APPLIANCE UPDATES - Q'S & A'S - CASE REPORTS - TECHNIQUE TIPS - REVIEWS

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TIP EDGE TODAY tm

Published Quarterly In The USA

DR. RICHARD PARKHOUSE CONGRATULATES DR. PETER KESLING AFTER HIS PRESENTATION IN CHESTER, ENGLAND (SEE PAGE 4).

FALL 1995

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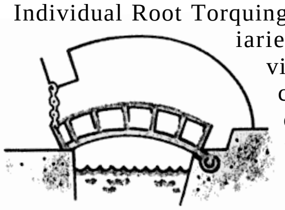
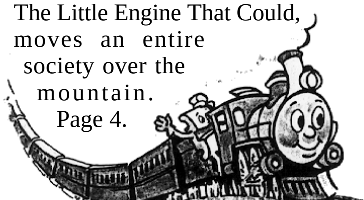


TIP-EDGE—

The Little Engine That Could, moves an entire society over the mountain. Page 4.



TIP-EDGE GRAPHIC

Tippy makes the friction problem disappear into thin air. Cover Story.

Article On Edgewise Brackets And Friction Misses The Tip-Edge Point

By: *Peter C. Kesling, D.D.S.*

A recent review of edgewise bracket designs and their effects on friction with archwires included mention of the Tip-Edge bracket[1]. The author, Dr. C.G. Matasa, who is not an orthodontist, evidently doesn't appreciate the functions of the Tip-Edge slot. He completely missed the point.

Matasa also referred to the Tip-Edge bracket as a spin-off of the Sved bracket. While resembling each other at first glance, they function in entirely different ways.

However, most orthodontists also don't realize that it is actually the binding between the upper and lower surfaces of opposed ends of archwire slots and archwires that makes friction clinically significant.

Furthermore it is **only** the binding that occurs when a tooth (and its bracket) tips mesially or distally that is significant. Such tipping occurs during translation of a tooth along a continuous archwire—even though steps such as the use of power arms or wide brackets are used.

The bracket tips because the tooth tends to rotate about its center of resistance. For a typical canine this point is located approximately 10 millimeters gingival to the archwire slot.[2]

The more force that is applied to move a canine distally the greater the friction that is generated at each end of the slot. It is much like trying to lead a mule, the harder one pulls the greater the resistance (Figure 1).

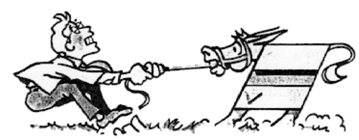


Figure 1. The more force applied to a conventional edgewise bracket the greater the friction.

During translation a conventional, narrow archwire slot rapidly closes down on the archwire to cause binding, (Figure 2-A).

