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Case Report

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Combined DNA appliance™ and Invisalign™ Therapy without Interproximal Reduction: A Preliminary Case Series

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Abstract

Objective: To use a biomimetic appliance prior to the use of removable clear aligners to reduce the necessity for interproximal reduction in the correction of malocclusions.

Subjects: Three adult females aged 23-38yrs. Subject A had a narrow upper arch and mandibular retrognathia; Subject B had crowding and an increased overjet; Subject C had anterior and posterior crossbite.

Intervention: All subjects were given optional treatment plans of DNA appliance therapy followed by Invisalign to improve the occlusion.

Results: Subject A showed improved mandibular positioning, with improved facial soft tissues. Subject B showed improved posterior occlusion with an increase in upper and lower arch width, resulting in improved facial soft tissues and smile esthetics. Subject C showed improved posterior occlusion, correction of the anterior crossbite and a corrected midline.

Conclusions: All three subjects that complied with a non-fixed, DNA appliance/Invisalign protocol showed functional and cosmetic improvements in occlusion without any interproximal reduction.

Introduction

The Daytime-Nighttime Appliance (DNA appliance™) system is designed to correct maxillo-mandibular underdevelopment in both children and adults [1]. The DNA appliance is preferred where fixed orthodontic appliances are not indicated. In some respects it represents a new generation of biomimetic appliances that are relatively easier to adjust as they putatively rely on gene-environmental interactions, secondary to temporo-spatial patterning [2] to achieve their effects. Typically, a DNA appliance consists of 6 patented, anterior 3-D Axial Springs™, a midline actuator (such as omega loops or screws), posterior occlusal rests, and a round labial bow (Figure 1).

The DNA appliance is preferentially worn during the evenings and at nighttime, but not during the day, and not while eating. The aim of the DNA appliance protocol is to harness circadian growth hormone rhythms that are encoded within the human genome [3].

The Invisalign system (Align Technology, Inc., Santa Clara, CA) has been available for several years, and represents another alternative to traditional orthodontics. In this procedure a wide range of orthodontic movements are achieved in an innovative way [4]. According to Phan

and Ling [5] patients seeking orthodontic treatment are motivated by esthetic considerations, but clinicians should recognize some of the limitations of this technique before choosing it as the treatment option. For example, while aggressive preparation is not required to obtain the desired result, finite amounts of enamel are removed through Interproximal Reduction (IPR) to achieve the best possible outcomes. In this regard, Boyd [6] suggests that IPR be undertaken when there is: better access to interproximal contacts; there is no significant overlap between teeth or until the tooth is aligned (to avoid removing enamel at an angle). In this way, a variety of malocclusions can be successfully treated, including moderate crowding, Class II division 1 malocclusions, and deep overbite. However, palatal expansion may be used instead of IPR as a primary way to provide space to resolve crowding. In a previous study, Singh [7] suggested that biomimetic appliances might best be deployed prior to the use of aligners. Therefore, the aim of this case series was to use the DNA appliance for foundational correction prior to the use of clear Invisalign aligners.

Study Design, Subjects, Interventions and Settings

In this prospective, longitudinal study, a female population between the ages of 23 to 38 years was selected. Subject A was 33 years of age with a narrow upper arch and anterior crowding. Subject B was 23 years of age with upper and lower crowding, and increased overjet. This subject had a history of orthodontic treatment followed by relapse. Subject C was 38 years of age with a posterior crossbite. She also had a



Figure 1: A typical acrylic-based DNA appliance, consisting of 6 patented, anterior 3-D Axial Springs™ (constructed from DNA wire™), a midline actuator (screw), posterior occlusal rests, and a round labial bow. The DNA appliance is preferentially worn during the evenings and at nighttime, but not during the day, and not while eating.

