TUNNEL BRACKET SYSTEM: Practitioner's First Look

By Jeffery Gerhardt, DDS

Brackets are one of the most important elements of an orthodontic appliance. There has been a debate in orthodontics involving which is the best bracket system. In my opinion, there are "pros and cons" about any bracket system just like there is good and bad about different filling materials for restorative dentistry.

Straight Wire Brackets

A straight slot bracket, which gives the treating dentist a lot of control, is good because the bracket slot is straight. However, it is harder to get a wire in it so the treating dentist has to go through a series of wires from small to large to express the final tip and torque prescription in the bracket.

Tip-Edge

The bracket slot opens up from .022 to .028. This allows the tooth to tip up to 20 degrees, which has the advantage of being able to use very light force to move a tooth, less anchorage is needed than with straight wire, plus less wire in bending. When finishing a case, the treating dentist had to then upright the tooth to achieve the final tip and torque prescription of the bracket.

TNL Tunnel Bracket System

The TNL Bracket System is the brainchild of Dr. Peter Kesling, Dr. Chris Kesling, and Richard Parkhouse, which is the same group of minds that introduced the Tip-Edge Plus® bracket in 2004.

I like to think of this as a hybrid bracket system that uses ideas from straight wire and Tip-Edge brackets. This system uses a .014 NiTi wire in a deep tunnel in the bracket to drive the bracket against a undersized .019 x .025 stainless steel wire to achieve final tip and torque angulation of the tooth with no need for third order bends in the archwire. TNL brackets allow about a 5-degree tip of teeth as opposed to a 20-degree tip with Tip-Edge brackets.

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Personal Preference

I teach a 2-year, hands-on Tip-Edge class for the Academy of Gp Orthodontics. In my personal practice, I use both Tip-Edge and straight wire brackets and have just started to use the TNL Brackets.

How to use the TNL Bracket System (In general)

Stage I (Fig .1)

1. Bracket anteriors and bicuspids, place molar tubes or bands on first molars.
2. I like to start with a .014 NiTi if teeth just need to be aligned or a .014 reverse sweeped NiTi if I need to open their bite.
3. When teeth are aligned properly, I go to a .016 stainless steel archwire and use 2-ounce elastics as needed.

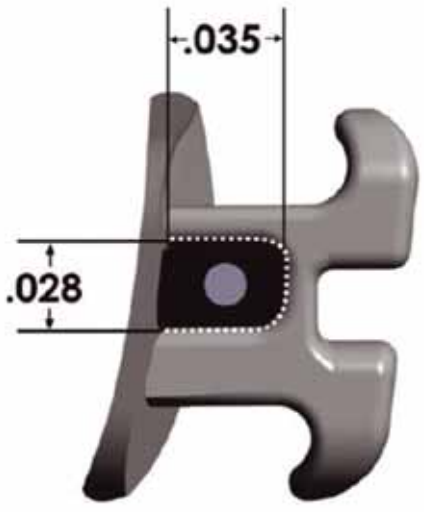
Stage II ***(only done if it's an extraction case or space too close case)*** (Fig .2)

