

Case report – An esthetic approach to treat class II subdivision malocclusion using clear aligners

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ABSTRACT:

Evolving recent advances in esthetic orthodontic treatment like clear aligners increased a need for esthetic treatment compared to conventional fixed appliances. The clear aligner is a clear, removable and made up of semi-elastic polyurethane material where it uses computer aided modeling technique for the purpose of fabrication and to move the teeth for establishing optimal occlusion. The objective of this case report was to explain an advanced orthodontic treatment method for correction of Angle's class II subdivision malocclusion with proclined upper and lower incisors, increased overjet, midline spacing in upper & lower anteriors and upper midline deviation towards the left side by 3 mm relating to the facial midline using clear aligners. At the end of aligner treatment, class II malocclusion, spacing and proclination within short period of time was corrected compared to that of fixed appliance. The patient was satisfied about functional and esthetic outcome after 1 year follow up.

Keywords- Angle Class II, Computer-Aided Design, dental occlusion, orthodontics

DIAGNOSIS AND ETIOLOGY

A 19 year old male came to our department of orthodontics and dentofacial orthopedics at Karpaga vinayaga institute of dental sciences with a chief complaint of proclination of anterior teeth and midline spacing. The medical history of this patient was negative for illness and allergy and there is no previous dental treatment history. On extraoral examination, facial photograph showed that leptoprosophic face, convex profile with posterior divergence (Figure 1). At intraoral assessment, the patient presented with Angle's class II molar relation and class II canine relation on right side & class I molar relation and canine relation on left side, proclined and protruded upper and lower incisors, increased overjet of 5 mm and 1 mm overbite, midline spacing in upper arch 3 mm & lower midline spacing 2 mm and upper midline deviation towards the left side by 3 mm relating to the facial midline (Figure 2). There is no sign or symptom of temporomandibular joint disorders. Panoramic radiography revealed that all permanent teeth present, normal alveolar bone level and presence of no teeth anomalies. The pretreatment cephalometric analysis showed a skeletal class II relationship, orthognathic maxilla, retrognathic mandible and retruded chin, proclined upper incisors and lower incisor with high mandibular plane angle (Figure 3). The consent form was obtained from the patient. Confidentiality of the information provided was assured and participation was purely voluntary.



Figure 1-Pre operative extra oral photographs



Figure 2-Pre operative intra oral photograph



Figure 3-Pre operative x rays

TREATMENT OBJECTIVE

The main objective was to achieve a molar and canine in class I relationship and to coinciding the upper dental midline with facial midlines. Further objectives were to correct midline diastema, proclination of upper and lower incisors, obtain ideal overjet & overbite. Moreover, develops facial esthetics with pleasant smile.

TREATMENT ALTERNATIVES

The conventional fixed appliance is the first and foremost treatment option which includes the use of class II interarch elastics. Nevertheless, patient refused conventional fixed multibracket appliance.

TREATMENT PROGRESS

The aligner used for this patient was **I-ORTHOLIGN** manufactured by **INNOVATIVE ORTHODONTIC TECHNOLOGIES**. Impressions were taken and scanned by **SHINING 3D-DS 200 3D SCANNER**. **ENVISION ONE cDLM 3D** printer was used to fabricate stereolithographic models. The resin used in 3d printer is **E1D-E-MODEL LIGHT** by **ENVISION TECH**. This manufacturer system is layerless & domeless technology which delivers super smooth models with highest accuracy. The dual linear slides provide super stability during build process where eliminates any shifting in the parts and it is 75% less supports compared to regular DLP printers. Nearly 0.75 mm thickness of **BIOLINE aligner sheet** were used to fabricate aligner trace. The virtual set-up dictated 16 treatment steps for each arch in order to achieve midline correction, diastema closure, overjet reduction and achieve class I molar occlusion on both sides (Figure 4). Treatment started with the correction mesial rotation of upper 1st and 2nd molars and an expansion of both arches to allow coordination between arches and to favour bicuspid and canines into Class I relationships. The aligners orthodontic tooth movement achieved by entire body of the aligner can be distorted elastically and it returns to its original shape carrying the tooth with it. The elliptical attachments (2.5 mm height × 4.0 mm width × 1.5 mm depth) are given in canines and molars of all quadrants. The attachments were placed with the central point of their base surface located 1 mm above the clinical crown center in the z-axis direction. Patient visited hospital 2 times and instructed to wear each aligner for 22 hours per day and ask them to use next one after 14 days. Overall treatment duration of aligner therapy was 32 weeks with 16 steps.

