Short Article

Clear Aligner Treatment: A new paradigm shift? Point & Counterpoint

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Abstract

The emergence of Clear Aligner Treatment (CAT) has redefined modern orthodontics by integrating advanced digital technology and 3D printing. Originating from the concept introduced by Kesling in 1945, CAT uses its digital foundation to allow precise tooth movement planning within virtual models. CAT's popularity has surged due to its cosmetic appeal and comfort, offering advantages like reduced root resorption and improved oral hygiene. The upswing of CAT systems by various manufacturers has the potential to enhance orthodontic treatment acceptance among the general public.

However, the counterpoint emphasizes that successful CAT outcomes hinge on accurate diagnosis, case selection, and above all, patient compliance. Aligner wear for a minimum of 22 hours daily is paramount for success. The viscoelastic properties of aligner materials introduce complexities, demanding a nuanced understanding of biomechanics for effective treatment.

Practitioners are advised to begin with simpler cases before advancing to complex malocclusions, emphasizing patient compliance, considering potential refinements, and incorporating appropriate force systems into virtual setups. Supervision by experienced orthodontists during the learning phase can optimize outcomes. In summary, while CAT holds immense promise, careful planning and patient engagement remain the cornerstones of achieving successful orthodontic results.

Key words: Clear aligner therapy, aligners, removable appliances

Introduction

In 1945, Kesling introduced the tooth positioner, perhaps seeding the idea that has culminated in the modern-day Clear Aligner Therapy. Utilizing cutting-edge digital technology and 3D printing, this innovative approach has allowed for tooth movement planning within a virtual model and brought about a new technological era in the world of Orthodontics. Recent years have seen a rise in the use of clear aligner therapy (CAT), which is today a widely accepted alternative to traditional fixed appliances largely due to its cosmetic advantage and comfort [1,2]. CAT may have several potential benefits, including a decrease in the amount and frequency of root resorption after orthodontic therapy[3], as well as a reduction in headache and TMD pain[4]. The production of clear aligner systems by various businesses today, including well-known manufacturers of orthodontic products, has the potential to increase the acceptance of general public towards orthodontic treatment.

Aligners have been highly advantageous in terms of maintaining patients' oral hygiene while undergoing treatment. Patients who undergo fixed orthodontic therapy have been shown to experience noticeable alterations in their oral microbiome, including greater levels of facultative and anaerobic bacteria[5]. This effect is attributed to the fact that fixed appliances make dental hygiene protocols more difficult due to brackets, archwires and elastics. The use of removable appliances, on the other hand, may enable orthodontic patients to maintain proper oral hygiene by allowing the standard procedures of brushing and flossing, which can be performed by easily removing the tray.

Additionally, as AI algorithms analyse patient data more thoroughly, they can identify possible problems and recommend optimal treatment plans. With the advent of digital patient data, analysis, treatment planning and appliance design, doctors may now create completely integrated end-to-end workflows.

Tele-dentistry has become an essential tool in orthodontics, with the growth of tele-health and the COVID-19 pandemic promoting the usage of remote healthcare solutions. Through virtual consultations and online communication tools, orthodontists are now able to remotely check on the progress of their patients. This has made orthodontic care more accessible, especially for individuals who live in rural locations or have mobility issues.

Counter Point

Although the introduction of Clear Aligner Treatments has made quick progress toward digitizing orthodontic processes, it seems that the complexity of orthodontic treatment has been oversimplified. Like fixed traditional appliances, the clinical success of aligners depends on careful case selection, precise diagnosis, biomechanically planned setups, and adequate patient counselling.

CAT's primary drawback is that it relies majorly on patient compliance. The patient's results improve as they wear it more frequently/continually. The treatment is based on a

sequence of upper and lower transparent aligners that the patient wears for at least 22 h/day and changes after 14 days[6]. Manufacturers of clear aligners have developed smart compliance indicators that are integrated into the aligners to monitor appliance wear and mobile applications for remote dental monitoring, allowing doctors and patients to track the progress of treatment and get alerts for aligner changes and checkups. Nevertheless, in a treatment that lasts for months to years, there will surely be instances of decreased wear time, loss or breakage of aligners, wear, and tear of attachments, etc. All these things have a negative impact on the treatment outcome. Thus, the necessity for refinement aligners (additional aligners) to finish the therapy is frequently encountered.

Additionally, as Clear Aligners are made of viscoelastic materials, their behaviour might change significantly when they are worn and taken off. These materials may, over time, experience a rise in deflection under constant loads (known as the creep phenomena) and a fall in load (known as the stress relaxation phenomenon), with the deflection being constant. Stress relief may be noticeable during the first few hours of wearing the aligners, but after three days of use, it rapidly diminishes. Thus, the material composition utilized to make orthodontic aligners has a significant impact on their effectiveness.

As Proffit has stated, removable appliances by their nature produce simple tipping movements of teeth, making control of tooth position challenging[7]. Virtual models, despite appearing to be flawless, do not precisely reflect the patients' final occlusion, hence overcorrection must be included in the virtual plans. Evidence-based data has demonstrated that severe dental rotations require 110% compensation and incisor supra-eruption needs to increase supercorrection to an average of 150% for overbites <50% and 200% supercorrection for deep overbites >50%[8]. Clinicians should develop a virtually over-corrected force system that will enable a good final occlusion in the patient rather than concentrating on producing an ideal virtual model. This cannot be left to artificial intelligence and requires in-depth knowledge of the biomechanical principles governing tooth movement.

Conclusion:

While Aligners have provided tremendous possibilities, we suggest a few pointers for ensuring predictable outcomes:

1. Begin with straightforward cases (cases with a 2 mm or less correction of a specific malocclusion). After mastering the fundamental aligner workflow and comprehending the biomechanical concepts of tooth movement, complex cases that call for corrections in more than one plane (transverse, vertical, and sagittal) of occlusion should be tried.

2. Stress the value of compliance from the initial visit onwards, and have regular monthly appointments to check on it.

3. During the initial consultation with the patients, Refinements and reboots of the original plan should be taken into consideration. When utilizing traditional fixed appliances, course corrections are typically necessary to attain perfection; aligners are no exception.

4. Make sure the virtual setup has the proper force system for the best post-treatment occlusion. Many mistakes can be avoided in the early years while doctors enhance their skills by having an orthodontist supervise or serve as the case planner. This will enable lesser refinements of treatment plans and increase revenues.

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