Continued on page 2

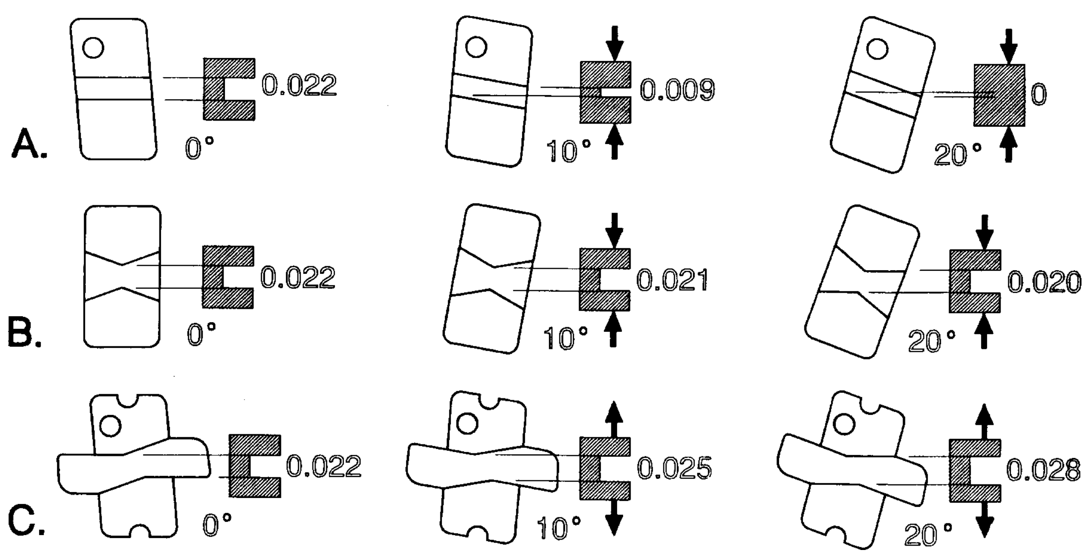


Figure 2. Crown tipping is an inseparable part of distal tooth movement during sliding mechanics. The effect this has on the effective vertical dimension of three different edgewise type archwire slots is graphically represented. A) Conventional, narrow, preadjusted archwire slot rapidly closes down on the archwire to cause binding. B) Archwire slot with pivot points in center (Sved) also gets smaller to create binding. C) Tip-Edge archwire slot becomes, in effect, larger vertically making binding impossible. This feature also facilitates moving directly into full size archwires.

Brackets And Friction

Continued from page 1

A Sved type slot does *not* lead to unlimited tipping because the pivot points are directly opposite to one another. Therefore, the points move together as the tooth tips, and begin to bind on the archwire. This, of course, is the same action as with all conventional edgewise archwire slots—albeit friction might be greater due to the proximity of pivot points (Figure 2-B).

In the Tip-Edge bracket the portions of the ends of the slot that would bind on the archwire have been removed—binding is absent. The slightest amount of tipping causes the effective archwire slot to *increase* (from .022" up to as much as .028"). This, of course, makes friction disappear into thin air! (Figure 2-C.)

Edgewise Slot is Source of Friction

The role the conventional edgewise archwire slot plays in the creation of friction is even more evident if one considers the formula for the frictional force (F_{fr}) between two sliding surfaces:

$$F_{fr} = \mu \times F$$

The value of μ (coefficient of friction) is determined by the materials themselves (Figure 3). "F" represents the force pressing the two surfaces together.[3]

Neither contact area size nor speed of movement have much effect on friction. Also, surprisingly, friction is about the same under wet or dry conditions.

In orthodontics, the significant variable in determining friction is the force pressing the surfaces together. It is mainly the vertical forces pressing each end of the slot against the archwire that cause frictional problems. With a conventional archwire slot these forces (F) are directly related to the horizontal pull applied to the tooth.

Material/ material, μ	
Steel/steel	0.55
Diamond/metal	0.15
Sapphire/steel	0.15
Metal/metal	0.15
Diamond/Diamond	0.10
Teflon/steel	0.04

Figure 3. Values of the static coefficients of friction between various materials.[1]

Eventually crown movement stops (Figure 4-A) and can only resume after periodontal remodeling permits the tooth to upright which in turn reduces the friction between the archwire and each end of the archwire slot.

This causes teeth to translate along archwires in a series of short steps rather than in a smooth continuous motion—but not when Tip-Edge brackets are employed (Figure 4-B).

Obviously the forces pressing slots against the archwires are not constant. They vary depending on the retractive force, the angulation of the slot to the archwire and/or the size of the archwire. Vertical forces between brackets and archwires also vary depending on bracket width and slot size. However, most important of all is slot design.

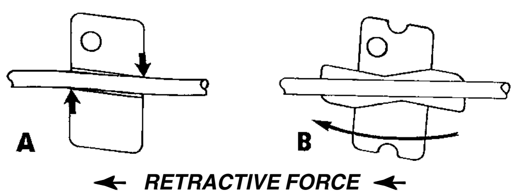


Figure 4. A) Conventional edgewise slot binds on wire until friction stops free sliding. Tooth must upright before sliding can resume. B) Tip-Edge slot prevents binding. Retraction can take place in one smooth, uninterrupted motion under less than ¼ ounce (15 grams of force).

