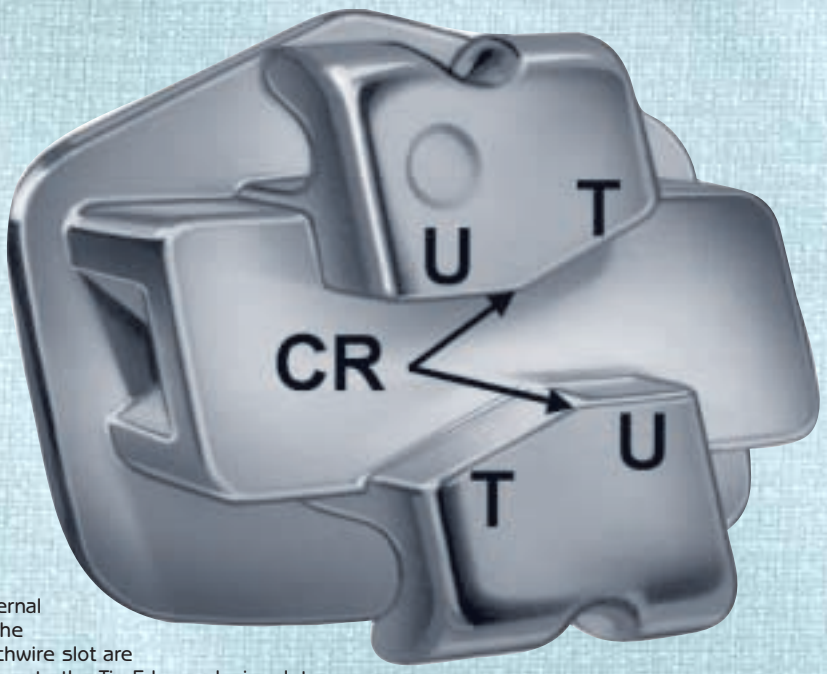

Figure 1: Internal surfaces of the edgewise archwire slot are modified to create the Tip-Edge archwire slot. Tipping surfaces (T) limit crown tipping during retraction. Uprighting surfaces (U) control final tip and torque angles for each tooth. Central ridges (CR) provide vertical control during initial tipping and final uprighting.

is virtually nonexistent. The only instance where it is necessary for a bracket to slide along an archwire is during initial unraveling of crowding or closure of anterior spaces. All other sliding mechanics occur within the molar tube as the entire archwire slides distally during retraction.

In contrast to the Tip-Edge archwire slot, conventional edgewise archwire slots tend to decrease in the vertical dimension relative to the archwire as teeth tip during retraction. This leads to increased binding and friction between the archwire and the slot. Multiple archwires and/or complex looped retraction archwires are often required to maintain engagement of the wire in the archwire slot when this occurs.

After retraction has been completed and uprighting is initiated, the Tip-Edge archwire slot gradually closes back down to .022" in the vertical dimension. As the slot closes down upon an engaged rectangular archwire (.0215" X .0275"), the torque values cast into each bracket base are gradually expressed (Fig. 3).

Eliminating Uprighting Springs & Auxiliaries:

Treatment with The PLUS

By Dr. Chris K. Kesling DDS, MS

The Tip-Edge® appliance and technique has continued to grow in popularity since its introduction in the 1980's.[1] This is due in large to the simplified treatment mechanics made possible by the unique archwire slot which has been modified by removing diagonally opposed corners of the internal archwire slot surfaces. This modification allows for the use of differential tooth movement during which controlled tipping is used to retract teeth or entire arches toward their final, desired positions (Fig. 1). Once the crowns have been repositioned, uprighting is used to bring the teeth to their desired, final axial inclinations. This results in a net bodily repositioning and should not be confused with round tripping during which teeth are tipped and uprighted only to end up in their original positions. Retraction through tipping has long been advocated by such orthodontists as Angle,[2] Tweed,[3] and Roth.[4]

