

## Review Article

# Aesthetic Removable Orthodontic Alternative- Invisalign

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### Abstract

Orthodontic treatment is one of the most essential and effective way to make individual smile in to radiant and more attractive smile. Sometimes patients are hesitant about the pain and discomfort related to braces as well as for image conscious teens and adults who want straighter teeth but will not consider traditional metal orthodontics. Invisalign aligners are utilized to fix crooked or mal aligned teeth, and also close spaces and alter overbites. The treatment includes wearing clear, plastic plate that is custom made for the mouth, making Invisalign a less-recognizable option. This review article has been prepared by doing a literature review from world-wide web and pub med/Medline.

### Introduction

The word orthodontics came from two Greek words orthos<sup>1</sup> means normal, correct, or straight and ‘dontos’ means teeth. Correction of malocclusion by correcting and improving the position of teeth is main concern of orthodontist [1]. The benefits of orthodontic treatment often go beyond the obvious physical changes of an improved bite and straighter teeth; it is also a great way to improve a person’s overall self-image. During orthodontic treatment braces are used to move the teeth by applying the pressure. The braces usually consist of small brackets cemented to the teeth which are connected by wire and rubber bands. A wire is regularly tightened by the dentist or orthodontist to gradually shift the teeth and jaw. Even with all of the recent advancements in orthodontics, wearing braces has never been easier. The brackets appear ugly on the patient’s smile, looking even dark on the teeth. It is very unattractive for any typical individual and it is even a more concerning issue for the individuals who are more established, who can’t bear resembling a metal-mouth just to have straighter teeth. Having metal free mouth is what any person in personal relation job always dreams of- flashing metal isn’t consider being a fashion. Investigators brought forward a few solutions like ceramic or composite braces, lingual orthodontics, and clear aligners to address the increasing aesthetic demand as an alternative to conventional braces [2-4].

Many adults are concerned about wearing metal braces and often put off treatment. Luckily, there are ways to correct most malocclusion problems by using clear braces such as Invisalign. Invisalign allows you to correct your smile while wearing a series of clear aligners, which are not that noticeable [5].

Invisalign is a virtual orthodontic appliance that is utilized to straighten the teeth without support of an undetectable way.

Invisalign makes utilization of the series of transparent, removable teeth aligners that will gradually straighten the teeth, which is the best alternative for patients who consider dental braces that require no consideration of metal wires or brackets. It is a highly recommended alternative to conventional metal dental braces and is considered by the patients to maintain their esthetic look [6]. Invisalign is perceived as a viable orthodontic procedure that corrects a wide assortment of bite, spacing and crowding issues utilizing a series of uniquely custom made, almost invisible, comfortable and removable aligners. While Invisalign is regularly asked for its aesthetic advantages, numerous patients don’t understand that it additionally has various oral health advantages [7].

The Invisalign system uses CAD/CAM stereo lithographic technology to forecast treatment and fabricate many custom-made aligners from a single impression. Invisalign has been used to treat over 300,000 people worldwide, most of them above 19 years of age [8].

The patented Invisalign system uses a series of clear, removable aligners to gradually reposition teeth. We've chosen to offer the Invisalign system because the aligners are more visually appealing than braces. They are also removable, which makes it easier to clean your teeth after eating. The aligners are smooth and comfortable and they don't irritate your gums, cheeks and tongue. The Invisalign system also eliminates any allergic reaction with metal [9].

