



Invisible Orthodontics: Gen. Next!

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Abstract:

The awareness about orthodontics has lead to drastic increase in many adult & adolescent seeking orthodontic treatment over the past decade. The two major setbacks for non acceptance include visibility of the appliance and the long duration of treatment. To overcome the above-invisible braces like – ceramic brackets, lingual brackets came into existence, but could not reduce the treatment time to a greater extent. Later surgical procedures like periodontal distraction, dentoalveolar distraction & inclusion of implant came to play. But involved surgical risk. To overcome these - the invisible braces so called clear aligners came into existence.

Clear aligners are a series of clear, removable teeth aligners that orthodontists use as an alternative to traditional metal / ceramic braces. They are more comfortable, kinder to tissues and used for minor orthodontic corrections.

Key words: Invisible braces, Clear aligners

Introduction:

Increasing number of late adolescent and adult patients are seeking invisible orthodontic care to correct mild to moderate anterior malocclusions. Since 2000, clear aligners have been the treatment alternative for patients seeking invisible orthodontics for minor tooth correction. Recently, there has been growing interest by orthodontists in alternative methods of invisible orthodontics.

The most obvious advantage of the treatment is cosmetics. The aligners are completely transparent, therefore far more difficult to detect than traditional wire and bracket braces unlike the other invisible braces like the ceramic or lingual which are relatively inconspicuous to the conventional metal braces (Fig 1 A-C). This makes the method particularly popular among adults who want to straighten their teeth without the look of traditional braces, which are commonly worn by children and adolescents. In addition, the aligners are marketed as being more comfortable than braces.^[1] Due to the removable nature of the device, food can be consumed without the encumbrance of metallic/ ceramic braces.

Clinically, aligners avoid many of the side effects of traditional fixed appliances,^[2] for example the effects on the soft tissues and supporting structures.^[3] Almost all other types of orthodontic treatment will cause the roots of teeth to shorten (root resorption) for most patients,^[4] and

demineralization or tooth decay occurs in up to 50% of patients^[5] because (unlike aligners) they cannot be removed for eating and because they prevent accurate x-rays from being taken. Patients "graduate" to a new set of aligners in their treatment series approximately every two/three weeks. The aligners give less force per week and less pain than do fixed appliances. Fixed appliances are adjusted approximately every six weeks and apply greater forces.^[6]

Aligners should be removed to eat, drink, to clean the teeth, or to have them checked by the clinician. Because patients are able to remove the aligners, there are no restrictions on foods that could damage the appliances. Computerized treatment planning is compulsory as part of the aligner protocol. As with other forms of orthodontic treatments that incorporate a computerized plan, this allows the prospective patient to review the projected smile design, learn how long the treatment is likely to take, compare different plans, and make a more educated decision about whether or not to use clear aligner. Clear aligner treatments have been claimed to be quicker than traditional orthodontics. A large-scale study of 408 patients with traditional appliances in Indiana took an average of 36 months with a maximum of 96 months,^[7] while clear aligners takes between 12–18 months.^[2] In a much smaller study^[8] clear aligner was shown to be faster and achieve straighter teeth than alternatives but relapsed to ultimately get similar results to the traditional appliances examined. The study was considered to be too small for many conclusions to be statistically significant. Furthermore, this general concept that clear aligner is faster has been challenged by the review which points out that there are other brace appliance systems that take half the time, for example by incorporating surgery or temporary implants that are inserted into the bone, to accelerate the procedure.