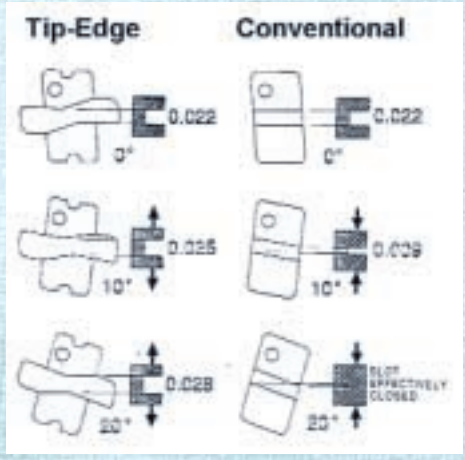

Figure 2: The Tip-Edge archwire slot increases in size in the vertical dimension as teeth tip during retraction. This eliminates binding between the archwire and the slot and virtually eliminates friction. Conventional edgewise archwire slots decrease in size as teeth tip during retraction. This leads to increased binding between the archwire and the slot and creates high levels of friction.

The Tip-Edge archwire slot is also unique in its ability to increase in size in the vertical dimension relative to the archwire during retraction.[5,6] As teeth are retracted, the archwire slot actually increases in size from .022" to .028". This increased size facilitates retraction by eliminating binding between the archwire and the slot (Fig. 2). Since enmasse retraction is employed with this technique, friction

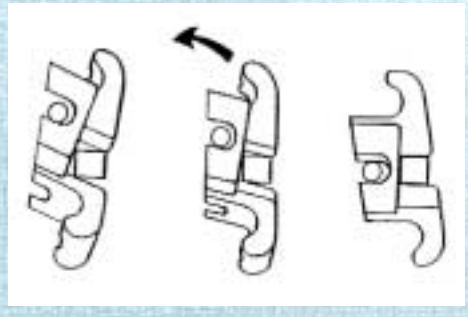

Figure 3: As teeth upright during stage three, the Tip-Edge archwire slot gradually closes back down from .028" in the vertical dimension to .022". When this occurs with a full size (.0215" X .0275"), rectangular wire engaged in the main archwire slot, the torque built into each bracket base is gradually and fully expressed.

Until recently, uprighting springs were required to upright and torque teeth during stage three, the final stage, of Tip-Edge treatment. These springs could be uncomfortable as well as unsightly and were sometimes lost or removed by patients. Many orthodontists appreciated the benefits of this technique but failed to adopt it due to the need for multiple springs and other auxiliaries, which made the technique seem overly complicated. With the introduction of the Tip-Edge

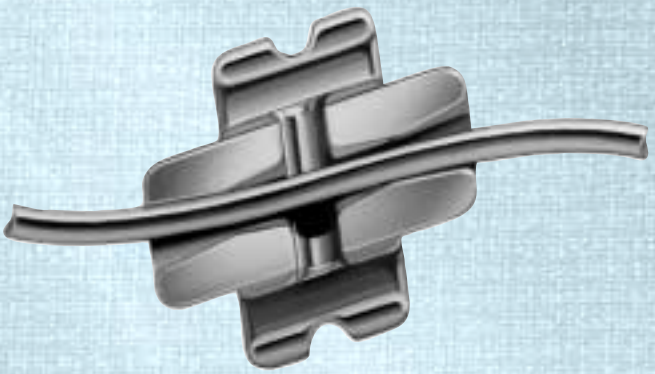

Figure 4: View of base of bracket with nickel titanium wire engaged in deep tunnel for final uprighting and torquing. At the beginning of stage three .012" nickel titanium is threaded through the deep tunnels of all brackets. This is usually followed with .014" nickel titanium threaded in the deep tunnels after 2-3 appointments.

