

A review of the clinical implementation of a transparent orthodontic system utilizing Korean technology

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Abstract

In recent years, various digital-based technologies have been implemented in dental clinical practice, with significant advancements observed in diagnostics and aligner therapies, particularly within orthodontics. While transparent orthodontic appliance systems have been introduced globally by several companies, this case review aims to demonstrate the clinical application of a computerized Clear aligners system developed in Korea, which offers a virtual treatment planning capability. The reported case demonstrates that a transparent orthodontic system utilizing Korean-developed technology can serve as an effective modality for correcting dental malocclusion.

Keywords : Clear aligners | computer technology | virtual treatment plan

1. INTRODUCTION

With the growing demand for esthetic treatments, an increasing number of individuals are seeking alternatives to fixed orthodontic appliances. Clear aligners offer a more esthetic and comfortable option for orthodontic care, leading to a substantial rise in their popularity over the past decade.[1] In 1997, Align Technology, Inc. pioneered the first orthodontic system utilizing three-dimensional digital technology, introducing it into routine clinical practice. By 2015, literature surveys had identified approximately 27 clear aligner systems available on the market, a figure that has been rising rapidly.[2-7] Other examples

of aligner systems developed using computer-based techniques include Orthero, ECliGner, EON Aligner, and Clear Correct.[1]

Following recent advancements, a new system named Serafine was introduced in Korea in 2022.[8] Similar to the Invisalign system, this approach utilizes a three-dimensional imaging program to algorithmically stage the correction of each malocclusion, thereby facilitating precise tooth movement. For every stage, a stereolithographic model constructed from photosensitive resin using a UV laser is fabricated, and a 0.030-inch-thick transparent overlay corresponding to each stage is sequentially worn by the patient for 1-2 weeks.

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The effectiveness of these appliances depends largely on the nature of the required tooth movement, making appropriate case selection essential. Suitable cases include mild or moderate spacing, mild or moderate crowding, narrow arch of dental origin, and relapse cases. Among their notable benefits compared to fixed braces are enhanced esthetics and removability, features that are especially valued by patients concerned about their appearance or those who speak publicly. Nevertheless, these devices present certain limitations; for example, achieving retention is challenging in cases involving short crowns, and such appliances are not suitable for making orthognathic skeletal corrections, restricting their use to malocclusions amenable to tooth movement alone. Moreover, patients typically incur greater costs than with conventional orthodontic appliances, due to expenses arising from digital scanning, virtual treatment planning, device production, and shipping.

To initiate therapy, the practitioner submits the treatment plan along with intraoral photographs, intraoral scan data, and radiographs into a dedicated computer program. The virtual treatment plan can then be reviewed and modified online, with any adjustments made by the company's orthodontist, who has the final responsibility for approval. All patient treatment plans are securely stored on the website. Upon final approval by the operator, the computer simulates sequential, controlled tooth movements, after which stereolithographic resin models corresponding to each stage are

produced, and the respective clear 0.030-inch-thick overlay appliances are fabricated for patient use.

The system enables both the operator and patient to view and assess the virtual treatment on a monitor prior to the commencement of therapy, and the entire progression of tooth movement can be thoroughly visualized from multiple perspectives. Final approval of this virtual plan is a critical step for the practitioner, because after approval, the treatment protocol cannot be altered.

Depending on individual patient needs, attachments are utilized to assist with specific tooth movements such as extrusion, intrusion, and rotation, following a process similar to indirect bonding, where composite resin is photopolymerized onto the enamel surface using a translucent template. The device is worn for 20–22 hours each day, typically over a one-week interval, although this may be adjusted based on the patient's and tooth's requirements. Regular comparison and overlay of the patient's tooth condition with the virtual treatment plan should be performed. Additional devices can be prescribed if necessary.

II. CASE REPORT

1. Diagnosis and etiology

A 20-year-old female patient, born in April 2002, presented to OO Dental Hospital for a multidisciplinary therapeutic consultation. The patient displayed a mildly convex facial profile with shallow glabellar lines. There were

no symptoms or clinical signs of temporomandibular joint dysfunction and the medical history was unremarkable. Intraoral examination identified a bilateral first molar relationship, as depicted in Figure 1. The maxillary left lateral incisor exhibited mild crowding.



