

# Invisible Aligners- Is it the future of Orthodontics?

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**Abstract:-** Now a day's patients are seeking for more aesthetic orthodontic treatment and donot prefer wearing the old fixed metallic orthodontic brackets and wires. Invisalign was introduced in the year 1999 by Align technology which grabbed the attention of the patients especially young adults and also the dental professional's attention due to the transparency of Invisalign appliance. Now a day's face and the teeth have equal importance in presenting oneself to the outer world. Tooth coloured braces had a popularity for few years but declined because of their own disadvantages. Now a days, orthodontic have given new dimension for treating the patient with aesthetic considerations.

**Keywords -** *Invisalign; Clear aligners; Invisible braces; Invisible orthodontic treatment; Recent advances.*

## I. INTRODUCTION

With increasing need to appear presentable, there have been many advances developed in dentistry to meet the patient's demands. One of the dental treatments which people hesitate to undertake is the correction of mal-aligned teeth involving metal braces and brackets. People find this unaesthetic. To tackle this, several alternatives for conventional braces have been developed. One among them is clear aligners which are also known as "Invisalign" (Fig 1). Invisalign is the new age orthodontic correction method that people demand for.<sup>[1]</sup>

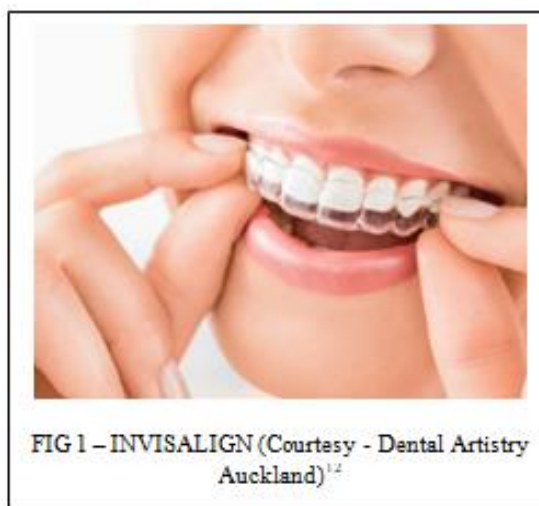


FIG 1 – INVISALIGN (Courtesy - Dental Artistry Auckland)<sup>1,2</sup>

Invisalign (Align Technology, Inc.) was introduced in 1999 based on the principles of Kesling (1945), Mr. Nahum (1964) and other authors such as Ponitz (1971) and McNamara.<sup>[1]</sup> Virtual 3 D model is produced by scanning the fabricated cast obtained from primary impression (Fig2). This 3-D model is then manipulated by the dentist using a pre-formatted software. This software produces a series of clear aligners that are used to correct the malocclusion.<sup>[2]</sup>



FIG 2 – INVISALIGN APPLIANCE  
(Invisalign.com)<sup>[1]</sup>

Each series of aligner is used to move teeth about 0.25 to 0.3 mm in two weeks and must be worn in a specific order.<sup>[3]</sup> It is suitable for correction of mild non-skeletal malocclusions in young adult patients and in permanent dentition with acceptable degree of malocclusion.<sup>[1]</sup> The appliance should be worn for 20 to 22 hours a day and for effective result each aligner should be worn 400 hours.<sup>[3]</sup>

## II. CRITERIAS FOR USAGE

### A. INDICATIONS

Invisalign are indicated in cases like a) mal-aligned teeth; b) mild crowding, where treatment is done with mild expansion or minor interproximal tooth reduction; c) deep overbite cases (Class II div 2) where intrusion and advancement of incisors has to be done; d) to retain to prevent relapse of corrected spacing problems of 1-5 mm; e) Expansion of narrow arches, f) distally tipped molars; g) extraction of lower incisor required in severe crowding cases that need to be kept aligned for further corrective procedures to be successful.<sup>[2]</sup>