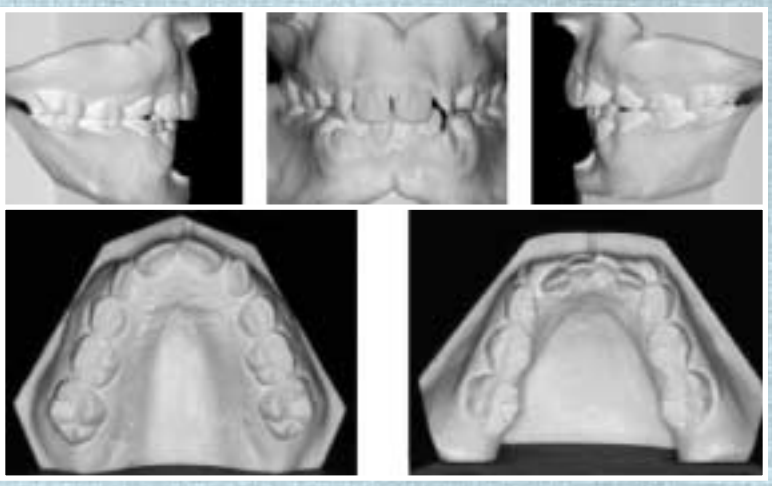

Figure 6: This patient exhibited a full step Class II malocclusion with severe crowding in both maxillary and mandibular arches.

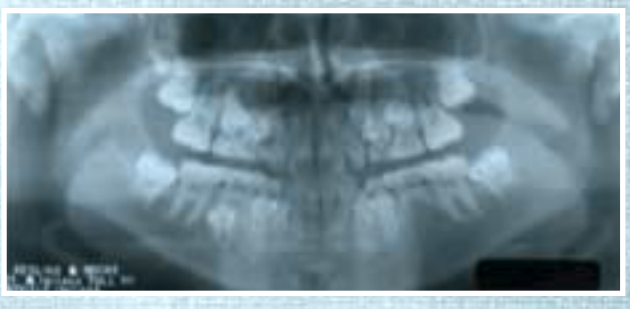

Figure 7: Start panorex. Note missing mandibular left second premolar and position of maxillary canines. Delayed eruption of these teeth added eight months to total treatment time.

PLUS bracket the need for uprighting springs and torquing auxiliaries has been eliminated. Instead, this bracket features a "deep tunnel" through which either a .012" or .014" nickel titanium wire is threaded at the beginning of stage three (Fig. 4). The nickel titanium wire not only uprights but also torques the teeth as the archwire closes down upon the engaged full size rectangular archwire in the same manner as seen when using uprighting springs.

The nickel titanium uprighting wire is first threaded through the deep tunnels at the start of stage three. It is engaged into the mesial openings of the deep tunnels on the central incisor brackets (Fig. 5A). At this point, the nickel titanium wire forms a circle which gradually decreases in size as the uprighting wire is threaded through the deep tunnels of the teeth in the buccal segments (Fig. 5B) Once fully threaded, the circle straightens out at the midline (Fig. 5C) and the main rectangular archwire is then engaged in the archwire slots (Fig. 5D).

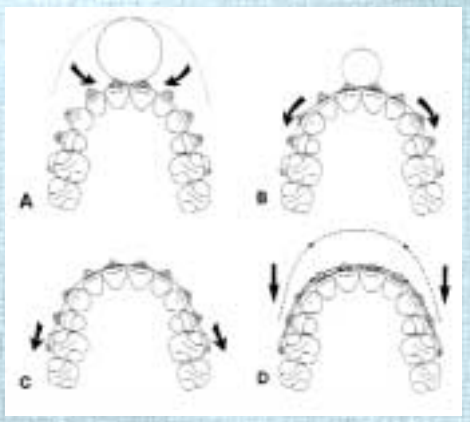

Figure 5A-D: A- At the start of stage three .012" nickel titanium wire engaged in mesial openings of deep tunnels of maxillary central incisors. **B-** Nickel titanium wire threaded distally though deep tunnels of posterior brackets. **C-** Nickel titanium wire completely engaged in deep tunnels of all brackets and gingival round molar tubes. **D-** Main .0215" X .0275" stainless steel archwire engaged in main archwire slot and retained with elastomeric ligatures. Ends are bent distal to molar tubes.

