Have fun, will brush: Improving orthodontic outcomes with effective home care

By Dr Dana Van Elslande, Canada

Getting braces is a time of both excitement and dread. For kids and teens, braces can be a rite of passage. For adults, it is an opportunity to invest in an improved appearance and more attractive smile. With this excitement comes a bit of worry for patients (and parents) though – how will I (or will my child) manage oral hygiene with all this apparatus in the way?

The orthodontic provider feels the same concern. Once the braces go on, brushing becomes much more challenging, and poor brushing leaves patients at risk for gingivitis, white scars and tooth decay. Ensuring adequate home care is one of the biggest challenges in most orthodontic offices: unless patients adopt some of the oral hygiene practices we recommend, they are not going to attain the incredible results that are possible.

Like many practices, we are seeing more adult patients every year – currently about 25% of our patients are adults. Often, they are parents of our younger patients, through their child’s experience, parents can see how the technology has changed since they were kids. Braces are generally easier to manage and often have shorter treatment time. Contemporary oral hygiene products also make it easier to get from braces on to the end goal of ‘beautiful smile’.

A comprehensive programme

Our practice adopted Crest Oral-B Ortho Essentials because we wanted a comprehensive programme to help encourage and motivate patients with their oral hygiene. Programme elements include an Office Oral Hygiene Visual Analogue Chairside scale (Fig. 1), commitment letter, communication letters for patients and parents, a ‘how to care for your braces at home’ video, and a regime of advanced home care products: an oscillating-rotating power toothbrush, stannous fluoride toothpaste, fluoride mouth rinse, and an orthodontic specific dental floss. These four products work together to help reduce plaque buildup and protect teeth from gingivitis, white scars and cavities.

One unique aspect of this programme is that the Office Oral Hygiene Visual Analogue Chairside scale interacts with our management software, allowing us to graph patient progress over time so we can show our patients (or mom and dad) how well they are doing with self-care. Together with patients, at each appointment we score their oral hygiene on a scale from 1–5. A score of ‘1’ indicates very poor oral care, whereas ‘5’ indicates excellent care. These scores are entered into our software programme, which has the ability to generate a graph where we can monitor how the oral care is progressing throughout the patient’s treatment. It is a wonderful tool to use with children and adults alike, as it provides us with a visual representation of how performance has either improved (meaning we need to celebrate) or declined (meaning we need to make changes before it becomes irreversible damage). In addition, we incentivise patients by giving tokens at each visit if they receive scores over a ‘3’. These tokens can be cashed in for merchandise or gift cards to their favorite stores or online sites. The technology helps us engage our orthodontic patients in a fun way, and not surprisingly, adults enjoy seeing their results just as much as kids do.

Noticeable outcomes

The Ortho Essentials kit contains four key products that work together to help achieve the outcomes we want.

The Oral-B PRO 5000 Smart Series Power Toothbrush with Bluetooth technology with ortho head is a cornerstone of the kit. The Ortho brush head is specifically designed to clean around brackets and wires; which can be very challenging to manage without additional tools (like a floss threader or interdental brushes).

The orthodontic specific dental floss (Fig. 2) is colour-coded to help patients distinguish between the interdental spaces and the slots under the braces wires. The floss threader that helps patients (particularly kids) easily thread floss under the braces wires.

The four components of the Ortho Essentials Kit work together to keep the teeth and gums protected and healthy. When a patient is not brushing, the Ortho Essentials kit reminds the patient:

- “Swollen gums, alert! You probably have plaque; chalky white spots on your teeth; we recommend you see your orthodontist soon. If you are not brushing at least twice a day, the natural bacteria in your mouth can ferment foods, resulting in plaque and tooth decay.”
- “Keep on brushing, flossing, and rinsing. To get even better. You’re almost acing it. You might see redness or swelling of your gums.”
- “Awesome! You should be seeing clean teeth and healthy gums.”
- “You’re doing well; keep going!”

Noticeable outcomes with Crest Pro-Health

The Crest Pro-Health Advanced with Extra Deep Clean Rinse offers additional anti-cavity fluoride protection. The Crest Pro-Health Advanced with Extra Deep Clean Rinse offers additional anti-cavity fluoride protection.