### B. CONTRAINDICATIONS

Invisalign are contra indicated in cases with crowding and spacing exceeding 5 mm, skeletal discrepancies exceeding 2 mm, teeth which are rotated more than 20-degree, extrusion, tipping cases having more than 45 degrees and short clinical crowns and multiple missing teeth.<sup>[1]</sup>

Also, relapse is commonly seen in cases after retreatment of anterior crowding and open bite. Moreover, premolar extractions patients are not indicated for Invisalign treatment because the appliance cannot keep the teeth upright during space closure.<sup>[3]</sup>

In Centric-relation and centric-occlusion discrepancies, as compared to Invisalign, fixed appliances show better results in treatment of buccolingual crown inclinations, occlusal contacts, occlusal relationships, and in overjet cases.<sup>[3]</sup>

## III. METHOD OF FABRICATION

### A. MATERIALS USED

Clear aligner therapy is of two categories, the first category is done with thermoformed appliances commonly known as Essix Retainers are made by making alterations to the tooth positions on models and preparing aligners to treat the minor malocclusion.<sup>[2]</sup>

The second category is where Invisalign is constructed using a thin-transparent plastic material formed using Computer Aided Designing Computer Aided Manufacturing laboratory methods. The aligners are equivalent to the splints which covers both the clinical crowns and marginal gingiva. Aligners are designed to create a tooth movement to a maximal range from 0.25 to 0.3 mm over a couple of weeks.<sup>[2,7]</sup>

### B. CLINICAL TECHNIQUES

The clinical assessment, diagnosis, and treatment planning for Invisalign is similar to conventional orthodontics. The pre-treatment records are prepared, which include high quality study models, Orthopantomogram and Cephalometric X – rays and clinical images of the patient. These records (except the study models) are sent to Align technology. The impressions can be made using polyvinyl silicon material and it should be explicit. Poly ether impression material can also be used. Impression can be made either by single phase or dual phase impression technique. (Aquasil Impregum, Pentamix opt). Silicone bite material is used to record maximum intercuspation.<sup>[6]</sup>

Once the assessment and diagnosis are completed, the comprehensive treatment planning is submitted online and impressions and records are sent to Align technology in hard copy form for those not submitted online.<sup>[6]</sup>

On the range of ten to fourteen days, the patient's virtual models in 3-D are received by the orthodontist in which the treatment plan has been furnished into tooth movements and can view the virtual correction in each stage and from any point of view. If any corrections has to be done the orthodontist can ask for alterations. This process is called Clin check. Once the orthodontist is satisfied with the virtual treatment the process is effectuated by confirming that align can proceed and manufacture the aligners.<sup>[6]</sup>



FIG 3 – ATTACHMENTS ADDED IN DIGITAL CAST (Courtesy - Ladera Ranch Orthodontics)<sup>[1]</sup>

This entire treatment planning process is made viable by Invisalign, making cast of the impressions and scanning those to their computer software. This software individualizes each tooth, so they can be individually repositioned and the software relates the maxillary and mandibular teeth together so that co-ordination is maintained between the arches. This software is imperative for Align technology and forms the indispensable core to the Invisalign process.<sup>[6]</sup>

Around 4-6 weeks later, the full set of aligners, from the beginning to the end is delivered to the orthodontist and a patient start-up and care kit is also provided. The manufacturing process is the final computer aided technology. The 3-D models of each step in the realignment are transformed onto hard copy model through a laser build up process (Fig 3). These models are then used to make pressure formed aligners. On the first visit, fit of the initial aligners and comfort are analyzed. Inter-proximal reduction, if any, is done based on the schedule given by Align technology. The wearing and cleaning instructions are given to the patients. The second visit can be scheduled after 2-3 weeks. During the second visit, patient's comfort and whether they are using the aligners on full time basis were assessed. The second aligner is placed and the third aligner is delivered so they can replace it after two weeks. Patient is reviewed every four weeks. Around 10 to 50 aligners may be used depending on the severity and treatment duration can last for about 50 weeks.<sup>[6]</sup>

