

The Invisalign: A Review

Abstract

Influence of appearance in personal and professional lives have led to a considerable interest among the adult population seeking orthodontic treatment in the last few years. Since then there has been an increased demand for esthetic alternatives to conventional fixed stainless-steel appliances. Align Technology (Santa Clara, California) has addressed this demand by developing an “invisible” method of orthodontic treatment (Invisalign) that uses a series of computer-generated, clear, removable appliances (aligners). Although the computerized Invisalign system is new, the idea of removable, flexible appliances made on an idealized setup has been used for many years. Before bonded appliances were in common practice. The practice of orthodontics is faced with new trends. Adults are increasingly aware of the influence of appearance in their personal and professional lives. Align Technology’s Invisalign system was introduced as a new orthodontic tool. This product offers adult patients full orthodontic treatment with an esthetic appliance. With Invisalign, the orthodontic treatment works through a series of invisible, removable & comfortable aligners which are convenient to the patient. Invisalign have been proven effective in professional research & in orthodontic practices worldwide. Many certified orthodontists are now providing this non-traditional treatment choice as an alternative to traditional metal braces.

Key Words

Invisalign; CAD-CAM; stereolithography

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INTRODUCTION

Movement of teeth without the use of bands, brackets, or wires was described as early as 1945 by Dr Kesling, who reported on the use of a flexible tooth positioning appliance. Later, Nahoum (Vacuum formed dental contour appliance, 1964) and others wrote about various types of overlay appliances such as invisible retainers. Minor tooth movements have also been achieved with a technique developed by Raintree Essix (New Orleans, La). This technique uses clear aligners formed on plaster models of the teeth. The aligners are then modified with “divots,” which create a force to push on the individual teeth, and “windows,” which create the space for teeth to move into. This type of appliance can be effective in correcting mild discrepancies in the alignment of

teeth. However, movements are limited to 2 to 3 mm; beyond this range, another impression and a new appliance are needed. Align Technology, Inc (Santa Clara, Calif), introduced the Invisalign system several years ago. Invisalign takes the principles of Kesling, Nahoum, others, and Raintree Essix even further, using computer-aided-design-computer-aided-manufacture (CAD-CAM) technology combined with laboratory techniques to fabricate a series of custom appliances that are esthetic and removable, and that can move teeth from beginning to end.^[1,2]

Indications

1. Mild to moderate crowding (1-6 mm).
2. Mild to moderate spacing (1-6 mm).
3. Nonskeletal constricted arches.
4. Relapse after fixed appliance therapy.



Fig. A: Polyvinyl siloxane impression



Fig. B: Three-dimensional computer image from impression



Fig. C: Set of clear plastic aligners

The manufacturer claims that Invisalign can effectively perform the following orthodontic movements: 1. Space closure. 2. Alignment after interproximal reduction. 3. Dental expansion. 4. Flaring and distalization. 5. Closure of a mandibular incisor extraction site can also be executed successfully.^[3-5]

Advantages

1. Highly esthetic
2. Removable treatment modality to correct adult malocclusions.
3. Patients find the aligners relatively comfortable to wear and have consistently endorsed them.
4. The ability to remove aligners to eat, brush and floss.
5. Ease of use.^[3-6]

Disadvantages

1. However, there are several reasons that Invisalign might not be as effective as fixed appliances. A. Only relatively small magnitudes of change are possible because of the technical difficulty of evenly dividing larger overall movements into small precise stages manually B. Compliance: Aligners are removable, the orthodontist must rely on the patient's motivation and dependability to achieve the desired results. The removability of Invisalign is an advantage to the patient but not to the clinician. C. Minimally addresses the occlusion: It was evident that the same or an even better result could have been achieved with conventional braces in arguably less time.

2. Align Technology reports that 20% to 30% of patients treated with Invisalign might require either midcourse correction or refinement impressions to help achieve the pretreatment goals. However, many orthodontists report that 70% to 80% of their patients require midcourse correction, case refinement, or conversion to fixed appliances before the end of treatment.