Bracket System

The following case reports are presented to provide a brief introduction to the use of the Tip-Edge PLUS bracket and technique. To better understand the progression of each patient's treatment, it is helpful to review the goals of each stage of treatment:

Stage One

Correct overjet or underjet.
Correct anterior overbite or openbite.
Correct anterior crowding or spacing.

Stage Two

Close pre-existing posterior spaces or extraction spaces.

Stage Three

Bring all teeth to their desired axial inclinations.

Case Reports Patient No. 1

The first patient was a 12-year-old female with a full step Class II malocclusion and severe crowding of both maxillary and mandibular arches (Fig. 6). She exhibited 4 mm of overjet and 3 mm of anterior overbite with a congenitally missing mandibular left second premolar (Fig.7). The patient had a convex profile with good lip balance (Figs. 8). Cephalometric analysis revealed that the mandibular incisors were -0.5 mm in relation to the A-Po line and the Wits value was +3.0 mm (Fig. 9). A special formula[5] is used to combine the arch length and cephalometric discrepancies. The total discrepancy for this patient was -9.0 mm. Generally when this value is -4.0 mm or less either interproximal reduction or extractions are indicated. Based on this relatively large total discrepancy the decision was made to extract the maxillary right and left first premolars, the mandibular right second premolar, and the retained mandibular left second deciduous molar.

Appliances were placed with .016" high tensile, stainless steel archwires in both arches. Molar stops were used

Figure 8: The patient exhibited a convex facial profile with good lip balance.

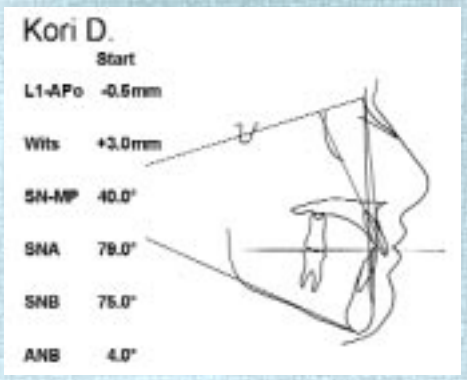

Figure 9: Start cephalometric tracing. Mandibular incisor was slightly behind A-Po line and Wits indicated a slight Class II skeletal tendency.

in the maxillary archwire to preserve space for the maxillary canines. Light elastic modules were engaged to Power Pins® inserted in the vertical slots of the mandibular canines to retract them distally and facilitate correction of the lower anterior crowding. The patient was instructed to wear light Class II elastics (1 ounce) 24 hours each day to open the anterior overbite (Fig. 10).

The maxillary canines still had not erupted after six months of treatment and the decision was made to have them uncovered. Both canines were bracketed and engaged within two appointments after being uncovered. The maxillary left canine was then engaged at the next visit (Fig. 11). Shortly thereafter, the premolars were also bracketed and engaged. The patient was instructed to wear the Class II elastics as needed to maintain an edge-to-edge incisal relationship.

One visit prior to starting stage three 022" high tensile, stainless steel archwires were placed in both arches with mild molar offsets to align the molars for easier engagement of the rectangular archwires at the following appointment (Fig. 12).

Stage three was initiated at the next appointment and .014" nickel titanium wires were threaded through the deep tunnels of all brackets and full size (.0215" X .0275"), rectangular archwires engaged in the main archwire slots in both arches. The patient continued to wear light Class II elastics as needed for the duration of treatment (Fig. 13).

After a little over two years (28 months), the appliances were removed and impressions were taken for a Perfector® and a bonded lower retainer (Fig. 14). Treatment was prolonged significantly due to the slow

Figure 10: Place appliance appointment. Maxillary and mandibular .016" high tensile, stainless steel archwires. Molar stops were placed in maxillary archwire to hold space for eruption of maxillary canines. Light Class II elastics deliver 1½ ounces of force. Elastomeric thread was used to retract mandibular canines and accelerate unraveling of anterior crowding.

Figure 11: After eight months of treatment both maxillary canines were finally erupted enough to bracket and engage to the archwire.