### Invisalign-What exactly this is?

Invisalign is a popular alternative to metal wire and bracket braces. This discreet system is ideal for image conscious teens and adults who want straighter teeth but will not consider traditional metal orthodontics. Invisalign was presented in the late 1990s by Align Technology Inc, and because of cutting edge innovation permitted a much less complex way to deal with this kind of treatment. In 1998, Align Technology (Santa Clara, Calif) presented Invisalign, a series of removable polyurethane aligners, as a stylish contrasting option to fixed labial braces [8,10]. Invisalign aligners or trays are made of medical grade plastic: polyurethane from methylene di phenyl diisocyanate and 1.6-hexanediol to be exact. The United States Pharmacopeia or the USP is the official pharmacopeia of the United States. USP standards for medical devices and prescriptions must be met and Invisalign materials are shown to be biocompatible to use for human use in the oral cavity. (Figure 1) Invisalign aligner trays are made in a highly controlled, high-tech medical manufacturing facility that utilizes specialized robots to mold and carve out each custom tray with laser precision [11].



Figure 1: Invisalign teeth aligner.

Invisalign is a different way of aligning teeth. The technology uses computer assisted 3D virtual models to correct dento alveolar malocclusions. A series of aligners is necessary to achieve the desired result. These aligners move the patient's teeth gradu-

ally into their desired new position. Each aligner is programmed to move a tooth or a small group of teeth 0.25 to 0.33 mm every 14 days. This unique method of tooth movement has involved more adults with orthodontic therapy [12,13].

### Procedure

You may undergo a routine orthodontic pre-treatment examination including radiographs (x-rays) and photographs. Your doctor will make impressions of your teeth and send them along with a prescription to the Align laboratory. Align technicians will follow your doctor's prescription to create a ClinCheck® software model of your prescribed treatment.

This 3D interactive software allows the technician to move each tooth in three dimensions, predict the "collisions (2 teeth occupying the same space) and build the sequence of movements precisely to obtain the optimal tooth movement and the resolution of the malocclusion (Figure 2).



Figure 2: 3D interactive Clincheck® software.

Upon approval of the ClinCheck treatment plan by your doctor, Align will produce and ship a series of customized aligners to your doctor. The total number of aligners will vary depending on the complexity of your malocclusion and the doctor's treatment plan. The number of aligners delivered is based on the complexity of the case and can range from as few as ten for minor corrections, up to 25 for moderate corrections and whopping 40 for severe conditions. The aligners will be individually numbered and will be dispensed to you by your doctor with specific instructions for use. Unless otherwise instructed by your doctor, you should wear your aligners for approximately 20 to 22 hours per day, removing them only to eat, brush and floss. As directed by your doctor, you will switch to the next aligner in the series every two to three weeks.

Treatment duration varies depending on the complexity of your doctor's prescription. Unless instructed otherwise, you should follow up with your doctor at a minimum of every 6 to 8 weeks. Some patients may require bonded aesthetic attachments and/ or the use of elastics during treatment to facilitate specific orthodontic movements. Patients may require additional impressions and/or refinement aligners after the initial series of aligners [12,14].

#### **Aligner Insertion:**

1. Ensure you have the correct aligner-upper for maxillary teeth and lower for mandibular teeth.
2. To help maintain a strategic distance from disarray each aligner is engraved with unique case #, a -U|| for upper and -L| for lower, followed by the stage number.
3. You may insert either the upper or lower aligner first. When inserting each aligner, gently push the aligners over the front teeth. Then, apply equal pressure, using your finger tips, to your left and right molars (back teeth) until the aligner snaps into place. DO NOT BITE your aligners into position. This will damage them.
4. Minor discrepancies between the new aligner and the current tooth position are normal since the teeth need time to conform to the new aligner position. However, if there is a problem with fit, do not proceed to the next aligner stage.
5. Your aligners have been programmed to reduce from 200 grams of force upon first insertion to 40 grams within 48 hours. For ease of removal it is recommended that new stages be placed after the last evening brushing and not removed until the next morning. By that time the force is down to 100 grams and the aligners will be easier to remove.

#### **Aligner Removal:**

1. Using your fingers, start on one side at the molars (back teeth) and slowly work your way around to the other side.
2. To help prevent damage, avoid unnecessary removal.
3. Do not use any sharp object to remove your aligners.

4. Immediately rinse the aligners with water, shake off excess water, and store your aligners.
5. As you proceed to each new stage, all old stages are to be saved in their corresponding zip lock packet until treatment is completed [15].