Retention & Stability

At present, retention protocol with this appliance is similar to that used with other types of appliances. Usually the final appliance or a thicker version (0.04 inch) of it is worn full time for six months, followed by night time wear indefinitely.^[5,6]

Limitations

1. Severe derotations, complex extrusions, and large translations are less predictable with Invisalign alone and might require auxiliary treatment.
2. Although Invisalign's laboratory fees are higher than conventional appliances, the virtual setup, ease of treatment, and patient acceptance might compensate for the extra cost. This setup is not only a diagnostic aid, but it can also be used as an educational tool for the patient.
3. In addition, patient cooperation is imperative for the success of the treatment. For this patient, cooperation was not an issue because he was enthusiastic about his treatment.
4. Currently, Invisalign is not generally recommended in treating more complicated malocclusions such as severe deep bite, anteroposterior corrections greater than 2 mm,

uprighting severely tipped teeth, or premolar extraction cases. Nevertheless, the case selection criteria of Align Technology are merely guidelines and are not restrictive.^[4,6]

Patients Selection & Records

A candidate for orthodontic treatment with the Invisalign System should have fully erupted permanent teeth, with growth completed. There is no age requirement, but the ability to comply with the treatment regimen of nearly full-time wear is mandatory. Once a patient is determined to be a good candidate for Invisalign treatment, the usual orthodontic records are taken, including study casts, photographs, and radiographs.

Fabrication of Aligners

1. The polyvinyl siloxane impressions material must be used, because it yields highly accurate impressions that remain stable for as long as three weeks and allow multiple pours (Fig. A). Impression, Centric occlusion wax bite, Photographs, Radiographs are sent to Align Technology with a detailed treatment-planning form.

2. Align Technology produces a three-dimensional computer image (Fig. B) from the impressions. The impression are poured up in dental plaster and then placed in a tray and encased with epoxy and urethane.

3. The tray is placed into a destructive scanner; the scanner's rotating blades makes numerous passes over the epoxy-encased models, removing thin layer with each pass.

4. Scanner linked with computer which assembles scanned information to create a 3-dimensional rendering of the models.

5. After the bite has been established, performs a "virtual treatment" using a software program to 'cut' the virtual model and separate the teeth, allow them to be move individually then for virtual gingival placement to serve as a margin for the manufacturing of the aligners.

6. The orthodontist's prescription is followed in positioning of the teeth & the bite to proper alignment virtually with the company's Treatsoftwear.

7. If necessary, the clinician provides feedback on the proposed final position and intermediate tooth movements to Align Technology, and adjustments are made until the orthodontist is satisfied with the treatment plan and prospective results.

8. Once treatment is approved by orthodontist, Align Technology fabricates a set of clear plastic

aligners (Fig. C), with the help of "Stereolithography" The computer images are converted to physical models by using a process called stereolithography. These models are used to fabricate the aligners on a Biostar pressure moulding machine. Align technology engineers have formulated a proprietary material for use in the aligners.

9. Aligners are trimmed and laser-etched with the patient's initials, case number, aligner number, and arch (upper or lower).

10. They are then disinfected, packaged, and shipped to the orthodontist's office.

11. Orthodontist delivers them to the patient with instructions for use. The overlays should be worn 20-22 hours per day and removed only for eating, drinking, and toothbrushing or flossing. The patient wears each pair of aligners for one to two weeks before moving on to the next pair in the series. These appliances are disposable and virtually undetectable from about two feet away.

12. Each aligner about .030" thick. Each pair of upper and lower aligners in the series (single-arch treatment is also an option) incorporates a small adjustment, allowing for .25-.33mm of movement. The number of aligners per patient depends on the number of stages required to complete the treatment.^[3,5-7]

CONCLUSION

The Invisalign System has opened up a new area of adult orthodontics, serving patients who may not want conventional fixed appliances or for whom traditional removable appliances may be unsuccessful. With Invisalign a new system for orthodontic tooth movement using the established methods for minor correction to achieve greater magnitudes of correction has been introduced. The major advantage of the system is the esthetic, hygienic, low discomfort and removable nature of the appliance. There are currently limitations to this appliance in terms of case selection, increased cost, experience required for computer treatment planning, difficulty obtaining certain tooth movements, and the lack of potential in cases involving mixed dentition or impacted teeth. Like any other appliance, Invisalign is one type of appliance with its own advantages and disadvantages. Ultimately, much will depend on the research and development that can be generated to improve aligner control over tooth movement, and our understanding of treatment and ability to plan prospectively.

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