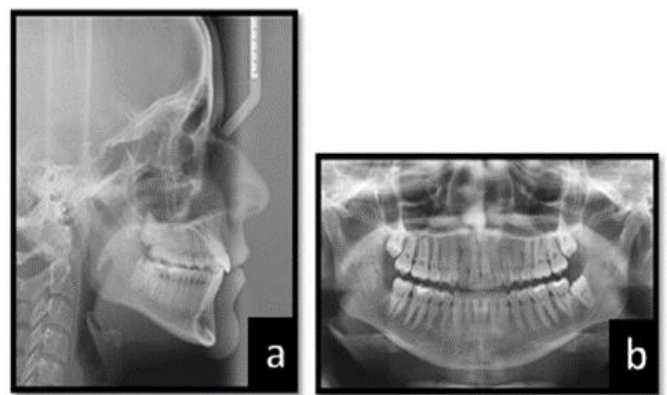


Fig 6: Post-treatment radiographs

(a) Cephalometric view showed normal growth pattern (ANB = 4) with correction of proclined upper and lower incisors

(b) Panoramic view showed adequate root parallelism with beginning of extraction of impacted upper and lower third molars

Buccal occlusion, Class I canine relation bilaterally with correction of the overjet and overbite (1, 5 mm for each), and Class I molar relation bilaterally maintained throughout the treatment (Fig.5). Post-treatment intraoral photographs and lateral cephalogram showed that the maxillary and mandibular incisors were inclined appropriately. The panoramic radiographs showed adequate root parallelism in both upper and lower arches (Fig. 6).

The patient wore aligners for retention over 9 months, and the results remained stable during maintenance and follow up.



Fig 7: post-treatment facial photographs

Discussion

One first aspect of great visual impact regarding the orthodontist-patient or orthodontist-orthodontist communication is due to the use and manipulation of accurate three-dimensional images of the patient's dental arches by the Clear Aligners system with the Clin Check 1.7 software. This tool allows a faithful visualization and prediction of the treatment in three dimensions (3D) prescribed by the orthodontist. From the interactive point of view, it also allows to change some initially prescribed movement, modifying the initial planning, progression and treatment outcomes. For the clinician, this means to visually predict the sequence, final result and estimated time of a suggested therapy before it was initiated. This way, it serves as a "self-evaluation" and a reference for possible corrections of the orthodontic planning. It is also important to emphasize that both the selection as the prescription and acceptance of a clinical case planning using the Clear Aligners system are responsibilities of the orthodontist. Furthermore, this reinforces the need of specific knowledge on diagnosis and compatibilities of the treatment goals with the selected therapy^[1].

Align Technology provides guidelines for the types of malocclusion that can be successfully treated with Clear aligners. That indicated mild to moderate crowding (Discrepancy: -1 to -6 mm), and/or spacing (+1 to +6 mm), non-skeletal constricted arches, and relapse after fixed appliance therapy^[12].

So in this case a thorough treatment plan is imperative with the Clear Aligners System and a full achievement of the expected treatment goals (Fig. 4) was observed. The orthodontic planning and treatment by these materials and methods together with the patient's good compliance, determined teeth movements that fulfilled the following therapeutic aims: a moderate anterior expansion in the upper and lower arches, appropriate alignment and leveling of the dental arches with effective retraction of the maxillary anterior teeth, a selective intrusion of upper incisors, and correction of canines rotations. Therefore, a Class I relation of the canines was achieved with more appropriate over-jet and over-bite and an enhanced esthetics of the smile. These findings correspond to those obtained by Boyd, Miller and Vlaskalic, who first revealed efficiency of this method as an orthodontic treatment alternative for clinical cases with mild to moderate malocclusions^[13, 14, 15].

The patient reported a full adaptation concerning the speech (Phonation) already during the first week using the aligners. He described a supportable degree of sensibility ("pressure on the teeth") during the first 24 and 48 hours of a new aligner placement (After change), what clinically corresponds to the sequential "activations" offered by a correction with progressive stages (0.25mm movement for each aligner). The patient also reported that the aligner esthetic condition is so favorable that it passes unnoticed inside the social context. Besides these advantages, the practicability of use and the clinical conduction of this method should be reinforced, considering the reduced chair time, the predictability and a minor number of interurrences.

Both the commitment to clinical visits and the compliance concerning the use and care of the aligners are fundamental in this treatment approach. The orthodontist should instruct, motivate and make the patients conscious so that they can achieve the expected corrections. A higher patient's expectation was also observed, since it is an "invisible" "step by step" alternative therapy and totally different from other conventional well-known ones.

All the advantages and/or disadvantages, together with the efficiency of an alternative method for the orthodontic treatment, are based on an accurate and detailed diagnosis and its consequent therapeutic planning. It is the orthodontist task to know and determine the harmony between the treatment goals and each of the properties, effects and limitations of the materials and methods that will be used.

Conclusions

Considering the treatment goals and outcomes in this clinical case with the Clear Aligners system, we can conclude that:

1. The comparison between the virtual treatment and the real treatment was highly satisfactory.
2. The planning and treatment with these materials and methods showed a trustful prediction, considering the achievement of the clinical findings compatible in quality, quantity and time to the expected three-dimensional planning.
3. The orthodontic treatment emphasizes the favorable properties from the esthetic, functional and handling point of view, for both orthodontist and patient.

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