



## Clear Aligners-An Insight: A Review

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### Abstract

Esthetics plays an explicit role in the life of each and every individual with the face forming an integral part of it. Tooth play a very important role in not only chewing food, but also helps determine the facial profile of the individual, rendering them with a pleasant smile. Repositioning of teeth by conventional orthodontic brackets is slowly being replaced by the advanced form of orthodontic treatments such as invisible aligners. The ability of aligners to overcome the shortcomings of the brackets has increased the popularity of aligners as an effective alternative in the treatment of malocclusion. However, its efficacy still remains inconclusive in severe orthodontic cases due to lack of definitive scientific evidence. This review focuses on the journey of invisible aligners along with their applications.

**Keywords:** Clear Aligners; Invisible Aligners; Retainers; Orthodontics; Occlusion; Esthetics; Brackets

### Introduction

Esthetics plays a very important role in the life of each and every individual at some point of life which needs to be addressed with utmost significance as facial profile forms an integral part of it. Over the period of time, there has been a constant surge in the demand for improving esthetic appearance of an individual with minimal intervention in their functional day-to-day activities.

Both adults as well as children are apprehensive about their esthetic appearance as there is a direct as well as an indirect impact of the same on their personal, social as well as professional life. This has led to the use of many advanced treatment modalities which are designed to meet the patient's demands [1,2].

Correction of mal-aligned teeth requires intervention by the orthodontist, in order to diagnose, formulate and treat patients with

the aim to establish normal occlusion and provide a beautiful smile to the patient which enhances the profile of the patient. However, the redundancy of the patient to receive treatment due to various factors makes it a hindrance to receive care and establish an ideal occlusion [1,2].

Orthodontic intervention at an early stage is more feasible in terms of achieving a faster, favorable and best outcome [1,2]. The outcome of orthodontic treatment is to alter the aesthetics and function, which will in turn improve the patients' quality of life on a personal social as well as the professional front [3].

The conventional treatment involves the use of metal or ceramic brackets; however technological advancements have made invisible aligners a part of the orthodontic treatment modalities with it being an effective alternative treatment modality. Invisible aligners

overcome the most common primary reason for which the patients defers treatment, which is esthetics [1-5].

Other advantages include maintenance of oral hygiene, better social acceptance and less chances of injury to the soft tissues.

However, there exists a controversy if invisible aligners can be used effectively as an orthodontic treatment modality in all cases as the efficacy of invisible aligners in moderate/severe cases is non-conclusive [4,5].

Clear aligner was introduced as early as 1946 by Dr. Harold Kesling with the help of thermoplastic tooth positioners which were found to be effective in the alignment of tooth structure. Since, then there has been continuous research and development in making it an effective treatment modality for movement of teeth and restoration of occlusion to the normal form while maintaining the form and function of the tooth and providing the patient with an esthetic smile [4,6-8].

However, the impact of clear aligners as a treatment modality has gained popularity in the last years of 1990s with its establishment and practice more common since then as an alternative to the common conventional bracket treatment [9,10].

Clear aligners were more commonly used to correct mild crowding or diastema cases, however with the technological evolution it is now being indicated for the treatment of moderate as well as severe cases but are still limited in some cases [8,11].

#### Indications [2,12].

- Mild crowding of teeth of about 1-5 mm
- Spacing problems of teeth of about 1-5 mm
- Deep overbite in terms of Class II div 2 cases
- Patients with narrow arch
- Distally tipped molars
- Malaligned teeth
- Lower incisor extraction in case of severe crowding cases

#### Contraindications [1,13,14].

- In case of moderate/severe crowding
- Spacing >5 mm
- Skeletal discrepancies >2 mm
- Teeth which are rotated > 20°
- Extrusion – requires more force
- Tipping cases >45°
- Short clinical crowns
- Multiple missing teeth.

#### Protocol [15].

Treatment planning for invisible aligner patients is no different and follows the conventional protocol of assessment and diagnosis by the combination of clinical as well as laboratory (X-rays and study models). Models can be made with impression materials such as polyvinyl silicone material with silicone bite material being used to record maximum inter-cuspal contact or the use of 3D scanner is now being advocated to record the details. The recorded diagnostic details are then sent to the aligner manufacturer of choice for further processing [1,15].

The Virtual 3-D models are then received by the concerned orthodontist after a period of 10-14 days in a detailed pattern with the outcome being elaborated after each stage of use of aligner. Any modifications, in such process is requested by the concerned orthodontist which are incorporated into the treatment protocol (if feasible) by the aligner manufacturer. All such alterations are re-confirmed with the concerned orthodontist before the initiation of any fabrication process of the aligners [1,15].