Scientific Studies:

In a systematic review of the literature, published in 2005,^[9] Drs. Manual Lagraverre and Carlos Flores-Mir were unable to draw strong conclusions about the effectiveness of the clear aligner system. They pointed to the need for randomized clinical trials.^[9] Since this paper, more studies about the clinical effectiveness have been published; for example in the UK, Dr Paul Humber has analyzed 100 back-to-back clear aligner cases. Assessing the patients after two sets of aligners, he found that 94% of the dentitions had achieved the objectives set.^[5] In the

USA, Akhlaghi and colleagues compared treatment with the clear aligner system and conventional braces, and concluded that "conventional fixed appliances achieved better results in the treatment of Class I mild crowding malocclusions".^[10] In a comparison of outcomes between the two approaches, Kuncio et al.^[8] reported that the clear aligner group displayed greater relapse saying "the mean alignment of the clear aligner group was superior to the braces group before and after the retention phase, but these differences were not statistically significant. Therefore, even though the clear aligner cases relapsed more, they appear to have the same, if not better, overall alignment scores." In a larger study^[11] Djeu and colleagues had similar findings to Akhlaghi above and concluded that "clear aligner was especially deficient in its ability to correct large anteroposterior discrepancies and occlusal contacts". They felt that "The strengths of clear aligner were its ability to close spaces and correct anterior rotations and marginal ridge heights." They added "clear aligner patients finished 4 months sooner than those with fixed appliances on average."

Furthermore, work at NYU/Buffalo University by Dr Omar Fetouh in 2009,^[12] where 67 patients were studied, half of whom were treated with clear aligner and half with traditional braces. All cases were treated non extraction. The post treatment results were graded using the ABO Objective Grading System. The results show that there was no statistical significant differences between the scores of both groups in treatment Alignment ($p=0.059$), Occlusal Relationship ($p=0.223$) and interproximal contacts. The clear aligner group had higher scores in marginal ridges, bucco-lingual inclination, occlusal contacts, and over jet than braces group. The study concluded that "clear aligner can treat mild cases of malocclusion as efficiently, if not better, as braces."

Treatment:

An orthodontist, begins by taking upper & lower polyvinyl siloxane (PVS) impression with bite registration, radiographs & photographs of the patient's teeth and sending them to clear aligner lab. The impressions are put through a CT scan from which a computer creates a three dimensional model. The information sent is manipulated by non-dentist or a qualified dental technician who individualizes the teeth in the computer model and moves them to their final position as prescribed by the orthodontist. Custom software then simulates the movement of the teeth in stages. The orthodontist reviews the simulation online approves or modifies the treatment. Once approved, a plastic resin aligner is manufactured for each stage of the computer simulation and sent back to the orthodontist.^[13]

Attachments (also called buttons) are sometimes bonded

to teeth that need to be rotated or moved more than other teeth. Patients can expect as many as fourteen attachments. They are tooth-colored and made of a glass-like substance. Elastic wear (rubber bands) are also used to move the teeth forward or back relative to the jaw, thus accomplishing anterior or posterior corrections. Reproximation, (also called Interproximal Reduction or IPR), is sometimes used at the contacts between teeth to allow for a better fit.^[14]

Average treatment time is about one year, again depending on the complexity of the treatment. Simple treatments (minor crowding, minor spacing) may be as short as twenty weeks. Although the aligners are removable, they must be worn at least 20 to 22 hours per day to avoid delaying the treatment process. If they are not worn consistently, treatment time will increase.

After the regular aligner or braces treatment is complete, retainers composed of a similar plastic material are usually required to be worn, at least at night.

Like other orthodontic systems, the patient has some flexibility. The final position of the teeth is not completely determined by the last aligner. If the patient wants to change the end position because the actual position is not optimal, new aligners are ordered, which are usually included in the originally quoted cost, called a 'Refinement.'

The aligners are usually made of 0.030 inch polyurethane vacuformed over a stone model setup. Each aligner programs up to 0.5 mm of tooth movement, allowing for up to 2.5 mm of movement per arch.

Clinical indications:

The ideal candidates for treatment are non-growing patients with Class I malocclusion with minor or moderate anterior crowding or spacing, or who have experienced minor orthodontic relapse. It is appropriate for the following conditions:

- Crowding or spacing of 2.5 mm or less;
- Midline correction of 2 mm or less; and
- Rotations of 10 degrees or less.

Clinical studies have shown that the least predictable tooth movements with removable aligners are incisor extrusion, canine/premolar rotation and root uprighting. Therefore, even a Class I malocclusion that requires extrusion of the maxillary lateral incisors, canine rotation or bodily tooth movement to close a large diastema may be less suitable for removable orthodontic aligners and more appropriate for anterior lingual braces.

