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RESEARCH ARTICLE

CLEAR ALIGNER THERAPY

***Dr. Rosaline Tina Paul, Dr. Ligil, A.R., Dr. Roshna Mandayapurath, Dr. Joseph K. Thanikunnel and Dr. Parson Paul**

P.S.M. College of Dental Science & Research, College in Akathiyoor, Kerala, India

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ABSTRACT

Clear Aligner Therapy is an orthodontic treatment in which the patient wears a series of clear, removable aligners that gradually move the teeth to improve bite function and/or esthetic appearance. These are thermoformed plastic aligners made from semi elastic polyurethane or copolyester covering buccal, lingual and occlusal surfaces of teeth. As with other treatments of the body, much of its success depends on the understanding and cooperation of the patient. Whether clear aligner therapy or traditional braces—has some limitations, inconveniences and potential hazards. This article describes in detail the advantages, disadvantages, indications and contraindications also.

***Corresponding author:**
Rosaline Paul

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INTRODUCTION

Esthetics has been of paramount importance as far as the field of orthodontics is concerned. This realm has further expanded even to the treatment procedure. This has seen an upsurge of esthetically driven procedures: clear aligners, lingual orthodontics and use of esthetic brackets and arch wires. However, lingual orthodontics and esthetic brackets has its own disadvantages. Lingual orthodontics even though esthetic poses a major hindrance to the patients' tongue and its biomechanics is rather cumbersome. Clear Aligner Therapy is an orthodontic treatment in which the patient wears a series of clear, removable aligners that gradually move the teeth to improve bite function and/or esthetic appearance.[1] These are thermoformed plastic aligners made from semi elastic polyurethane or copolyester covering buccal, lingual and occlusal surfaces of teeth. As with other treatments of the body, much of its success depends on the understanding and cooperation of the patient. Whether clear aligner therapy or traditional braces—has some limitations, inconveniences and potential hazards. Clear aligners were introduced as an aesthetic alternative to fixed appliances. Orthodontic treatment with CAT was first introduced in 1945 by Kesling in the form of tooth positioners. Align technology in 1998 revised Kesling's concept and introduced invisalign aligners. Invisalign may be used for space closure, alignment, dental expansion, flaring and distalization.

However, the Invisalign concept was given by Kelsey Wirth and Zia Chisthi who founded Align technology in April 1997. Clear Aligner Therapy not only offers the end benefits of traditional wired orthodontic treatment, such as straight teeth and improved bite function, it also offers unique benefits during treatment that are only available when going wireless. Invisibility and patient comfort offered by clear aligner treatment (CAT) is the key factor that gives it an edge over the contemporary braces. Some of the advantages include the benefit of no wires, no brackets and no need to hide one's smile. The aligners are so clear that many people won't even notice one wearing them. Comfort is another advantage that the Clear Aligners offer. There are no cuts or abrasions from wires or brackets like with traditional braces. With Clear Aligner Therapy, it is convenient as there is often less time spent at the dentist's office than with traditional braces. As these aligners are removable, they allow the patient to eat, drink, brush and floss with complete freedom. Removable orthodontic aligners were created using computer aided technology. The aligners are made of clear plastic and formed on models that are digitally modified to slowly correct the alignment of the teeth. This mechanism of alignment is referred to as broad surface pressure. The original concept behind orthodontic aligners was an outgrowth of Dentsply Raintree Essix plastic used to stabilize anterior teeth. This system requires special training to utilize it and is rather costly to purchase.

Clear aligners may be broadly grouped into: - Minor Tooth Movement (MTM) with limited clinical applicability - Direct to consumer alternatives - Make your own aligners - Complex, Comprehensive systems[2] Clear aligners may be made in a series which relies on the progressive alteration of aligner shape using one aligner material. Clear aligners may be vacuum formed and some are pressure formed. Bonded resin attachments are a feature of some aligner systems. The attachments have been introduced to retain the appliances on the teeth and to extend the ability of clear aligners to perform movements. Aligner systems which lack the ability to incorporate bonded attachments can only generate limited tooth movement.