Tip-Edge Gets The "F" Out of Friction

The Tip-Edge archwire slot design prevents the creation of vertical forces between the bracket and the archwire during retraction. This could then result in zero friction because one of the components (F) of the formula for friction, might itself be zero:

$$F_{fr} = \mu \times 0$$

$$F_{fr} = 0$$

In fact, because of its unique design, it seems it would be difficult to design a study to compare the friction of Tip-Edge to conventional edgewise brackets. In order to simulate the clinical situation, all brackets tested should be free to tip as they move along the archwire. If this were the case, the ends of the conventional edgewise slots would bite into the archwire while the effective size of the Tip-Edge slot would increase.

Of course, there is another factor that can cause friction during space closing or retraction—ligatures. However, steel ties can purposely be made loosely and elastomeric ligatures begin to "take a set" within a few days. Both features tend to reduce ligature/archwire friction.

Techniques Can Also Vary Friction

Conventional, (continuous archwire) edgewise techniques can create friction at several areas in each quadrant:

A. Canine bracket during canine retraction
B. Canine and premolar brackets as well as molar tubes during final space closure

In contrast, orthodontists using Tip-Edge brackets and the Differential Straight Arch® Technique may have the best of all worlds. The only sliding between attachments and archwires during canine retraction and/or posterior space closure occurs in the molar tubes.

The friction of a wire sliding through a molar tube is less than that when sliding through a bracket. This is true for three reasons:

A. Molar (as the anchor tooth) does not tip.
B. Molar tube is longer (wider).
C. No ligatures.

The resultant drop in friction permits relatively rapid continuous tooth movements with minimal strain on anchorage. This is an advantage being recognized by more and more orthodontists each day as they abandon static slots for the dynamics of Tip-Edge.

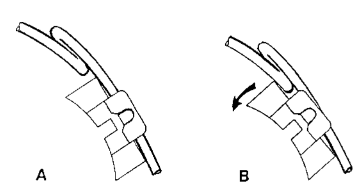
1. Matasa, CG. The Orthodontic Materials Insider, Vol. 8, No. 1, March 1995.
2. Tidy DC. Frictional forces in fixed appliances. Am J Orthod Dentofac Orthop 1989; 96:249-254.
3. Bednar JR, Gruendeman GW, Sandrik JL. A comparative study of frictional forces between orthodontic brackets and archwires. Am J Orthod Dentofac Orthop 1991; 100:513-522.

Q's and A's

Q. *It always amazes me how quickly and easily the mandibular canines tip distally when aligning crowded incisors. However, it also seems this causes the canines to rotate mesiolingually—but not all the time. Why is this?* EL PASO, *TEXAS*

A. In cases of mild anterior crowding it is customary to place a plain (no vertical loops) .016" archwire with the intermaxillary circles pressing lightly against the mesial surfaces of the canine brackets. This mild force, plus straightening of the archwire as the anterior teeth align causes the canines to tip distally.

However, this will cause the intermaxillary circles to rest over the labial surfaces of the mesial wings of the canine brackets for a short period of time. Since the distal portions of the circles are lingual to the buccal segments of the wire there is a tendency to rotate the canines—see figure.



(A) Intermaxillary circles should not contact the canine brackets. (B) If the circles are too far apart they can press on the labial surfaces of the mesial wing tips and cause undesired mesiolingual canine rotation. Ligature ties deleted for clarity.

Using IRTA's To Provide Third Order Control of Pontics

On occasion it is necessary to hold spaces during orthodontic treatment for final prosthodontic restorations or implants to replace missing teeth. Attempting to accomplish this with coil springs is difficult and imprecise.