Case Report:

A female patient aged 25yrs reported with chief complaint of spacing in upper front teeth & overlapping in lower front teeth. As the patient was highly educated she had information about invisible aligners and requested if it can be done. After clinical and radiographic evaluation as she had no skeletal and dental abnormality to contraindicate, clear aligner was planned. A series of 7 aligners including retainers in each arch were given on a regular basis of change of appliance 3-4 weeks after seeing the response at each stage. During stage 2 of the lower to relive the crowding in the anterior segment interproximal reduction was done to gain approximately 2mm space, this also gave sufficient leverage of over jet to correct the spacing in the upper arch. The treatment was completed in 20 weeks followed with retention by continuation aligner. The serial photographs show the outcome of the clear aligner treatment procedure (Fig 2 A-J).

Fig 1. A- C. Case Showing Metal Brackets, Ceramic Brackets and lingual brackets



Fig. A



Fig. B



Fig. C

Fig. 2.A- D. Case treated with clear aligners, Pre Treatment: Extra oral, Intra oral Frontal, upper and lower occlusal



Fig. A



Fig. B



Fig. C



Fig. D

Fig.2. E-G. With aligners in finishing stage: intra oral frontal, upper and lower occlusal



Fig. E



Fig. F



Fig. G



Fig. I



Fig. J

Fig. 2.I-J. Post Treatment:
Extra oral & Intra oral.

Treatment with aligners:

When seating the first aligner, encourage patients to bite edge-on to ensure full seating. Attachments should be placed at the first appointment using aligner one — there is no separate aligner for placing attachments. Choose to perform all reproximity at the second aligner visit and never at the first appointment, which should be an enjoyable experience for the patient.

Sequencing treatment:

Each aligner is worn 22 hours a day for one to three weeks, resulting in treatment duration of 10 to 20 weeks. AO Laboratory literature suggests that check-up evaluations may be as infrequent as six to eight weeks, with the patient given the subsequent aligners to change on his or her own.

Give one aligner per office visit, with each aligner to be worn for a minimum of three weeks. Patients may assume a certain amount of chair time to justify the cost of treatment, without which may cause frustration despite achieving high quality results.

Disadvantages

Like traditional fixed braces, they are largely dependent on a patient's habits and their co-operation. The success of the clear aligners is based on a patient's commitment to wear the aligners for a minimum of 20–22 hours per day, only removing them when they are eating, drinking, or brushing their teeth.

Because the aligners are removed for eating, they could be lost. It is recommended that the patient keep the previous aligners in case this happens.

Unlike traditional braces, if a patient grinds or clenches teeth during the day or while sleeping, the aligners can become damaged, however this protects the teeth from damage which would otherwise occur. In practice, however, this problem is very rare and a new aligner can be ordered. Also, similar to traditional metal braces, aligners may cause a slight lisp at the beginning of treatment. This usually disappears as the patient becomes used to the treatment.

The aligners are constructed of implantable-grade polyurethane. Though extremely rare, there may be cases of allergic and toxic sensitivity reactions because of material. Minor symptoms such as sore throat, cough, and nausea have been reported.

Word of caution:

Do not recommend placing attachments if the patient intends on bleaching during treatment (by using the aligner as a bleaching tray) as the composite buttons result in unbleached circles around the tooth.

Pricing:

The treatment price is often more than traditional braces. Treatment price is set by the orthodontist, although the cost of treatment varies considerably by doctor. Doctor fees are usually determined by complexity and length of treatment. As it is entirely dependent on precise lab procedures for CAD CAM designing of the series of appliances in the lab, expenses incurred is high which is transferred to the patients, thus making overall cost on higher side.

Conclusion:

Clear aligners are the next generation in invisible orthodontic therapy. Even though there are limitations for major corrections, with time solutions would come & also at a reduced cost if more and more adults opt for such treatment procedures.

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