1. Go to a .018 or .020 stainless steel archwire.
2. Use e-links to close space.
3. Use 2-ounce elastics as needed.

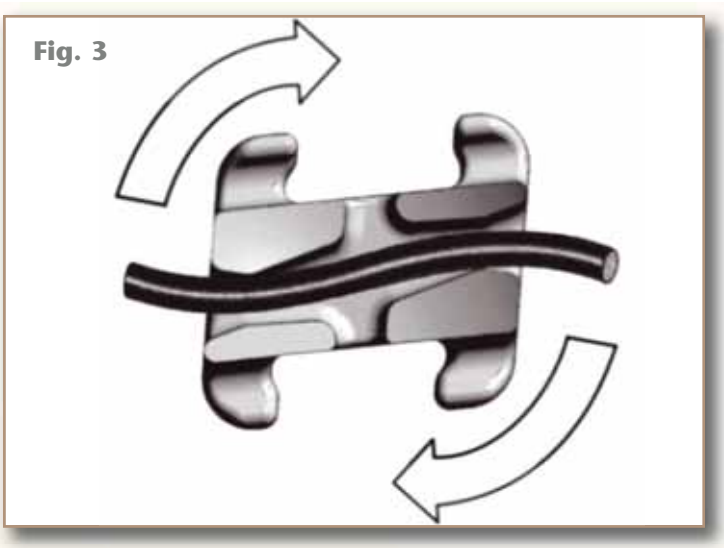
Fig. 1

Maxillary Right Canine TNL Bracket (Hook is optional)

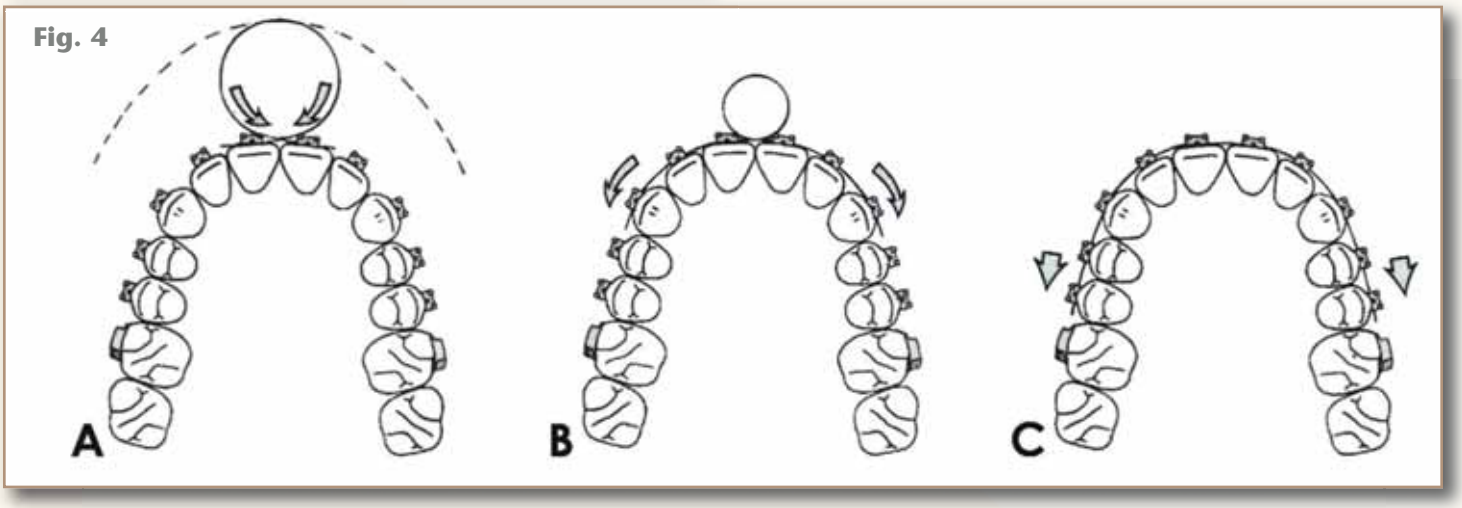
Fig. 2



Ease of threading NiTi into "funnel-shaped" ends of tunnels.



"As the NiTi uprights and corrects rotations, it is also powering the archwire slot surfaces against the rectangular wire that expresses the prescription and automatically creates buccal or lingual torque as required."



Stage III (Fig. 3)

1. If no buccal torque or anterior is needed, finishing can occur in round wires.
2. If tipping and/or torque is needed, I thread a .014 NiTi auxiliary wire in the deep tunnel and go to a .019 x .025 ss archwire. As the NiTi uprights and corrects rotations, it is also powering the archwire slot surfaces against the rectangular wire that expresses the prescription and automatically creates buccal or lingual torque as required.
3. Space is closed as needed with a medium or mini power chain.
4. Increase elastic strength as needed. Normally up to 3- or 4-ounce elastics.