Figure 12: Maxillary and mandibular .022" stainless steel archwires engaged in preparation for full size, rectangular archwires at next appointment. Light nickel titanium wire (.012") was threaded through deep tunnels of all brackets in the maxillary arch to initiate uprighting.

Figure 13: Stage three with full size (.0215" X .0275"), stainless steel archwires in both maxillary and mandibular arches. Nickel titanium (.014") wires threaded through deep tunnels of all brackets to upright and torque teeth to final axial inclinations. Note lack of need for uprighting springs or other auxiliaries.

Figure 14: Finish. Class II molar relationship was corrected to a "super" Class I without the need for any extraoral forces. Total treatment time was 28 months—treatment was prolonged due to delayed eruption of maxillary canines. Treatment was completed in 14 appointments.

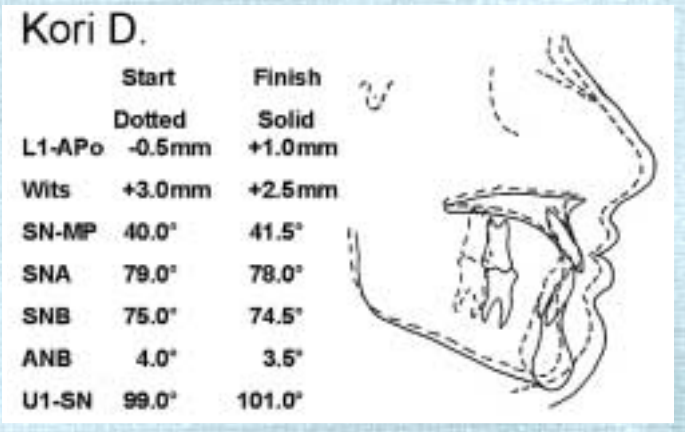

Figure 15: Superimposition of start and finish cephalometric tracings.

Figure 16: Final facial profile remained relatively unchanged with good lip balance due to position of lower incisor 1 mm ahead of A-Po line.

eruption of the maxillary canines, which took over eight months to erupt to the point where brackets could be bonded to them. Superimposition of start and finish cephalometric tracings revealed the mandibular incisors went from -0.5 mm to +1.0 mm in relation to the A-Po line (Fig. 15). The patient experienced favorable mandibular growth, which probably contributed to the correction of her Class II molar relationship. Her facial profile remained essentially unchanged (Fig. 16). The desired root paralleling was achieved for all teeth adjacent to extraction sites (Fig. 17).

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Figure 17: Finish panorex. Desired root paralleling was achieved at all extraction sites.

Patient No. 2

This 10-year-old male patient exhibited a full step Class II malocclusion with 5 mm of overjet and 100 percent overbite with the mandibular incisors occluding on the palate. There was mild crowding present in the maxillary arch and mild spacing in the mandibular arch (Figs.18). His facial profile was relatively straight (Fig. 19).

Cephalometric analysis revealed the mandibular incisors were +1.0 mm in relation to the A-Po line with a Wits value of +3.0 mm (Fig. 20). When the arch length discrepancy was combined with the cephalometric discrepancy, a total discrepancy of +1.0 mm calculated. Since this patient was just starting his final mandibular growth spurt and had a well-aligned mandibular arch with the lower incisors +1.0 mm to A-Po line, it was decided to treat him using a nonextraction treatment plan. No problems were found on the start panorex (Fig. 21).

Appliances were placed with .016" high tensile, stainless steel archwires in both arches. Strong bite opening bends (approximately 45 degrees) were placed just mesial to the molar tubes. Light (1 _ ounce) Class II elastics were initiated which the patient was instructed to wear 24 hours a day. To facilitate bite opening premolars are never bracketed or engaged when a deep anterior overbite is present until after the overbite has been corrected. Molar stops were used in the maxillary arch and Bump-R-Sleeve® over the archwires in the mandibular arch to preserve space for the premolars until they could be bracketed (Fig. 22).