#### C. DURATION OF TREATMENT

The treatment time can be lengthened than the normal orthodontic procedure because it may require additional time for documentation, that may include initial assessment, diagnosis, treatment plan and completion of pre-treatment documenting like orthopantomogram, lateral cephalogram and bite registration.<sup>[3]</sup>

The technology looks after the transition of every tooth moment from begin to the end of the treatment. The lag time of the treatment after insertion can take up to 2 months and this may cause further delay in duration of treatment.<sup>[3]</sup>

This treatment requires patient's motivation for wearing the appliance for at least 20-22 hours a day. For a proper effectiveness of the treatment patient must wear all

aligners for 400 hours and patient co-operation is essential during the complete course of treatment. Around 0.25 mm of tooth movement is designed to be done in every aligner, again patient's acceptance plays a vital role.<sup>[9]</sup>

#### IV. BENEFITS AND DRAWBACKS

##### A. ADVANTAGES

Clear aligners are invisible – aesthetic, comfortable and easy to maintain. No mucosal irritations since there are no metal brackets and better oral hygiene can be maintained when compared to conventional braces (Fig 4).

The aligners as they are removable it is easy in maintaining the oral hygiene and helpful during eating.<sup>[5]</sup>

When compared with conventional braces, the visit to the dentist is comparatively less as patient can replace their aligners by themselves every few weeks depending on the dentist's instructions. Also, slenderization technique can be done to gain inter-dental space by which extraction of premolar can be prevented.<sup>[5]</sup>

On a technical basis, it is easier than lingual orthodontics. There is lesser risk of enamel decalcification unlike conventional braces. Studies have proven that there is no measurable root resorption, so the patients with short roots can be treated with Invisalign.<sup>[5]</sup> This appliance acts as a thin night guard which prevents further occlusal wear, so this is an excellent option for patients with the habits of bruxism and grinding. In a recent study, Clear aligner have proved that it reduces myofascial discomfort in patients with parafunctional habits and pain. The intrusion mechanics of tooth can also be predicted.<sup>[3]</sup> Periodontal health, quantity and quality of plaque were better in patients using Clear aligner when compared to fixed appliances.<sup>[10]</sup> Moreover, tipping of crown can be easily accomplished.<sup>[11]</sup>



FIG 4- TREATMENT OF BIMAXILLARY PROTRUSION USING INVISALIGN (Courtesy-Apos Publications)<sup>[12]</sup>

##### B. DISADVANTAGES

Patient should wear Invisalign for 22 hours a day, thus, the patient's compliance, desire and persistence towards the treatment plays a significant role to achieve expected results or outcome. This treatment is expensive compared to conventional braces. Poor patient compliance, skipping appointments, excessive bone growth, poor oral hygiene maintenance, fracture or damage of appliances can increase the duration of the treatment and expense and affect the quality of outcome. Patients may forget to remove

the aligner while drinking hot beverages which may cause warping or staining. <sup>[5]</sup>

Patients who must undergo premolar extractions are not suitable candidates for Invisalign treatment because this appliance cannot retain the teeth upright during the space closure. Minimal success rate has been reported in the treatment of anterior open bite using Invisalign. <sup>[3][8]</sup>

Furthermore, limited intermaxillary correction in case of skeletal discrepancies cannot be contemplated with Invisalign. If the treatment goes off track, the orthodontist must start the treatment from the beginning and patient has to bear the expenses for this again. The lack of operator control can also be perceived as a disadvantage. <sup>[6]</sup>

## V. CONCLUSION

Influence of appearance in personal and professional lives have a considerable interest among the adult population who are seeking orthodontic treatment. Invisalign appliance gives its esthetical attractiveness for the young adult patients. Educating the patient about the advantages, disadvantages, duration of treatment and outcome of the aligner therapy is most important for the patient cooperation throughout the phase of treatment. Invisalign appliance represents an option in treating of simple malocclusion (as suggested by Joffe) but has few limitations. Nevertheless, the Invisalign appliance can give an expected esthetics during the treatment, easy to wear, use and it enhances in maintaining the good oral hygiene when compared to the traditional fixed orthodontic treatment. <sup>[6]</sup>

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