Enabling compliance

Compliance with a proven oral care regimen is essential to successful orthodontic outcomes. If a patient is not able or willing to brush, the braces may have to be removed and treatment delayed until he or she is able to comply. If a patient is struggling with, we can use the built-in technology to programme these areas into a diagram on their mobile device app. By working with a cell phone and the Bluetooth-enabled toothbrush, the app provides immediate feedback during home care. With these tools, the patient can continue to work on trouble areas between scheduled appointments and receive feedback on their progress.

Supported by clinical evidence

As a practitioner, I am very evidence-based, so I feel comfortable recommending proven products to my patients. I am always aware of the clinical data behind the products we recommend. For patients who are not ‘wowed’ by clinical evidence, they usually just want to know what products I use at home. I would not recommend the programme if I did not personally believe in it.

Conclusion

In the end, orthodontic treatment is not just about positioning the teeth and improving looks, it is also about better functioning and oral health. Patients are expecting a certain ‘look’, when their braces are removed – beautiful, white, shiny teeth and tight pink gums. The key to a successful outcome is good oral hygiene. Unfortunately, patients that involve the most cutting edge technology available. Some patients appreciate knowing about the clinical data behind the products what we recommend. For patients who are not ‘wowed’ by clinical evidence, they usually just want to know what

Fig. 1. Example of office oral hygiene visual analog scale.

Fig. 2. Ortho brush head
Insignia® system is a reverse-engineered production of custom brackets, based on the desired final alignment. "Begin with the end in sight." Efficient sequencing is the key to efficient management of a malocclusion with passive archwire therapy. Each step in active treatment is directed toward a specific objective, consistent with ensuring patient comfort, maximizing the potential of each step in treatment, and achieving alignment to place the final archwire as soon as possible. There are four phases in Insignia® progressive archwire therapy: (i) light stock round wires, (ii) customized rectangular copper-nickel-titanium (CuNiTi) wires, (iii) major mechanics as needed, and (iv) finishing. This article recommends archwire sequencing, based on clinical experience with the Insignia® bracket system. In addition to traditional progressive archwire therapy, the Insignia® system is well designed for segmental determinate mechanics, to decrease PDL compressive stress. Segmental mechanics, with extra-alveolar bone screw anchorage and anterior bite turbos, is designed to enhance outcomes and decrease treatment time by increasing the rate of tooth movement and controlling root resorption. (Int Orthod Pediatr Dent 2007;46:60-69)

### Key words

- Insignia® system, passive self-ligating bracket, archwire sequence, customized bracket, custom torque, low PDL stress, enhanced rate of tooth movement, decreased root resorption.

### Abstract

Insignia® system is a reverse-engineered production of custom brackets, based on the desired final alignment. "Begin with the end in sight." Efficient sequencing is the key to efficient management of a malocclusion with passive archwire therapy. Each step in active treatment is directed toward a specific objective, consistent with ensuring patient comfort, maximizing the potential of each step in treatment, and achieving alignment to place the final archwire as soon as possible. There are four phases in Insignia® progressive archwire therapy: (i) light stock round wires, (ii) customized rectangular copper-nickel-titanium (CuNiTi) wires, (iii) major mechanics as needed, and (iv) finishing. This article recommends archwire sequencing, based on clinical experience with the Insignia® bracket system. In addition to traditional progressive archwire therapy, the Insignia® system is well designed for segmental determinate mechanics, to decrease PDL compressive stress. Segmental mechanics, with extra-alveolar bone screw anchorage and anterior bite turbos, is designed to enhance outcomes and decrease treatment time by increasing the rate of tooth movement and controlling root resorption. (Int Orthod Pediatr Dent 2007;46:60-69)

### Phase I: Stock Round Light Wires

The objectives for the first phase of treatment are: (i) level and align, (ii) initiate archwire development as needed, and (iii) resolve 90% of the rotations. A stock 0.016-in Damon® copper-nickel-titanium (CuNiTi) wire is used as an initial archwire to achieve intermaxillary discrepancies and level the arches. The small dimension of the initial round archwire minimizes friction and binding between the wire and the tube-like lumen of the PSL brackets (Fig. 3). This mechanism helps the archwire slide easily along the wire as they are leveled and aligned. To manage severe crowding, narrow arch form and/or compromised periodontal support, a stock 0.016-in or 0.018x0.025-in Damon® CuNiTi wire can be used as an alternative second archwire to further align the incisors and second molars (Fig. 3).