How To Place NiTi (Fig. 4)

1. Start between front teeth, making a circle in wire.
2. Just go along and pull through, use gentle force to pull wire through.
3. Cut off distal to second bicuspids.

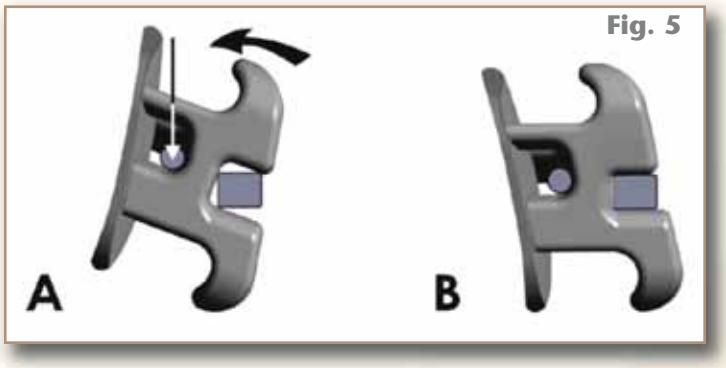
You can see video of this procedure at https://www.youtube.com/user/KeslingSlot.

What The Wire Is Doing (Fig. 5)

The NiTi wire wants to straighten out, creating a coupling force on the bracket. The de-rotation caused by the NiTi wire plus the force from the module pushes the bracket into the .019 x .025 stainless steel wire. As the bracket engages the rectangular wire, buccal torque is created.

What Should Happen Over Time

First NiTi placed in deep tunnel.(Fig. 6) Then place .019 x .021 stainless steel archwire (at same appointment).(Fig. 7) As the NiTi wire straightens out, the archwire slot closes onto the rectangular wire expressing the torque and tip prescription of the TNL bracket. (Fig. 8)