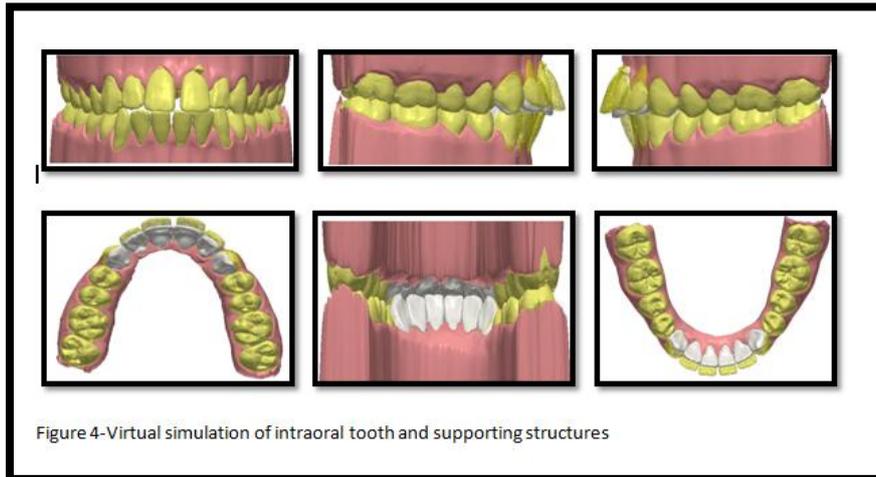


Figure 4-Virtual simulation of intraoral tooth and supporting structures

RESULTS

The result of post-treatment records reveals satisfactory final results with all objectives accomplished. On intraoral examination shows the accomplishment of all desired objectives, i.e. dental class I molar and canine relation, centered midlines, and upper and lower diastema correction, with proper incisor inclination and ideal overjet and overbite (Figure-5,6). The panoramic radiography presented good root parallelism, no signs of alveolar bone loss. The lateral cephalogram exhibited a major improvement in the axial inclination of upper and lower incisors, in conjunction with good vertical control (Figure-7)(Table -8). The patient was reassessed for functional and esthetic outcomes and results are stable after one-year follow-up.



Figure 5 -Post operative extra oral photos



Figure 6-Post operative intra oral photographs



Table 8- Cephalometric values

| Parameters | Case patient | | Norm | |
|------------|---------------|----------------|------|-----|
| | Pre treatment | Post treatment | mean | SD |
| SNA | 82° | 81° | 82° | ±2° |
| SNB | 78° | 78° | 80° | ±2° |
| ANB | 4° | 4° | 2° | ±2° |
| Wits | 3 | 2.6 | 0 | 1 |
| FMA | 31° | 32° | 25° | ±3° |
| U1-SN | 127° | 111° | 102° | ±5° |
| IMPA | 100° | 91° | 90° | ±5° |

SNA, Sella-Nasion-Subspinale Angle; SNB, Sella-Nasion-Supramentale Angle; ANB, Subspinale-Nasion-Supramentale Angle; Wits, Wits Appraisal; FMA, Frankfort Mandibular Plane Angle; U1-SN, Upper Incisor to Sella-Nasion Angle; IMPA, Incisor Mandibular Plane Angle.

DISCUSSION

The aim of the case report is to explain about management of class II malocclusion using clear aligner therapy where patient was not willing to undergo fixed appliance. The concept of moving the teeth using clear thermoplastic material was familiarized by Kesling who used clear aligner as tooth positioned [1]. Invisalign system was established by Align Technology in 1999, it helps to treat more difficult tooth movement using clear thermoplastic appliances produced from casts and manufactured using CAD-CAM technologies [2]. Initially, the aligners were used effectively to deal with mild malocclusions such as anterior crowding and generalized spacing. However, there were controversies over whether moderate to difficult orthodontic treatment could be methodically accomplished with the orthodontic aligner system [3]. The dental features of class II malocclusion present mesial rotation of their maxillary 1st and 2nd molars. One of the foremost reasons for molar displacement is that the mesial movement into the residual leeway space where it creates loss of arch length and leads to mesial rotation of the remaining dentition anteriorly, creating a class II cuspid relationship and increased overjet [4,5]. The study by Lombardo L et al in 2013, proved that plaque

retention was more in both labial and lingual appliances which consecutively leads to increase in *S. mutans* concentration and gingival inflammation [6]. Likewise, use of fixed multibracket appliances showed increased concentration of chromium and nickel in patient mucosa which may provoke DNA damage [7]. Indeed, previous studies have shown that there is no association between aligners and any type of cytotoxicity [8]. The study by Buschang PH et al revealed that estimated time period for aligner is lesser than conventional fixed appliance therapy [9]. Ormiston JP et al suggested that Class II are about two times as expected to be unstable and patient with more than 5 mm of arch length before treatment would have roughly half the risk of being unstable [10]. The objective of the treatment was completely accomplished after sixteen months of active treatment and considering Ormiston JP finding, current case achieved full cusp class I molar and canine relation. Despite this, problem encountered during completion of treatment was mild rotation seen in mandibular right canine. Reason behind mandibular crowding is multifactorial like late mandibular growth, complex growth pattern, soft tissue maturation, force from periodontium, tooth structure, occlusal factors, and changes in connective tissue which might cause rotation in mandibular canine. Crowding and facial divergence might increase anterior vertical dentoalveolar eruption because hyperdivergence cause retroclination of the incisors, which may cause crowding by reducing the arch length [11].

CONCLUSION

The use of aligners is an effective means of resolving orthodontic problems such as class II malocclusion, proclination and anterior spacing within short period of time related to conventional fixed orthodontics. The goal of treatment was achieved with exceptional esthetics and good oral hygiene.

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