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history of prior orthodontic treatment but mandibular growth during her teenage years had occurred after her orthodontic treatment had finished, and she now wished to avoid jaw surgery for her current orthodontic correction. All subjects were given optional treatment plans of traditional, fixed orthodontics with brackets or a combined DNA appliance/Invisalign protocol. All subjects chose the combined therapy, in which the first phase of treatment was undertaken with an acrylic-based DNA appliance (Figure 1), followed by a second finishing phase using Invisalign full with refinements. The protocol followed was that the subjects wore the DNA appliance for about 16 hrs each day (during the early evening and nighttime, but not during the day, and not while eating). This phase lasted for 6 months on average, followed by a phase of Invisalign therapy that lasted for a further 6 months on average. All patients were treated by the same clinician (Dr. Ataii).

Results

Subject A: Showed improved anterior occlusion and resolution of lower anterior crowding, as well as an improved facial soft tissue profile in less than a year (Figure 2).

Subject B: The overjet was reduced to within normal limits. In



Figure 2: Subject A showed improved anterior occlusion and resolution of lower anterior crowding, as well as an improved facial soft tissue profile in less than a year.

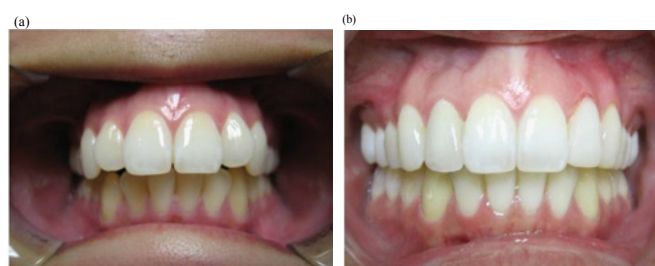


Figure 3: Subject B, showing the overjet reduced to within normal limits. The intermolar width increased by 2.5mm in both the upper and lower arches, resulting in a better soft tissue profile, and improvements in smile esthetics.

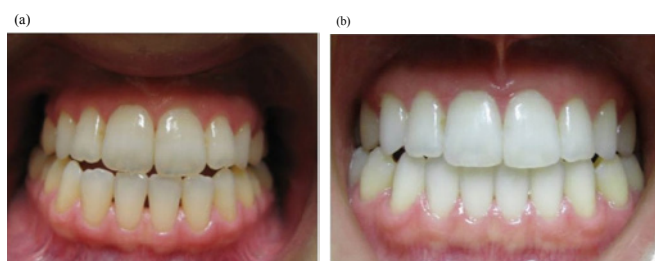


Figure 4: Subject C showed correction of the anterior and posterior crossbites, and a corrected midline.

addition, the intermolar width increased by 2.5 mm in both the upper and lower arches, resulting in a better soft tissue profile, and improvements in smile esthetics (Figure 3).

Subject C: Showed correction of the anterior crossbite and a corrected midline (Figure 4).

Discussion

The DNA appliance is a biomimetic system for craniofacial correction in children and adults [1,2]. The Invisalign System is a series of clear plastic aligners that move a patient's teeth in small increments from their original state to an improved, treated state [8]. The concept of Interproximal Reduction (IPR) has gained much momentum over the past decade or so; in line with newer methods of orthodontic correction. However, enamel thickness has anthropologic significance. For example, in primates enamel thickness is negatively correlated with extension rate. This mechanism seems to ensure that there is sufficient time for enamel maturation to be completed before tooth eruption takes place [9]. The corollary of that conjecture is that the finite amount of human enamel laid down has to last the lifetime of the individual. Therefore, IPR may not be the optimal solution for tooth alignment requirements. An alternative method for providing space to accommodate a full dentition of 32 permanent teeth is via palatal expansion. In this procedure new bone volume is produced to resolve crowding, even in adults patients [2]. Kravitz et al. [10] demonstrated the efficacy of tooth movement with removable aligners, and we conclude that all three subjects in this present preliminary study benefitted from a combination protocol of the DNA appliance worn only during the evening and nighttime, followed later by the use of Invisalign aligners.

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