#### **Mechanism of action of Invisalign?**

Initially, a 3D computer imaging technology will be utilized by an Invisalign trained dentist to plan for the complete treatment course based on the initial teeth position to the desired final teeth position. The imaging technology is generally used to fabricate the custom-made aligners in individualized series. The positional movement of teeth occurs incrementally when a patient wears an aligner for the duration of at least two weeks. Aligner can express its maximum potential which consists of movements planned with clin check, at the rate of 0.25mm per tooth. The old aligner will be later replaced by a new one after two weeks until a desired final position is achieved [16].

#### **Treatment duration**

On placement of each set of aligner followed by the next in series, the patient's teeth will gradually move lesser within the duration of several weeks. However, one should wear it until the teeth are straightened and aligned in final position as recommended by an orthodontist or a general dentist. As planned, the treatment progress can be observed by an orthodontist once every six weeks. The average treatment duration usually ranges from 7 to 15 months and it usually depends upon the total number of aligners. Although, the number of aligners can range between 10 and 30, however the number can vary for each case [6].

#### **Traditional Braces Vs Invisalign [17]**

With regular braces, you may experience some or all of the following: pain, discomfort, mouth sores or injuries caused by the brace wires, tooth decay (from inadequate brushing and flossing), plaque buildup, tooth discoloration, tooth/bracket breakage, or difficulty eating, food restriction (Table).

Parameters	Traditional Braces	Invisalign
Color	Metal braces have typically silver colour, for tooth color braces pt has to pay extra.	Clear/invisible
Treatment time	24x7 for a normal of 2 years, contingent upon patient needs.	22-24 hrs/day for 6 months to year and a half, contingent upon patient needs.
Cost	\$1,800-\$5,500	Average of \$5,000
Color	Metal braces have typically silver colour, for tooth color braces pt has to pay extra.	Clear/invisible
Treatment time	24x7 for a normal of 2 years, contingent upon patient needs.	22-24 hrs/day for 6 months to year and a half, contingent upon patient needs.
Cost	\$1,800-\$5,500	Average of \$5,000
Pros	More effective for more complex issues. No temptation to leave them out, so less self discipline is needed for success. No extra cleaning steps required besides regular brushing and flossing	Invisible Removable No issues with food getting caught. No difficulty eating. No discomfort from wires.
Cons	May have some pain, sores or discomfort from wires, brackets or tooth movement May have some tooth discoloration or breakage May have difficulty eating sticky, hard foods	May have discomfort from tooth movement. Must remove before eating or drinking anything but water. Must brush after each meal to avoid staining
NOT ideal for	Patients playing rough contact sports regularly	Patients with: bridgework back tooth bite issues The need to rotate canines or premolars The need to move teeth vertically Lack of discipline to keep trays in for at least 22 hours daily

**Table 1:** Difference between traditional braces and Invisalign.

**Indications [18,19]:**

- Somewhat crowded and mal aligned issues (1-5 mm). Treatment that should be possible with slight lateral and/or antero-posterior expansion, with some minor inter proximal tooth diminishment, or by extraction of a lower incisor.
- Spacing problems (1-5 mm).
- Profound overbite issues (Class II division 2 malocclusions) where the overbite can be lessened by intrusion and advancement of incisors.
- Narrow arches that can be expanded without tipping the teeth excessively.
- Relapse after using appliance therapy.
- Minor rotations.

**Contra- Indications [20]:**

- Teeth with crowding and spacing more than 5 mm.
- Anterior-posterior skeletal discrepancies of more than 2 mm (as measured by discrepancies in cuspid relationships).

- Centric-relation and centric-occlusion discrepancies
- Severely rotated teeth (more than 20 degrees).
- Open bites (anterior and posterior) that need to be closed.
- Extrusion of teeth.