There are different generations of clear aligners namely: - First generation aligners which solely depend on the aligner to achieve their results. - Second generation aligners include composite buttons to be placed on the teeth and could also start to use inter- maxillary elastics. - Third generation aligners in which attachments are placed automatically.

The invisalign process involves the acquisition of complete patient records from the treating orthodontist. These records go through a series of steps from scanning to case setup and then back to the clinician for a review called ClinCheck. The process of manipulating virtual tooth movements is completed when the clinician approves the ClinCheck. Once the ClinCheck is approved, the aligners are processed and sent to the clinician.

GENERATION OF ALIGNERS

FIRST GENERATION ALIGNERS:

These earliest form were solely reliant on the aligner to achieve their results. No auxiliary elements were incorporated. These were used for the treatment of mild malocclusions. Djeu et al in 2005 compared their first 48 clear patients with a cohort of fixed appliance patients. Using the American Board of Orthodontics objective grading system, they evaluated the results produced by different treatment system. It was observed that both treatment modalities showed similar results in terms of marginal ridge alignment and root angulations. However, in terms of buccolingual inclination, occlusal contacts, occlusal relationship and overjet reduction, fixed appliances showed better results.

SECOND GENERATION ALIGNERS: In these aligners, the manufacturers began to encourage the use of attachments to improve tooth movement. Clinicians could request composite buttons to be placed on the teeth and could also start to use inter- maxillary elastics. However, the attachments introduced in the second generation aligners did not seem to improve overall accuracy. Kravitz et al (2008, 2009) assessed the accuracy of tooth movements produced by these newer aligners. The assessment was made between the groups; aligners with attachments/ aligners with interproximal reduction and aligners alone. Similar results were obtained between the groups.

THIRD GENERATION ALIGNERS:

In these systems of aligners, attachments are now placed automatically by the manufacturer‘s software where extrusions, derotations and root movements are required. Indentations in the aligners are fabricated where root torque is needed. Non- precision attachments can also be placed on the teeth where it is felt that they would improve the movements achieved. There are 3 common types of attachments: ellipsoid, bevelled and rectangular. Ellipsoid attachments are singly used for de- rotations or in pairs where root movements are attempted. Bevelled attachments are used most often when trying to extrude a tooth. The rectangular attachments are used when large mesio- distal movements are requested.[3]

TYPES OF CLEAR ALIGNERS

The clear aligners can be grouped into the following categories:

Minor Tooth Movement (MTM) with limited clinical applicability: They are positioned as a cheaper, faster alternative to the comprehensive orthodontic treatment. This category includes Originator, Simpli 5, MTM Clear Aligner and ClearguideSystem.

Direct to Consumer Alternatives: These are ―at home‖ treatment for the patient with a dental professional possibly offeringremote oversight. They are considered to be more convenient and 50% cheaper. Thiscategory of aligners includes Crystal braces and Smile Care Club.

Make Tour Own Aligners: 3D treatment planning software, integrated with scanners and 3D printers, enables full in-house or laboratory fabrication. They include Orchestrate, 3 Shape and Suresmile.

Complex, Comprehensive Systems: Incorporating 3D CAD CAM tooth movement, a computerised 3D interactive treatmentplanning and appliance design, bonded resin attachments and possibly additional featrures,designed for more complex, comprehensive tooth movements, improved control of toothposition in all planes of space. Example: Invisalign, ClearCorrect, ClearPath, eClingner, KLine and Orthocaps.[2]

INDICATIONS & CONTRAINDICATIONS

INDICATIONS: Primarily clear aligners are preferred by teenagers and adult patients because oftheir esthetic concern. Apart from esthetics, they are preferred in certain cases where clearaligner therapy presents with excellent results. Some of the indications of clear alignersinclude:

- Esthetic concern: the clear aligners are clear, comfortable and removable. As these
- Appliances are clear, they are undetectable from a distance of atleast 2 feet. These are esthetic alternative for straightening teeth.
- Mildly crowded and malaligned problems (1–5 mm). Treatment that can be done with some slight lateral and/or antero-posterior expansion, with some minor interproximal tooth reduction, or by removal of a lower incisor. Joffe et al suggested that Invisalign appliance is most successful for treating mildly malaligned malocclusions with 1- 5mm of crowding[4]

