An Inside Look at Invisalign G3

An Interview with Dr. Rene Sterental and John Morton

by Wm. Randol Womack, DDS

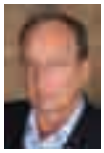
Invisalign recently introduced Invisalign G3, the company's latest innovation aimed at improving clinical outcomes and broadening the clinical application of the appliance. I recently had the chance to go behind the scenes to take a closer look. Here is what I learned through an interview with two people who have been at the heart of developing Invisalign G3: Dr. Rene Sterental, clinical director, and John Morton, director of R&D at Invisalign.

Why is Invisalign introducing Invisalign G3 now, and what is new with this release?

Sterental: At Invisalign, perhaps more so than ever, we are focused on improving predictability through continuous innovation. The releases in the last couple of years, first with the Optimized Attachments introduced in 2009 and now with Invisalign G3, represent how we are and will continue to rapidly evolve the appliance for greater predictability.

As for what is new, Invisalign G3 includes a broad set of features that are designed to improve clinical outcomes. These features include Precision Cuts, which are hook-and-button cutouts that make it easier to use elastics with Invisalign when treating Class II and Class III patients. Invisalign G3 also includes very significant upgrades to the ClinCheck software and the Invisalign Doctor Site, designed to make it easier to communicate the doctor's treatment plan. But most importantly, Invisalign G3 leverages the power of biomechanics to provide better control of tooth movements with new and improved SmartForce features.

Tell me more about SmartForce features and why we should expect greater predictability with them.



Morton: It is well accepted in orthodontics that if the force system produced by the appliance is correct for the movement, then the probability of achieving the movement is greater. This is the basic biomechanical principle in orthodontics and the principle that guides our SmartForce development.

We design and test each SmartForce feature to ensure it delivers the force systems necessary to achieve a specific tooth movement. To accomplish this in the development process, we first use advanced virtual modeling software that is capable of evaluating a large number of design options – the number is usually in the thousands. This software helps us to efficiently narrow down the options to those with the most potential of producing the correct force systems for a particular movement. For the high potential designs, we then proceed to physically measure the forces imparted to the teeth by the aligner with or without attachments, using state-of-the-art force measurement equipment developed by Align.

This SmartForce design process is an iterative process very much like what has taken place in orthodontics in past years. Specialists would place a bend in a wire, or change the position of the bracket on the tooth and evaluate how well it worked at the patient's next few visits to the office. This can take months, or even years. The same iterative process is used with the SmartForce development process, except the process can happen much more quickly by leveraging advanced technologies.

Iterations of software take a matter of minutes and different aligner designs can be evaluated in just a few days. High potential candidates are then each physically tested using the benchtop measurement system. Aligner and attachment designs which pass this phase of testing might then undergo clinical evaluation.

What features have been specifically developed using the SmartForce process you described?

Morton: The Power Ridge feature and the family of Optimized Attachments have been developed using the SmartForce process. Some of these features were introduced in late 2009, and extensions were rolled out with the Invisalign G3 launch recently.

For those who are not familiar with the recent releases, the Power Ridge feature is a specific aligner shape that has been engineered to produce the force systems necessary to control the lingual movement of the root with respect to the crown. With Invisalign G3, the Power Ridge feature is now available for lower incisors as well as upper incisors. In addition, a buccal and lingual Power Ridge pair is available to better control lingual root torque while retracting upper incisors.

Optimized Attachments for extrusion and rotation are also designed using the SmartForce process. These attachments have an active surface designed to engage with the aligner to create the forces and moments necessary for the movement.

Additionally, our research has shown that we must consider the shape of the tooth when determining the shape of the attachment. Hence with the Optimized Attachments, we are leveraging the power of computing to provide a customized attachment that is *specific* for each tooth of each patient. This is patient-specific orthodontics using the Invisalign appliance.

Tell me more about Precision Cuts.

Sterental: In the past, doctors and their teams have had to manually modify aligners in order to use elastics with Invisalign for anchorage support when treating Class II or Class III patients. This was an inconvenience and a rather time consuming process. With Invisalign G3, this process is now automated and doctors can request aligners that are pre-cut with button cutouts and hooks for elastics. From our research, we understand that doctors usually customize the elastic configuration for each patient based on the treatment plan considerations. To meet this need, Invisalign G3 includes an interactive drag-and-drop interface that allows the doctor to easily customize the Precision Cuts prescription.

What is new with ClinCheck 3.0 and the Invisalign Doctor Site?

Sterental: The ClinCheck software has been improved significantly. Those familiar with previous versions of the ClinCheck software will notice the difference right away. The new ClinCheck 3.0 software has a simpler look, and is designed to be faster and easier for doctors to communicate their treatment plans. For example, with a new drag-and-drop tool in the ClinCheck software, doctors can add or remove attachments without typing instructions.

The Invisalign Doctor Site, formerly known as Virtual Invisalign Practice (VIP) site, has also been redesigned to be more intuitive and easier to use. The new navigation is designed to mirror the way doctors and staff members manage patients throughout treatment, making access to important information easier.

What is ahead for Invisalign?

Morton: Our aim is continue to innovate and improve the predictability and clinical scope of Invisalign. In the past year, clinical innovations that addressed movements which were previously considered to be challenging for Invisalign were introduced – including rotation of canines and bicuspids, extruding teeth and controlling root movements. While strong progress had been made, there is more to do.

The SmartForce development process has proven to be a powerful tool in better controlling tooth movement with aligners. Invisalign will continue to use this technology to determine solutions for treatment decisions such as retention requirements and control of the vertical dimension, as well as to address tooth movements which remain challenging. Invisalign will continue to research and improve the process with the same goal all orthodontists pursue: to improve control of tooth movements and predictably achieve an excellent treatment outcome for each patient. ■

Invisalign G3

Fig. 1: Invisalign Virtual Model

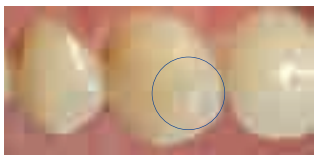


Fig. 2: Optimized Attachment

Fig. 3: Optimized Rotation Attachments

Fig. 4: ClinCheck 3.0 Drag & Drop