After three appointments, the overjet and overbite had been corrected. The bite opening bends were removed from both archwires and replaced with mild bite opening sweeps. The premolars were bracketed and engaged to the archwires (Fig. 23).

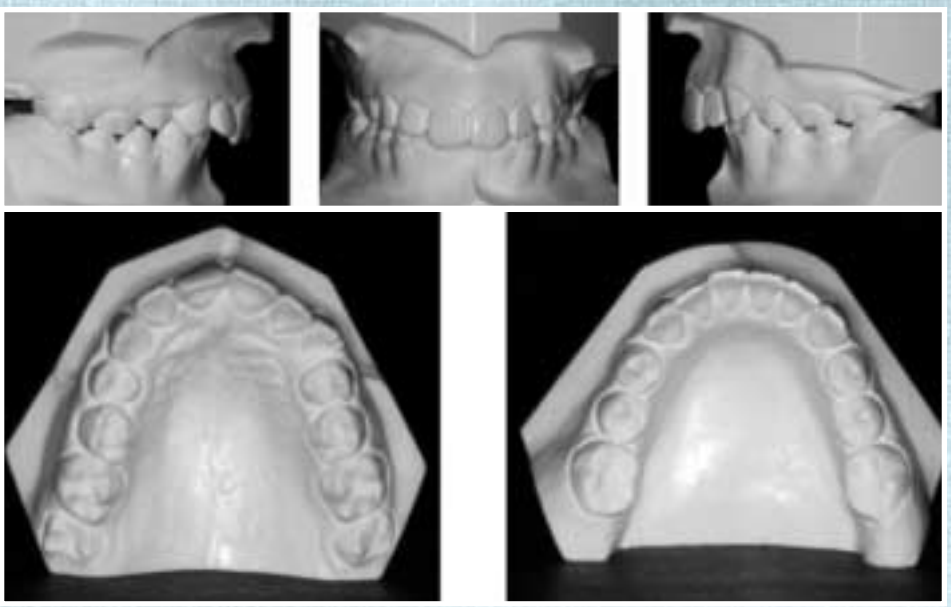

Figure 18: Patient No. 2 exhibited full step Class II, division 1 malocclusion with 5 mm of overjet and 100 percent overbite. Mild crowding was present in maxillary arch with mild spacing in mandibular arch.

Figure 19: Start facial photographs.

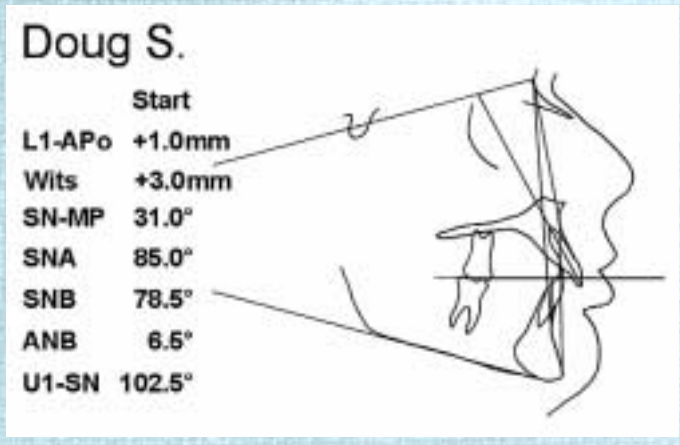

Figure 20: Start cephalometric tracing. Patient exhibited a mild Class II skeletal relationship.

Stage three was initiated with a full size (.0215" X .0275"), stainless steel rectangular archwire in the maxillary arch and a .022" high tensile, stainless steel archwire in the mandibular arch. To upright and torque the teeth .014" nickel titanium wires were threaded through the deep tunnels of all brackets (Fig. 24).

