



The Aesthetic Alternative in Orthodontics With Sequential Aligners: The Invisalign System

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Abstract

The Invisalign treatment consists of a series of nearly invisible and removable aligners that are replaced every two weeks by a new set. Each aligner is individually manufactured for each patient. In addition, a virtual 3D treatment program (software ClinCheck®) shows the series of movements that teeth will follow during the course of treatment: it allows the patient to know in advance what will be the final result.

In this article are taken into account characteristics, indications, contraindications, disadvantages and advantages, among which the fact of being customized (dental impressions are taken that will serve to make the aligners), removable (for eating, drinking, brushing teeth), effective (the alignment of teeth begins immediately), comfortable (do not irritate gums or mouth) and transparent. Invisalign can transform the smile without interfering with the daily life of patients.

Introduction

The 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. The whole process of realization of the Invisalign aligners is a marvel of modern technology. This system uses the CAD-CAM technology in combination with laboratory techniques to fabricate a series of positioners (aligners) in polyurethane. This aligners are personalized, aesthetic and removable, capable of producing tooth movement (in increments of about 0.25-0.3 mm) from beginning to end of treatment. For each patient, the orthodontist submits a set of polyvinyl siloxane impressions, a centric occlusion bite registration, a panoramic radiograph, a lateral cephalometric radiograph, and photographs to Align Technology. At this point, the system scans the plaster models, develops a 3D presentation, separates the teeth (allowing them to be moved individually) and places virtual gum, thus simulating the results.

Tooth movements are staged in order to avoid

interproximal and occlusal interferences; the number of stages required is related to the amount and complexity of the necessary movement. These data are then sent to the orthodontist: when he has approved the proposed treatment plan, the aligners will be manufactured in order to reproduce, on the patient, the observed movement on the monitor. Each aligner is laser-engraved with the patient's initials, case number, aligner number and arch (upper and lower). They are then disinfected, packaged and shipped to the orthodontist.

Discussion

What is Invisalign: the Invisalign appliance includes a series of aligners that consist of a transparent, thin (less than 1 mm) plastic material manufactured with CAD-CAM technology. Each aligner is able to move the teeth a maximum of 0.25-0.3 mm in a period of two weeks and it must be worn in a specific sequence.

It is suitable for mild nonskeletal malocclusions in adult and adolescent patients, in the permanent dentition, with an acceptable level of compliance.

Illustration 1. Invisalign Aligners.

1. Compliance: since these devices are removable, patient motivation is important to achieve the desired results: to be effective, in fact, these devices must be worn 22 hours a day (must be removed during meals, when drinking hot drinks that could spot or cause deformation, sugary drinks and during the oral hygiene at home).

2. Clinician's involvement: despite the diagnostic preparation is similar to that used for therapy with conventional fixed orthodontic appliances, clinician plays a more limited role during treatment with the Invisalign appliances. After preparation, which includes an initial assessment, diagnosis, treatment planning and records (impressions, bite registration, radiographs, photographs), clinician displays the virtual treatment to evaluate the final position of the teeth given by the system: at this point he may require changes but, once the aligners have been produced, they can no longer be altered during the treatment. If the results are unsatisfactory, clinician may use

auxiliary appliances (fixed braces) or request new aligners.

3. Indications: the best results are obtained in the treatment of mildly malaligned problems (1-5 mm of crowding or diastema), deep overbite problems (Class II division 2 type malocclusion) that can be reduced by the intrusion or protrusion of incisors; narrow arches (non-skeletal type) that can be expanded by means of a limited movement of tipping; mild relapse after fixed appliance therapy.

4. Conditions difficult to treat and contraindications: crowding or diastema > 5 mm; skeletal antero-posterior discrepancies > 2 mm; centric relation and centric occlusion discrepancies; rotations > 20°; open bite (anterior/posterior); extruded teeth; tipping > 45 °; teeth with short clinical crowns; arches with multiple missing teeth.

Patients who require extractions (in particular of premolars or incisors) are not suitable candidates for this type of treatment, since these devices can not maintain the teeth in a vertical position during the closure of the spaces, thereby tipping excessive around the extraction sites.

5. Disadvantages: Djeu et al. found that fixed appliances are higher than Invisalign in the treatment of bucco-lingual inclinations, occlusal contacts, occlusal relationships and overjet.

In addition, because of the reduced thickness of these devices, intrusion of posterior teeth is often observed (0.25-0.5 mm): therefore it should be compensated in the retention period.

The Invisalign appliances, because of their removability, have very limited control over precise tooth movements (root alignment during closure of the extraction spaces, uprighting, significant tooth rotations and tooth extrusions) and can prevent the use of Class II or Class III elastics.

Bollen et al. have shown that the Invisalign appliances show the most predictable results with tipping movements.

The delay time between the formulation of a virtual treatment plan and the application of the appliance can sometimes exceed 2 months: this can cause further delay if dental changes are significant, since it will be necessary to reschedule the treatment and wait for the period required to make new aligners.

In a study conducted by Nedwed et al. of 54 patients it

was found that the majority of patients who undergo this treatment is female (78%) and this is probably related to the greater attention to the aesthetic aspect. The results obtained are shown in the table.6

Illustration 2.

Conclusions

Adult patients who need orthodontic treatment are increasingly motivated by aesthetic considerations: the treatment options currently available include Essix retainers, Trutain retainers, Invisalign and lingual orthodontic appliances.

The Invisalign appliances represent an option in the treatment of simple malocclusions (as suggested by Joffe) but have some limitations: in fact achieving similar results to those obtained with conventional fixed orthodontic appliances can be difficult. Nevertheless, such devices show excellent aesthetic during treatment phases, ease of use, are comfortable to wear and show superior oral hygiene.

The majority of adults who undergo this type of treatment are highly motivated, especially for what concerns the aesthetic appearance: the importance that is attributed to this aspect decreases with age, while more attention is placed to functional problems. Bauer & Diedrich found that patients tend to be less cooperative when the aesthetic appearance is the only treatment motivation.

If the indications are correctly established and the patient is properly informed, treatment with Invisalign can be a source of great satisfaction for both the patient and the clinician.

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Illustrations

Illustration 1

Invisalign Aligners.



Illustration 2

Table

Study conducted by Nedwed et al. of 54 patients.

<i>Adaptation time</i>	Max 1 week (83.3%)	Max 2 weeks (16.7%)	Max 4 weeks (0%)
<i>Pain</i>	Severe (11.1%)	Minimal (53.7%)	No (35.2%)
<i>Speech impairments</i>	Strong (1.9%)	Slight (51.9%)	None at all (46.3%)
<i>Tongue irritations</i>	Strong (5.6%)	Slight (24.1%)	None at all (70.4%)
<i>Temporomandibular joint (TMJ) problems</i>	Yes (9.3%)	No (90.7%)	
<i>Motivation</i>	High (93.6%)	Avarage (3.7%)	Low (0%)
<i>Satisfaction with prevailing progress</i>	Yes (88.9%)	No (3.7%)	Uncertain (7.4%)