The use of a pontic the same size and shape as that desired for the final restoration not only eliminates repeated adjustments of coil springs, but also enhances the patient's appearance throughout his or her treatment.

During Stages I and II when round wires are generally used to facilitate retraction and bite opening, some type of auxiliary or archwire manipulation is required to prevent the labio-lingual rotation of the pontic around the archwire. In the past, attempts to provide the necessary torque control with a round base archwire have proved awkward to fabricate and were crude in appearance.

Individual Root Torquing Auxiliaries (IRTA's) provide an esthetic means of precisely holding pontics in place without archwire manipulation or other auxiliaries. Once the desired space has been established, an impression is taken and the proper shade selected. The laboratory then adapts the proper size pontic to rest passively against the alveolar ridge with no visible space between it and gingival tissue.

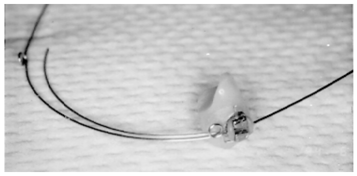


Figure 1. Pontic with attached bracket ligated to archwire. IRTA is engaged through vertical slot and adjusted to provide third order control of pontic.

Figure 2. Archwire fully ligated with attached pontic to replace missing maxillary left cuspid. End of IRTA is annealed and bent just distal to the maxillary right central incisor bracket to keep pontic from sliding distally.

At the patient's next visit the labial/buccal surface of the pontic is buffed lightly with a green rubber wheel and a bracket is bonded using the Direct-On® adhesive system. The archwire is then removed from the patient's mouth and the pontic is ligated to it. An Individual Root Torquing Auxiliary is engaged into the vertical slot of the bracket attached to the pontic. The IRTA is then adjusted so the pontic exerts slight pressure against the alveolar ridge without blanching the underlying tissue when the archwire is fully engaged. The archwire and attached pontic are engaged as a single unit (Figure 1).

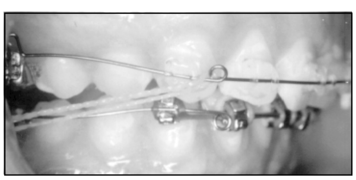
To prevent the pontic from sliding along the main archwire mesiodistally, the end of the Individual Root Torquing Auxiliary can be bent either mesial or distal to the bracket on an adjacent tooth to lock the pontic in place mesiodistally (the tail of the IRTA should extend through the brackets of at least two adjacent teeth for adequate torque control).

With proper shade selection it is difficult to differentiate the pontic from adjacent teeth when the archwire is fully engaged. The fact that an IRTA is virtually invisible, significantly enhances the overall esthetic appearance of the appliance (Figure 2).

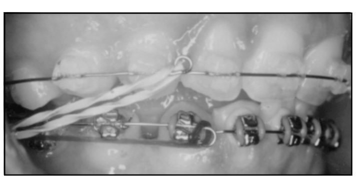
Once retraction has been completed and the patient is ready for final uprighting and torquing, rectangular base archwires can be used to hold the pontic in its properly torqued position until appliance removal (if using a Tip-Edge bracket without a Deep-Groove, a Side-Winder uprighting spring or Tip-Edge elastomeric ring would be required to achieve full torque control with the rectangular archwire).

CASE REPORT

This 18 year old female presented with a Class II Division 2 malocclusion with a deep anterior overbite and generalized spacing of the mandibular arch. A previous orthodontist had insisted that headgear would be required to correct her overbite. She sought a second opinion and was pleased to learn that no extraoral forces would be needed with Tip-Edge. Due to the spacing present in the mandibular arch and the position of the mandibular incisors (3mm behind the A-Po line) a nonextraction treatment plan was initiated.

