A new era in digital orthodontics

By Jeffrey T. Kozlowski, USA

A true straight-wire appliance would necessitate a patient-specific appliance based on an individual's anatomy. Now, with advances in computer software and digital scanning and fabrication, that idea is a reality and a practical consideration for your practice. Customized Insignia™ is the first true straight-wire appliance. It involves two components: customized appliances—brackets, wires and placement gauges—and 3D real-time virtual treatment planning software. The 3D software enables clinicians to design the patient's final occlusion on-screen before initiating treatment, then prescribes the fabrication of patient-specific appliances to achieve the planned result. This concept is quite different from how clinicians customarily practice orthodontics. Traditionally, we choose appliances with specific torque values to have certain effects, then react to those effects by repositioning brackets and making wire bends to guide the teeth into the desired positions. With Insignia, we begin with the end in sight and drive directly towards the desired end result.

Over 20 years in development, customized Insignia appliances offer the only comprehensive patient-specific solution available. The treatment planning process begins with accurate PVS impressions. New clinical methods and materials make this procedure quick and easy. From the impressions, the pre-treatment malocclusion (T1) is digitized into a precise mathematical model of the patient's skeletal and dental anatomy and the proposed setup (T2) is signed (Fig. 1a-b).

See Dr. Craig Andreiko's discussion. The setup is loaded to the Insignia web portal where, used on clinical experience, functional and aesthetic preferences and intimate knowledge of the patient's specific orthodontic needs, the clinician can easily customize it using the Insignia Approver software (Fig. 2). The included software offers clinicians unprecedented control in determining accurate tooth position and in their ability to make changes directly to the 3D models without relying on an operator's interpretation of instructions.

Insignia does not determine treatment mechanics nor prescribe tooth movements and it allows clinicians to use the mechanics and adjuncts of their choice. As doctors modify the desired final outcome in the Approver software, they can view in "real time" how the changes affect the opposing occlusion.

Once the clinician finalizes the ideal setup, the Insignia software engineers the customized brackets, wires and precision bonding placement gauges to the exact prescription required to deliver the desired end result accurately and efficiently.

My experience with Insignia is with both the customized passive self-ligating appliance (Insignia custom SL) and Insignia using stock Damon® System appliances. The Insignia software can be used to fabricate patient-specific conventional twin brackets and aligners as well. You can also use Insignia software with stock appliances (OrthoR, Inspire ICE™ and, as I mentioned, Damon).

The difference between customized Insignia and Insignia using stock brackets is the third-order customization (torque) that is engineered into the customized brackets. This difference saves considerable treatment time and effort over using a "best fit" stock appliance. Having treated with both customized Insignia SL and Insignia using stock Damon brackets, I can attest to the superior value of the customized appliances.

The Clinical Evaluation

My initial experience with customized Insignia SL began in 2007 when I conducted an extensive clinical evaluation by treating 41 patients to completion. The only limitations on the selection criteria were that patients have no missing or impacted teeth, no pending restorative needs, and must not exhibit poor oral hygiene. The criteria were limited in these ways simply because it wouldn’t have been feasible for me to coordinate the ancillary procedures from across the country. At the time, I was in the process of opening my new office in Connecticut and the clinical evaluation was to be conducted at Ormco in California—nearly 3000 miles away. For operator consistency, I played the roles of doctor and assistant, performing the diagnoses, treatment planning, initial bondings and wire changes, providing all mechanics for 100% of treatment. Full records were taken of each patient, including PVS impressions and iCAT® scans (Imaging Sciences, International, Hatfield, PA) for diagnostics and treatment planning using the Insignia interactive Approver software. Based on my previous experience with Damon System appliances, I estimated that treatment time for the 41 patients would average 17.5 months.

While I wouldn’t recommend selecting this many patients to begin treating with customized Insignia SL for the first time, I am convinced that the best way to learn Insignia is to submit cases regularly. Regular case submission allows the clinician to relate what is designed in the digital environment to the clinical experience and final results. This positive feedback loop of learning will help the clinician design each successive Insignia
case with a higher level of understanding and accuracy and hence be more successful with its application. My experience has been that clinicians who recently submitted Insignia cases are more successful with it than those who start only a few cases and wait to see how they work out. My skills improved substantially through the first 10 to 20 cases, and like using any other new appliance, it takes a bit of time to learn the nuances. I also strongly recommend doctors initially select easier cases, and then add more challenging cases when they become familiar with the software and clinical protocols.

In late February, 2008, in a one-chair operatory at Ormco’s Insignia manufacturing facility in Glendora, California, I bonded all 41 patients over a five-day period. This intensive week of bonding proved to be my first insight into the potential efficiencies of Insignia’s direct view/in-direct bonding process. After just the first few patients my bonding technique using the placement gauges significantly improved and during the balance of the week, the bonding appointments averaged less than one hour, including preparing the teeth, bonding the brackets, placing hip-turbos, engaging the wires, attaching the elastics and reviewing the patient instructions. And all without the help of a clinical assistant!

We all know the importance of placing brackets correctly, but few of us can consistently and quickly place each bracket precisely where it needs to be. With Insignia, you design the final occlusion, but for all those cases for treatment in late mixed dentition, the precision built into the placement gauges significantly improved.

Direct bonding proved to be my first insight into the potential efficiencies of Insignia’s direct view/in-direct bonding process. After just the first few patients my bonding technique using the placement gauges significantly improved and during the balance of the week, the bonding appointments averaged less than one hour, including preparing the teeth, bonding the brackets, placing hip-turbos, engaging the wires, attaching the elastics and reviewing the patient instructions. And all without the help of a clinical assistant!

At six months, the first patient finished treatment and by December 2009, after just 21 months, the 41st patient had his Insignia brackets removed. To determine the value of customized Insignia SL, for my own practice, I initially compared the results of this evaluation with my previous seven years of experience treating patients with direct-bonded Damon System appliances. This comparison helped me evaluate customized Insignia SL, with what I used to do in my office—direct bonding. These 41 customized Insignia cases treated in an average time of 12.5 months—a full five months (26%) shorter than my estimate of 17.5 months (Fig. 5). I based the estimates on my previous seven years of experience with the Damon System appliance but before I had had any experience with Insignia. In my opinion, this difference alone attests to the efficiency of customized Insignia SL treatment. Another value indicator was the number of repositioned brackets needed to finish the customized Insignia SL cases, which was 50% less than my cases with direct-bonded stock Damon System appliances.

After completing the evaluation, I compared the results with comparable patients I later treated with Insignia using stock Damon appliances. This second comparison assisted me in placing a value on the patient-specific customized torques of the customized Insignia SL appliance. The 41 customized Insignia SL cases in the evaluation finished in 22% shorter treatment time (at 12.5 months) than the next consecutive 41 cases using Insignia with stock Damon brackets which I treated in my private practice (16.1 months). The average number of appointments for the 41 customized Insignia SL cases was 10.2 versus 8 appointments for the 41 customized Insignia SL cases.

In terms of quality, a subjective evaluation I grant you, I feel that my customized Insignia SL cases finish with quality that equals or exceeds my direct-bonded Damon System cases or my Insignia cases using stock Damon brackets yet in less time and with significantly less effort. I have felt confident enough with the customized Insignia case results to have shown them in presentations around the world and have been so pleased with the results that I now treat 70% of my cases with customized Insignia SL appliances. I still treat 30% of my patients with direct-bonded stock Damon appliances primarily those who start treatment in late mixed dentition, but for all those cases for which customized Insignia SL applies, it is now my appliance of choice.

This article highlights a few of the patients I treated in the clinical evaluation, demonstrating the quality of the results and efficiency of treatment.