The purpose of these round CuNiTi wires in the Phase I (initial stage) is not to completely resolve rotations, but to provide adequate alignment of brackets to automatically transition to the second phase in the sequence (rectangular archwire). If a patient feels the need to advance the skeletal anchorage that does not interfere with the path of tooth movement. Each archwire can be retracted, intruded or rotated to achieve even severe malocclusions conservatively.

### Phase II: Insignia® Rectangular CuNiTi Wires

The objectives of the second phase are (i) start resolving torque and root angulation problems, (ii) complete leveling and alignment, (iii) finish rotation corrections, and (iv) continue arch form development, as needed. The recommended Insignia® CuNiTi rectangular archwire sequence is 0.019x0.025-in, 0.021x0.025-in, and 0.022x0.025-in. Each archwire must be inserted with minimal archwire sequence

- Insignia® system, passive self-ligating bracket, archwire sequence, customized bracket, custom torque, low PDL stress, enhanced rate of tooth movement, decreased root resorption.

### Introduction

Insignia® (Ormco, Glendora, CA), introduced by Dr. Craig Andreiko in 1997 (Fig. 1), offers clinical efficiency for control of rotations, that are easily managed with edgewise mechanics. A bracket set is precisely designed for ideal archwire engagement. (c) Any tooth can be adjusted in 3D as specified by the clinician. (d) Any tooth can be adjusted in 3D as specified by the clinician. (e) More space is gained by accurate bonding a customized appliance to optimize treatment planning software. (f) The small dimension rectangular archwire sequence is premature. (g) The small dimension rectangular archwire sequence is premature.

### Phase III: Major Mechanics

The objectives of the third phase are to (i) close any remaining spaces as well as to correct anteroposterior and intermaxillary relationships. All teeth in the anterior segments of each arch are retracted en masse (altogether). Consistent with a straight wire approach, a stock 0.016x0.022-in SS archwire is used for sliding mechanics. A relatively rigid SS archwire (0.016-in or 0.018x0.025-in) is recommended for maintaining the integrity of the arch during space closure, either by chains of elastics or closing loops. Rigidity across edentulous segment is particularly important for large extraction spaces. The stock SS archwire is adjusted to fit the patient’s specific arch form before insertion. Moreover, reduction of the SS archwire in the posterior segment is recommended to bracket friction and binding when placing spaces with elastomeric chains.

In addition, if intermaxillary correction is required, OrthoOnlinesCrystals® (OrthoOnliners, Aarhus City, Taiwan) are an ideal source of anchorage for the Insignia® system. OrthoOnlinesCrystals® are an orthodontic appliance that is physically placed buccal to the molars in each arch to provide skeletal anchorage that does not interfere with the path of tooth movement. Each archwire can be retracted, intruded or rotated to achieve even severe malocclusions conservatively.

### Phase IV: Finishing

The objectives of the fourth phase of treatment are to complete torque expression and final detailing to achieve ideal intra-arch and intermaxillary alignment. An Insignia® 0.019x0.025-in CuNiTi rectangular archwire is used to achieve the full expression of the corrected arch. If needed, final finishing is achieved with an Insignia® 0.021x0.025-in TMA archwire. It is important to order the final TMA archwire as a backup, because uncontrolled anatomical variables can result in minor alignment discrepancies, that are easily managed with routine finishing adjustments.

Figs. 4 and 5 are sequences of instrnullat photographic documents showing the treatment with Insignia® progressive archwire therapy. Discussion

The aim is to reduce to deflection rate (resilience) of an archwire in CuNiTi archwire results in the application of a relatively intrusive histologic data set range. These are desirable characteristics for a more physiologic approach to orthodontic therapy apnullifying adequate force to stimulate cellular activity in the periodontal ligament. Further discussion of the importance of orthodontic force is beyond the scope of this article. The orthodontic force is beyond the scope of this article. However, it is important to note that the forces applied to the teeth should be adequately managed with passive force transfer and required for occlusion.