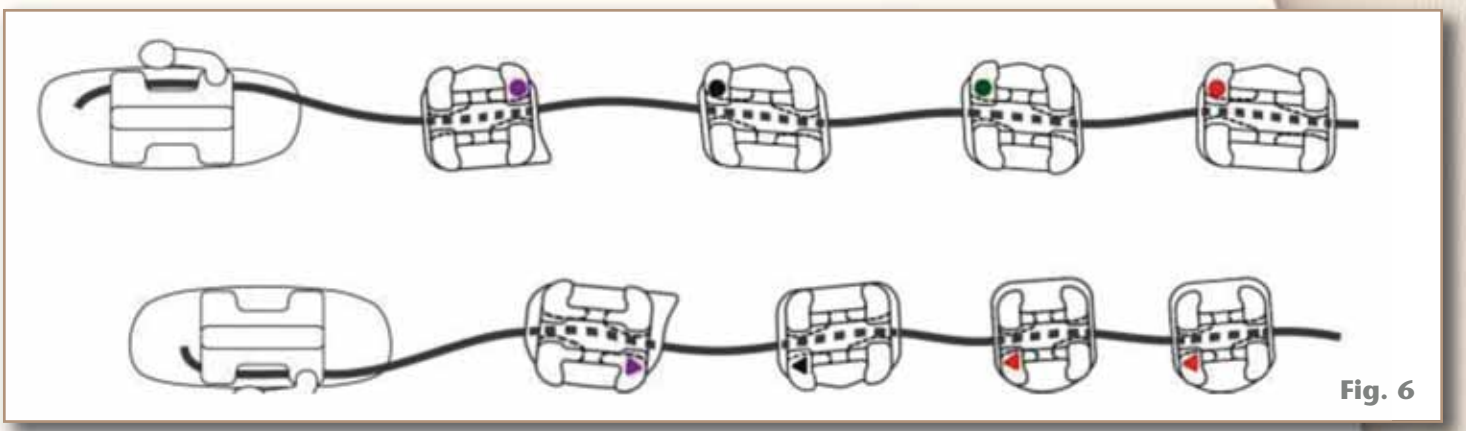


Fig. 6

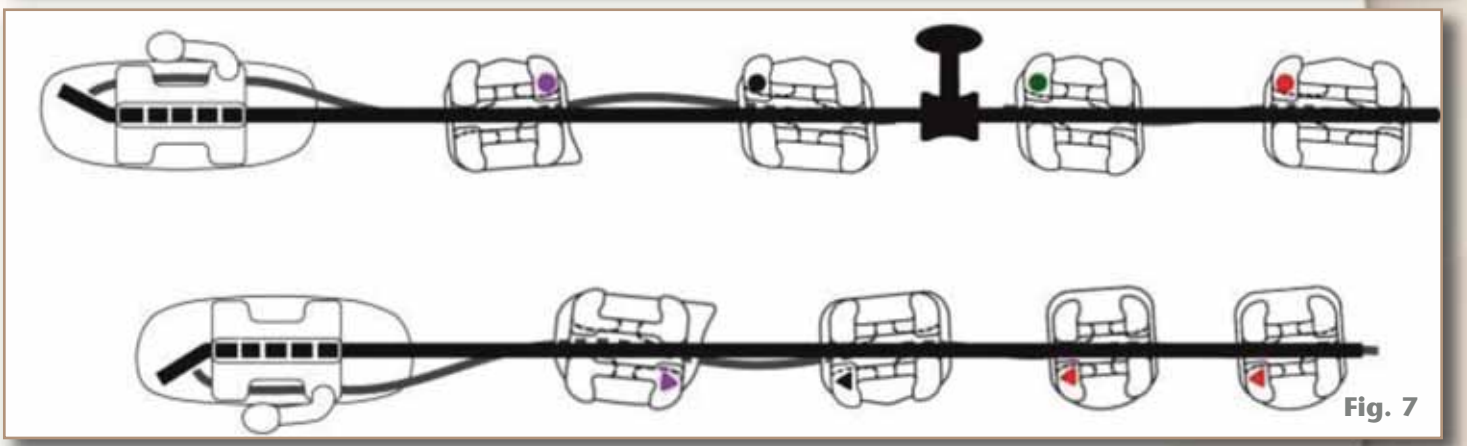


Fig. 7

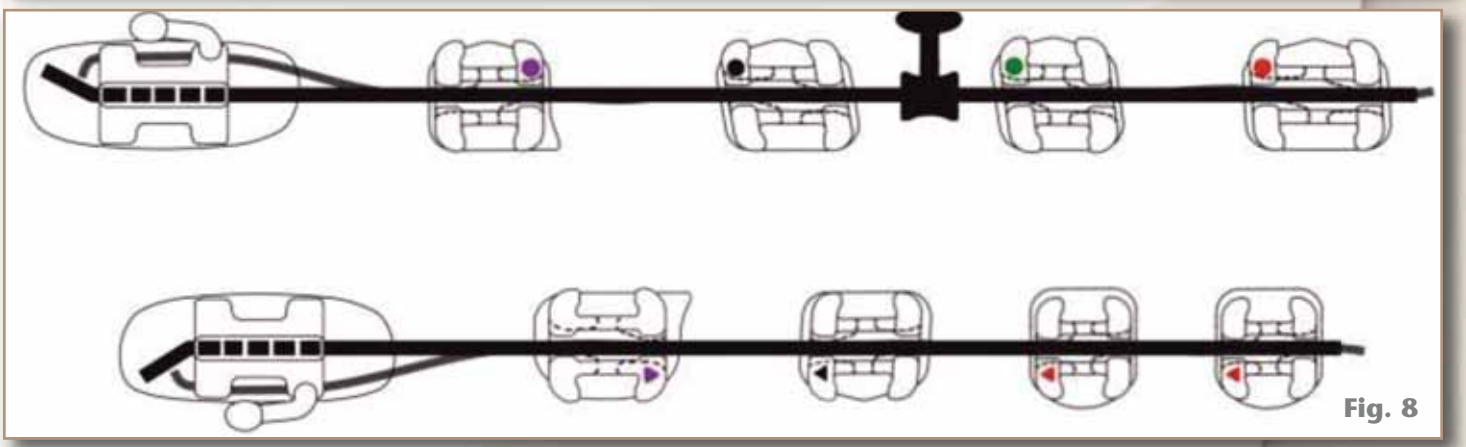


Fig. 8

Brackets From a Coupling Force Aspect

1. Equal and opposite forces cancel each other out. So, if we have a 2-ounce force pushing in equal and opposite directions, the net force is 0.(Fig. 9)