Fig. 1. Initial conditions

2. Treatment objectives

The objective of treatment was to establish a class I canine and molar occlusal relationship with coincident midlines bilaterally, as well as to resolve anterior dental crowding.

3. Treatment progress

Clear aligner therapy was commenced after obtaining informed consent from the patient and reviewing the virtual treatment plan together (Figure 2). The aligners were changed every 10 days per set.

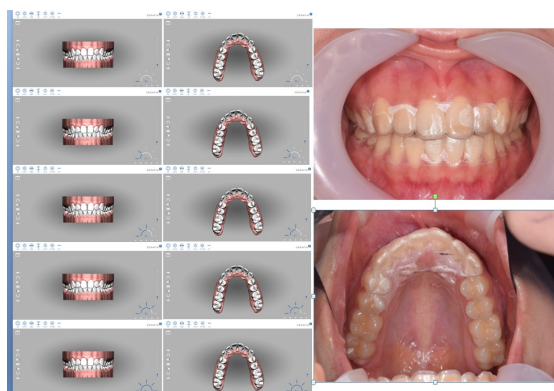


Fig. 2. Virtual treatment plan and wearing appliance

4. Treatment results

The active phase of clear aligner therapy lasted 2 months. As illustrated in Figure 3, upon completion of aligner treatment, a class I canine and molar relationship with normal overjet and overbite was achieved bilaterally. Post-treatment evaluation confirmed coincident midlines of the maxillary and mandibular arches. Additionally, a stable buccal occlusion was attained.



Fig. 3. Treatment results

III. DISCUSSION

Since the introduction of the Tooth Positioner (TP Orthodontics) in 1944, removable appliances similar to clear aligners have been utilized for facilitating mild to moderate orthodontic tooth movements. Although clear aligner therapy has long been incorporated into orthodontic practice, its adoption has notably increased since the release of Invisalign appliances (Align Technology) in 1998, making it a more prevalent option within the orthodontic repertoire. An online search currently identifies at least 27 distinct clear aligner products available for orthodontic treatment.[9] Bushang et al. [10] examined differences in total treatment duration and chair time between conventional fixed appliances and Invisalign® aligners in

non-extraction cases. Their findings indicated a 67% reduction in total treatment time for the Invisalign® group. The shortened duration associated with aligners was attributed to the lack of a finishing and detailing phase, which can extend up to 6 months when using fixed appliances. Conversely, for extraction cases, the treatment period with Invisalign® is 44% longer compared to fixed-appliance approaches.[11] Patients demonstrating good compliance require orthodontic visits at 10–12 week intervals with aligner therapy, whereas fixed appliances necessitate more frequent visits every 4–6 weeks. As a result, a greater number of appointments are needed in fixed appliance therapies. Additionally, the chair time per visit is significantly less for patients in the clear aligner group, enabling clinicians to manage a larger patient load.[10,12] The computerized searches across 3 databases yielded 1,553 articles, with 169 full-text documents assessed for potential relevance. Following the application of eligibility criteria, 33 studies were ultimately included. Cohort study design accounted for the majority of these (76%), and most had been published within the past 5 years (79%). Non-extraction protocols were the focus for 73% of the studies, and 79% documented outcomes specifically for the Invisalign® system. The movement most predictably achieved was buccolingual tipping, whereas rotation, intrusion, and extrusion exhibited lower predictability. Aligner therapy proved effective for resolving mild to moderate crowding, but

the rate of successful overbite correction remains limited.[13] Although the device described in this review was developed in Korea and has been in clinical use for a shorter duration than international technologies, a follow-up study is planned to compare foreign and Korean technologies, utilizing the findings from this study as a reference.

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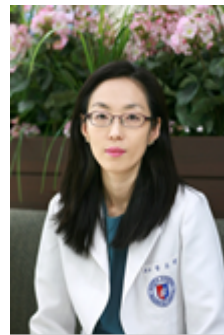
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