**Disadvantages:**

- It is a fact that the aligners are removable means they are not persistently adjusting the teeth; consequently they were to a great extent reliant on a patient's propensities and their consistency in wearing the aligners. The accomplishment of the Invisalign aligners depends on a patient's dedication to wear the aligners for at least 20-22 hours for each day, just evacuating them when they are eating, drinking, or brushing their teeth.
- Invisalign® aligners are unable to rotate certain teeth. For eg. Few round shape lower premolars are difficult for aligners to grasp and apply rotational force.
- Invisalign® only has a limited ability to keep teeth upright

during space closure. Attachments, formed by bonding tooth colored restorative material in a vertical 'bar' to the buccal surface of certain teeth can give the aligners greater rotation and angulations control. This is only partially effective. As materials improve it is these 'attachments' that will allow much greater control over tooth movements. This may improve the treatment outcome in the more difficult cases, but would increase the overall cost.

4. Restricted control over root development, for example, root paralleling, gross revolution rectification, tooth up righting and tooth extrusion.
5. Limited inter maxillary correction. Obviously, severe skeletal discrepancies cannot be contemplated with Invisalign® alone. Surgery or a pre-Invisalign® functional phase would be necessary.
6. The use of Class II elastics to buttons bonded to the buccal aspects of the aligners has been tried but retention of aligners when wearing elastics is a limiting factor. Treatment planning does allow for some sagittal A-P correction of the buccal segments up to 2 mm and, thereby, some dento-alveolar reduction of any maxillary incisor protrusion.
7. Lack of operator control. As the aligners are made in total, from treatment start to treatment completion, the clinician has no ability to alter the appliance during the course of treatment. If treatment goes off track, then new impressions are needed and the case is 'rebooted' through the ClinCheck® mechanism (as though one was starting treatment from scratch). This can be costly, even though an add-on 'insurance' payment can be elected before case submission to cover the reboot.
8. The system is also somewhat expensive, as conceded by the Align Company and can be more expensive than traditional wire and bracket systems.
9. Because the aligners are removed for eating, they could be lost. Invisalign recommends that the patient keep the previous aligners in case this happens.
10. Severely tipped teeth (more than 45 degrees).
11. Teeth with short clinical crowns.
12. Arches with multiple missing teeth.

#### **Advantages:**

1. Cosmetic aspect of the treatment is most important advantage of this treatment: the aligners are completely transparent, therefore far more difficult to detect than traditional wire and

bracket braces. This makes the method particularly popular among adults who want to straighten their teeth without the look of traditional metal braces, which are commonly worn by children and adolescents.

2. In addition, the aligners are marketed as being more comfortable than braces. Due to the removable nature of the device, food can be consumed without the encumbrance of metallic braces [18,21].

#### **FDA Approval**

Invisalign aligners are classified as Class II medical devices by the FDA, and Align Technology, Inc. received the necessary 510K clearance from the FDA to be able to sell and market the Invisalign system in 1998.

#### **Invisalign Cost?**

The cost of Invisalign treatment is comparable to the cost of metal braces, and in the U.S., can range from \$3,000 - \$8,000. As with other medical treatments, only your doctor can determine the actual cost based on your specific needs and will work with you to customize your individual plan. Other factors contributing to your cost may include the complexity of your individual needs, how long you are in treatment, where you live, your doctor's experience level, your orthodontic insurance coverage, and additional factors determined by your orthodontist or dentist. In some cases, complex treatment needs may result in costs that exceed the range above [21].

#### **Conclusion**

If anybody has a desire for a delightful smile, metallic braces cannot be an option? Now, Invisalign® could provide for you that smile you generally needed without utilizing brackets also wires. Invisalign® is arrangements of customized, clear, retainer-like appliances that can be utilize to straighten the teeth. Basically unobservable and removable, patient might at last smile with confidence. The Invisalign framework has opened another territory for grown-ups orthodontics, serving patients who might not have any desire of routine appliances or for whom conventional removable appliances might be unsuccessful.

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