Recurrent PDL Necrosis: Episodes of PDL necrosis (hyalinization) may be phase I of treatment and enhance the expression of extracellular matrix remodeling. (a) Clinical evidence that the apex of the tooth moves in a relatively small area of the PDL, which usually is <0.45 mm. (b) The relative large reactive force applied to a small area of the PDL near the apex results in compressive stress. (c) The reactive force applied to a small area of the PDL produces a lag phase in tooth movement, which may last 2 weeks or more. (d) The usual pattern of engaging individual teeth on multiple archwires produces a large reactive force that increases treatment time. (e) Consistent orthodontic force applied to the teeth reduces treatment time. (f) Orthodontic force applied to the teeth reduces treatment time.

### Case Reports

**Fig. 1: Dr. Craig Andreiko (1950-2013)**

The inventor of the Insignia® bracket system. In addition to traditional progressive archwire therapy, the Insignia® system is well designed for segmental determinate mechanics, to decrease PDL compressive stress. Segmental mechanics, with extra-alveolar bone screw anchorage and anterior bite turbos, is designed to enhance outcomes and decrease treatment time by increasing the rate of tooth movement and controlling root resorption. (Int Orthod Pediatr Dent 2007;46:60-69)
tooth movement is relatively slow. Controlling PDL compressive stress is a high priority for advanced mechanics to enhance the rate of tooth movement and decrease the incidence of root resorption. The Insignia® system is an ideal, fixed appliance platform for developing a new generation of mechanics to increase the rate of tooth movement and decrease the incidence of root resorption (Fig. 6).

**Enhancing the Rate of Tooth Movement**

Adult second mandibular molars, engaged as single teeth on an archwire, were placed in tension at the rate of about 0.5mm/mo.**1** Second molars as part of a mandibular arch, that is engaged as a segment and connected by a rigid archwire, are intruded about 7mm in 6mo.**2** Thus, the rate of molar movement for the entire arch as a segment is about three times the rate of sustained molar movement with routine mechanics.

**Controlling PDL Stress**

Within the limits of current technology, avoiding damage to the periodontal ligament is a prerequisite for mechanics that enhance the rate of tooth movement. When an archwire is activated, the load delivered to a tooth is directly related to the discrepancy between the bracket slot on the tooth and configuration of the unloaded archwire. The most idealized teeth receive the highest direct loads, but all teeth on a continuous archwire are indirectly loaded to some degree, because the molar anchor delivered to the malaligned teeth as the archwire is engaged. The only evidence of long-term tooth movement from indirect loading is the removal of bone in the path of tooth movement that is 8-10kPa in rodents.**9**

**Initial Alignment and Leveling**

The precise bracket position and torque of the Insignia® system is an ideal platform for accomplishing initial alignment and leveling in a relatively atraumatic manner. Small dimensions, round CuNiTi archwires are effective for correcting rotations and aligning marginal ridges, but most lack the buccal stiffness to level the arch. New materials, manufacturing processes and clinical methods are needed to gently accomplish optimal initial alignment, leveling and torque control with a single archwire. A single archwire approach eliminates the repetitive lag phases in tooth movement due to multiple archwires with progressive stiffness. In addition, the efficiency of relatively atraumatic alignment can be improved by three currently available clinical methods:

1. Differential enamel stripping of well-aligned teeth to make space to align crowded teeth;
2. Retracting canines with OBSs, placed buccal to the molars; and 3. Anterior bite turbos constructed on the palatal surfaces of anterior teeth to open the vertical dimension of occlusion (VDO).**8**

The objective for initial alignment and leveling is to atraumatically align each arch to receive a full-size rectangular archwire as soon as possible. A reverse engineered bracket system such as Insignia® is ideal for mechanics that minimize PDL compressive stress.