- Spacing problems including midline diastema : Mild spacing of about 1-5mm in adults and teenagers can be best treated using clear aligners.[4]
- Deep overbite problems (Class II division 2 type malocclusions) where the overbite can be reduced by intrusion and advancement of incisors. It is often indicated in patients with excessive maxillary incisor display at rest or a deep mandibular curve of spee associated with excessive lower anterior facial height. The clear aligners may be used with vertical elastics in such cases.[5]
- Anterior crossbite cases: the Modified Essix appliance represents a safe, quick, easy and esthetically acceptable alternative for the correction of anterior dental crossbite. The procedure is low- cost, involves no discomfort and it can be completedin few visits.
- Relapse after using appliance therapy: relapse is one of the main problem associated with fixed orthodontic treatment. However, they may be rectified using clear aligners.
- As retention appliances: the Essix retainers change the rules of permanent retention. They are thinner, but stronger, cuspid- to- cuspid of the full arch, vacuum formeddevices. The advantages include: the ability to supervise without office visits,absolute stability of the anterior teeth, durability and ease of cleaning, low cost and ease of fabrication, minimal bulk and thickness (.015‖) and brilliant appearance of the teeth caused by light reflection.[6]
- Minor rotations: rotations are reported to be difficult to achieve and control with the clear aligner. Kravitz et al (2008, 2009) demonstrated that aligners were able to control the rotation upto 15˚. But Gianluigi et al demonstrated a severe tooth rotations of lower incisors(upto 45˚) can be corrected with clear aligners.
- Sleeping bruxism: the clear aligners can be used for sleeping bruxism. While clear alignersseem to be capable of reducing clenching (occlusal load), in sleeping bruxism patients, thegrinding activity seems to be not influenced by those appliances atleast in the short term ofthe present investigation.

CONTRAINDICATIONS:

- Crowding and spacing over 5mm
- 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
- Severely tipped teeth (more than 45 degrees)
- Teeth with short clinical crowns
- Arches with multiple missing teeth
- Skeletal anterior-posterior discrepancies of more than 2 mm (as measured by discrepancies intercuspid relationships)

ADVANTAGES

- **ESTHETICS:** The most obvious advantage of the treatment is esthetics. 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.
- **COMFORT:** 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.
- **REMOVABILITY:** Clear aligners being removable help in maintaining the oral hygiene. Restriction in diet is also not a problem with clear aligner therapy.
- **BONDING TO ENAMEL DEFECT:** Clear aligner therapy is indicated in cases like amelogenesis imperfecta where the hypocaclified enamel makes bonding to teeth difficult.
- **ROOT RESORPTION:** The clear aligners have precisely controlled movements thatcan be specified by treating clinician and studies have shown clear aligners to haveleast root resorption.[7]

DISADVANTAGES

1. The success of the Invisalign aligners is based on a patient's commitment to wear thealigners for a minimum of 20–22 hours per day, only removing them when they areeating, drinking, or brushing their teeth.
2. Certain teeth are slightly problematic for Invisalign aligners to rotate.
3. They have limited ability to keep teeth upright during space closure.
4. Limited control over root movement, such as root paralleling, gross rotation

correction, tooth uprighting and tooth extrusion.

5. Limited intermaxillary correction. Severe skeletal discrepancies cannot be

contemplated with Invisalign alone.

6. Retention of aligners when wearing elastics is a limiting factor
7. Lack of operator control.
8. The system is 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.
10. Unlike traditional braces, if a patient grinds or clenches his or her teeth during the dayor while sleeping, the aligners can become damaged.
11. Aligners may cause a slight lisp at the beginning of treatment. This usually disappearsas the patient becomes used to the treatment.
12. There may be cases of allergic and toxic sensitivity reactions to Invisalign.
13. If the patient fails to keep the aligners in for the required length of time, then the next aligner in the series will not fit, and a new set of impressions and aligners will be necessary, adding to the cost.
14. While chair side time is greatly reduced, the input on treatment planning, treatment Clin Check revisions and mid-course Clin Check assessments can and does increasenon-chair side time.[8]

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