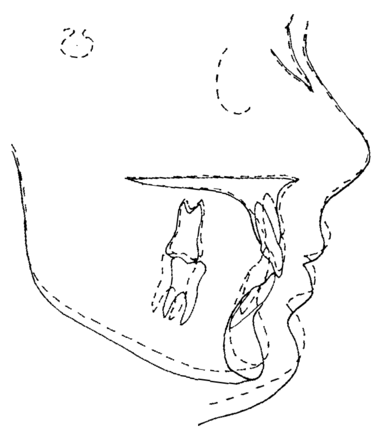


CeramaFlex® Tip-Edge brackets were placed in the maxillary arch and metal Tip-Edge brackets in the mandibular. Australian archwires (.016") with strong anchor bends. Class II elastics pulling 1 oz. on each side were worn 24 hours each day.



After 7 months, Stage II began with the incisors edge-to-edge. Space in mandibular right quadrant was closed without braking mechanics to correct the midline which had shifted slightly to the left.

Approximately 10 months after placing the appliances, Stage III mechanics were initiated with maxillary and mandibular .022" Australian wires. Dual IRTA's were placed to torque the maxillary central incisors (Tip-Edge Today, Summer 1994).



K.K. .... Female, 18 Years
Class 2, Division II
Non-Extraction
Archwires Used 6 (2U, 4L)
Adjustments .... 15, **Time**: 22 Months
Retention .... Positioner

Cephalometric Changes:

	Start - Dotted	Finish-Solid
1-APo	-3.0 mm	+1.0mm
Wits	+6.0 mm	+1.5 mm
SN-MP	23.0°	25.0°
ANB	4.0°	3.0°
SNA	82.0°	81.0°
SNB	78.0°	78.0°
1-SN	94.0°	101.0°

E.B.S. Meeting—a Tip-Edge Forum

Drs. Richard Parkhouse, Thomas Rocke, and Peter Kesling in front of antique, steam driven slate train.

The European Begg Society held its biannual meeting May 19th-24th in medieval Chester, England. The meeting, under the direction of its president, Dr. Richard Parkhouse, was well attended. Speakers included Professors Jim Moss, Hans Pancherz, Kuni Miyajima and Milton Sims as well as Drs. Hans Booy, Peter Kesling, Thomas Rocke and Richard Parkhouse. It is interesting to note that Tip-Edge has become the appliance of choice for all these speakers as well as most of the other members of the association. Could a Society name change be eminent?

A side trip to northern Wales included a ride on the Ffestiniog Railway—a small, steam driven train that was originally used by slate miners in the mountains of Snowdonia. A stop at ancient Conway Castle concluded a most enjoyable day.

Tip-Edge Association of Mexico

The third quarterly meeting was held July 28 at TP Mexico's new offices in Mexico City. Over eighty orthodontists were in attendance as well as Andrew Kesling, President of TP Orthodontics.

Presentations were given by Drs. Antonio Valle (Stage Two and clinical cases), Eduardo Aquilar (Pre Stage Three) and Thomas Mendoza (Protraction With Tip-Edge Ceramic Brackets). All of the speakers have had training in Tip-Edge and the D.S.A.T. with Drs. Kesling and Rocke at the Orthodontic Center, Westville, Indiana.

Tip-Edge Course in Strasbourg, France

A two day Tip-Edge course was given in France in March. It was held at the University of Strasbourg and organized by Prof. Charles Bolender of the University.

All the orthodontic speciality training students of the Universities of Reims, Nancy and Strasbourg attended. Their official university training is a four year program resulting in a "Certificat d'études spéciales Mention Orthodontíe" (C.E.C.S.M.O.). This "certificate" is necessary to be an officially recognized orthodontist in France.

Prof. Bolender was assisted in teaching the Tip-Edge course by his son Dr. Yves Bolender and brother Dr. Guy Bolender.

A more advanced course for orthodontists in private practice is planned for September 4th and 5th. It will be held at the same location, Faculté de Chirurgie Dentaire de Strasbourg.

Drs. Bolender (front row left and right) and students during Tip-Edge Course at the University of Strasbourg.

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