After 15 months and just nine appointments the appliances were removed and impressions were taken for a Perfector and lower Spring Aligner (Fig. 25). The Perfector was only worn for two weeks and was followed with an upper wrap-around retainer, which was worn only at night. Superimposition of start and finish cephalometric tracings reveal downward mandibular growth pattern with the Wits value dropping from +3.0 mm at the start of treatment to -3.0 mm at the finish. The lower incisor went from +1.0 mm to +3.0 mm in relation to the A-Po line (Fig. 26). The patient's facial profile remained relatively straight (Fig. 27). The finish panorex shows the divergence of the lower anterior roots as advocated by Williams[7] to enhance posttreatment stability (Fig. 28). Correction of the patient's Class II relationship was accomplished without the need for extraoral forces or removable appliances.

Figure 21: Start panorex.

These case reports illustrate the simplified treatment mechanics made possible through the Tip-Edge PLUS archwire slot. Only six, straight archwires and light intraoral forces are required to correct even the most severe malocclusions.

Figure 22: Place appliance. Maxillary and mandibular .016" high tensile, stainless steel archwires were placed. To maximize bite opening the premolars are not bracketed and engaged until after the overbite and overjet are corrected. Molar stops were used in the maxillary arch and Bump-R-Sleeve in the mandibular arch to preserve space for premolars.

Figure 23: Pre-Stage III. Premolars are bracketed and engaged in preparation for .022" archwires at following appointment.

Figure 24: Stage three with .014" nickel titanium wire threaded through deep tunnels of all brackets in both arches. Full size, rectangular archwire engaged in maxillary and .022" round archwire in mandibular arch. Both were stainless steel archwires.

Figure 25: Finish. Total treatment time 1 year and 3 months with just 9 appointments required to complete treatment. Full step Class II and 100 percent overbite were corrected without the use of extraoral forces or removable appliances.

The elimination of the need for uprighting springs and auxiliaries brought about by the introduction of this bracket has made this technique far easier for those using conventional edgewise appliances to learn and use. Hopefully, a new generation will embrace and enjoy the treatment benefits made possible through the use of differential tooth movement with the Tip-Edge PLUS bracket.

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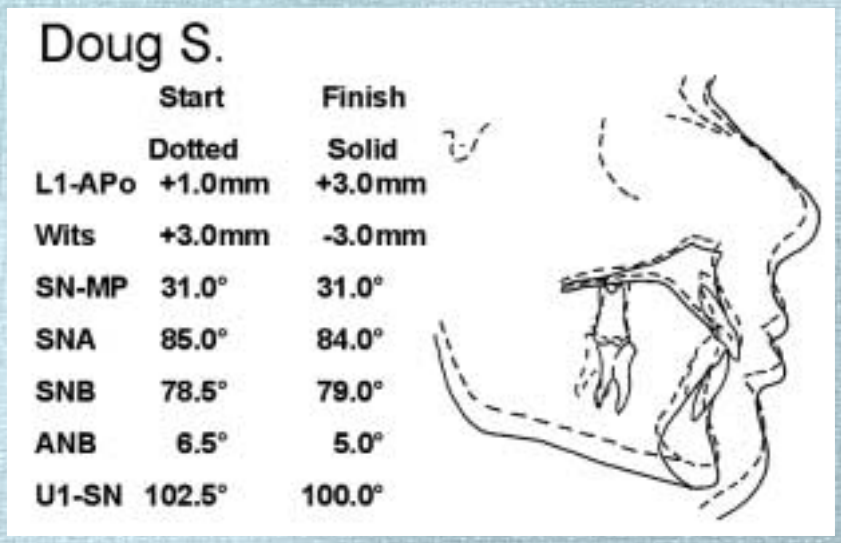

Figure 26: Superimposition of start and finish cephalometric tracings.

Figure 27: Finish facial photographs.

Figure 28: Finish panorex.

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Dr. Chris Kesling, DDS, MS

Dr. Chris Kesling began his practice at the Kesling & Rocke Group in 1984 after receiving his Master's degree in orthodontics from Saint Louis University. In addition to lecturing and presenting advanced orthodontic courses throughout the United States, he has also written and published several articles in leading orthodontic journals. Dr. Kesling is a Diplomate of the American Board of Orthodontics and a Clinical Professor at Case Western Reserve University.