Each manufacturer uses their own software and models in the fabrication of the aligners to provide the desired end result. The fabricated set of aligners are then sent to the concerned orthodontist with the patient start-up and care kit which helps as a guide for the patient in maintain the oral hygiene whilst cleaning and wearing of the fabricated laser-guided invisible aligner. Further, an instruction in terms of change of the aligner at the particular period is provided to the patient [1,15].

A follow-up visit during the change of aligners to the subsequent set is recommended to assess the patients comfort, usability as well as to address any issues/concerns they are facing whilst using the aligner. A review after every 4 weeks is recommended to assess the progress of the treatment with a change in aligner treatment most commonly recommended after every 2 week interval.

It is difficult to generalize the number of aligners and the treatment period as it is highly variable with the range being 10 to 50 aligners and the treatment duration lasting 50 weeks [1,15].

Thermoplastic materials remain the primary material used for the fabrication of clear/invisible aligners but the thickness of the material, gingival design, fabrication technique and the use of other materials such as attachments and auxiliaries vary from manufacturer to manufacturer. Further, different companies use different fabrication systems which makes it difficult to call it a “single system” [16,17].

**Advantages [1,2,14,18,19].**

- Invisible/Clear in appearance
- Increased confidence to smile.
- Better oral hygiene
- Technically much easier than lingual appliances
- Ideal for retreatment
- Short dental engagement period of visits
- More precision as treatment outcome
- Interproximal reduction can be done
- Extractions can be avoided

**Disadvantages [1,2,14,18,20].**

- Removable
- Patient compliance is very important
- Positive reinforcement of patient
- Required to be worn 22hrs/day
- To be removed during meals
- Treatment outcome is highly dependent on patients
- Poor oral hygiene is a common problem
- Not cost-effective
- Requires precise laser addition/increment
- Availability
- Not cost-effective.

**Key findings**

Establishment of any treatment modality requires concrete evidence with scientific backing to understand their true nature in terms of their characteristics and properties.

A detailed literature search in terms of efficacy of invisible aligners as an effective treatment modality showed the highest level of evidence segregated by Ke Yunyan., *et al.*, in their systematic review for assessment of effectiveness of clear aligners in comparison to the conventional fixed appliance therapy, wherein they found clear aligners to be in par with brackets in treating malocclusion. Clear aligners also showed better performance in terms of segmented movement of teeth along with reduced duration of treatment. However, neither adequate torqueing of teeth nor occlusal contacts could be established by aligners, with retention being the biggest common issue [4].

The use of clear/invisible aligners is more commonly indicated for the management/treatment of mild malocclusion cases, as invisible aligners are not as effective as brackets in carrying out procedures such as extrusion, rotation and bodily distalization of upper molar which was in agreement with the results of Rossinin., *et al.* [20].

Pavoni., *et al.*, [21]. found that braces produced significantly more transverse dento-alveolar width of maxillary intercanine and inter-premolar, and more perimeter of maxillary arch width than

clear aligners did, while two groups had similar effects on increasing intermolar width and maxillary arch depth.

Grunheid., *et al.*, [22]. found brackets to be more effective in decreasing the proclination of mandibular canines, with Hennessy., *et al.* [23]. finding similar results with respect to mandibular incisor proclination.

The most important part of any treatment is the post-operative or maintenance phase, which was found to be more unreliable in patients treated with clear/invisible aligners than in comparison with patients treated with brackets who showed better post-retention time, as per the results of Kuncio D., *et al.* [24].

Invisible aligners are becoming an integral part of orthodontic treatment modality which is slowly superseding brackets in the use of orthodontic treatment. However, the lack of scientific evidence, inability to exercise it in severe cases, availability and not being cost effective are some of the main limitations of invisible aligners. Further, different manufacturers use different technology, software and different materials for the fabrication of the aligners which may play an important role in determining the treatment outcome.

**Conclusion**

In recent times, invisible aligners have gained immense popularity due to its capability to overcome the shortcomings of the conventional brackets. Invisible aligners have been found to be effective to treat mild as well as moderate cases, with also some severe cases being managed effectively. However, there is a dearth need to provide more scientific evidence in support of use of invisible aligners as an effective alternative to the conventional brackets during the execution of orthodontic treatment in the anticipation of a desired outcome.

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