**Segmented Arch Mechanics**

When force is applied to the archwire as a segment, connected with a rigid archwire, is equivalent to a large multi-rooted tooth. Segments have distinct advantages with respect to the physics and biology of orthodontics. When force is applied to the archwire in a rigid segment the mechanics are deterministic, so that all loads (forces and moments) in the applied system can be calculated with equilibrium equations.**3** Thus, the compressive stress in the PDL is known when a determinate load is applied to a tooth or segment. From a physiologic perspective, PDL stress is distributed over the entire root surface of all the teeth in the segment.**2** This is a critically important advantage for controlling PDL necrosis under experimental or clinical conditions.

When the PDL remains patent under conditions of compressive loading, the osteoclasts can continually remove bone in the path of tooth movement, thereby increasing the rate of tooth movement while decreasing the incidence of root resorption.**7**

**Insignia® System Advantages**

- Determining precise bracket position and torque by reverse engineering from the desired final alignment, has obvious advantages for progressive archwire therapy, the current mainstream of orthodontic therapy. However, this high-technology precision appliance is also a critical step in the evolution of advanced biomechanics to enhance outcomes and decrease treatment time. The precisely defined brackets facilitate the initial alignment and leveling to receive a rigid straight archwire in each arch, so that the major correction can be accomplished with determinate, low PDL stress mechanics. Extra-alveolar (E-A) bone screws are ideal anchors for moving arches as segments. Precision customized brackets, E-A bone screws and anterior bite turbos are well established (Fig. 6).**1**

The current challenge is to develop materials and methods for relatively atraumatic initial alignment in preparation for major mechanics, with innovative methods, to resolve the skeletal malocclusion with segmental treatment.

**Conclusion**

1. Progressive archwire therapy with the Insignia® system begins with the end in sight and all mechanics are a direct progression toward the desired final alignment along a straight wire. The recommended archwire sequence is summarized in Table 1. Clinicians select archwire sizes and materials according to the treatment plan. It is important to allow each archwire adequate time to provide the prescribed degree of alignment in preparation for the next archwire.

2. Insignia® is a futuristic fixed appliance, compatible with innovative 3D concepts in biomechanics. A low PDL stress approach focuses on 1. relatively atraumatic alignment and leveling with multi-force archwires, 2. Anterior bite turbos to correct the VDO, 3. E-A OBS anchorage, and 4. segmented determinate mechanics to move entire arches en masse. These methods promise to expand the scope of treatment, enhance outcomes, decrease treatment time, and control root resorption.

**Acknowledgment**

Thanks to Mr. Paul Head for proof reading this article.

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**Table 1: The recommended archwire sequence is summarized for progressive archwire therapy utilizing the Insignia® bracket system**

<table>
<thead>
<tr>
<th>Archwire Sequence</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insignia Archwire Sequencing</td>
<td>Stock light round wires</td>
</tr>
<tr>
<td>Stock round wires</td>
<td>0.019 x 0.025 (alternative)</td>
</tr>
<tr>
<td>Insignia edgewise CuNiTi wires</td>
<td>0.019 x 0.025</td>
</tr>
<tr>
<td>Stock SS</td>
<td>0.021 x 0.025</td>
</tr>
<tr>
<td>Major mechanics</td>
<td>0.019 x 0.025</td>
</tr>
<tr>
<td>Insignia® MA</td>
<td>0.021 x 0.025 (backup)</td>
</tr>
<tr>
<td>Insignia® MPA</td>
<td>0.019 x 0.025</td>
</tr>
</tbody>
</table>

**Fig. 4: The maxillary occlusal view of the treatment sequence is shown over 13 months using Insignia® progressive archwire therapy. The archwire and months of treatment are shown at the top and bottom of each photo.**

**Simple System**

- Simple color-coded gels guide proper miniscrew placement
- Complete starter kit for one-step shopping
- Needleless anesthesia for greater comfort and improved patient acceptance

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**Intelligent Design**

- Self-tapping and self-drilling to minimize the need for tissue punches or pilot drills
- Asymmetric bullet thread technology for enhanced pulpal health
- Patented double-drive head for greater comfort and treatment flexibility
- Titanium alloy for improved patient acceptance
- Titanium-fit for maximum strength and biocompatibility

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