2. Now, move the forces out about 1 mm each. There is a rotation force of about 4 ounces.(Fig. 10)

3. Move that same 2-ounce force out to 2 mm. Now we have a rotational force of about 8 ounces. (Fig. 11)

Bottom line: The longer the bracket, the more coupling force can be produced, but this also increases the friction of the bracket so it's harder to move the tooth down the wire.

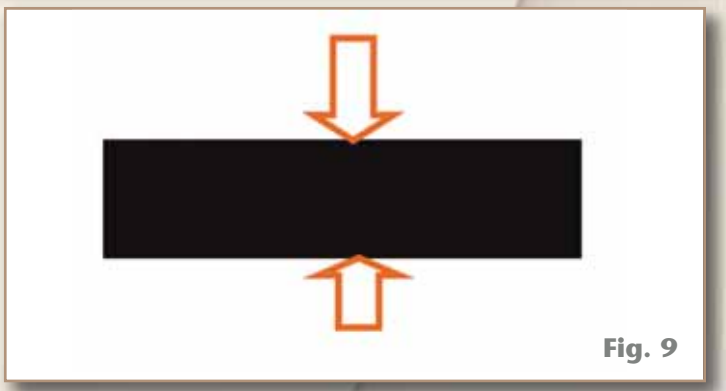


Fig. 9

Brackets Systems From Prospective of Coupling Forces

1. Straight Wire Bracket design (Fig. 12):
   - Long mesial-buccally for control and to create

Fig. 10

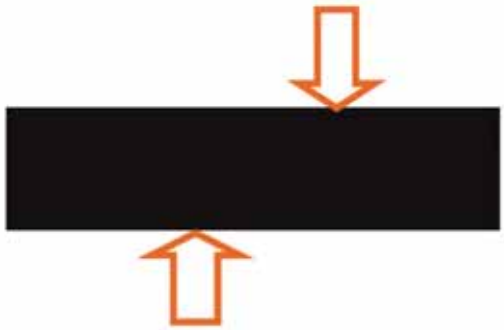


Fig. 11

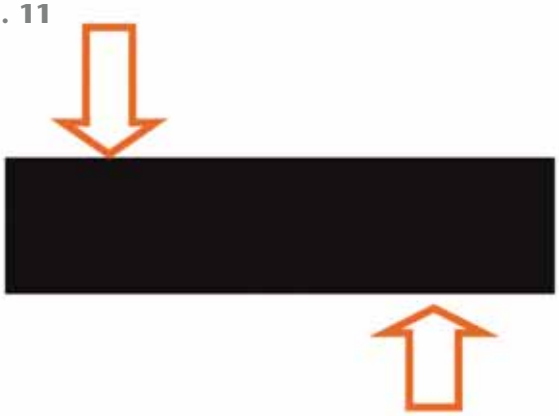


Fig. 12

Fig. 13

a coupling rotational force on a tooth. This width also creates more friction so it's harder to move tooth down the wire.

- Methods to create a rotational force with a module (but these relax in a few days),rotating wedged, and bends in the wire.

❷ Tip-Edge Plus® Bracket design (Fig. 13):

- Based on a Tweed straight wire bracket. Has an angle cut out of straight wire slot that allows tooth to tip distally up to 20 degrees. It also retains flat portions of the bracket slot "wings" for rotational control and a tunnel to accept NiTi auxiliary wires.
- Not as wide bucally-lingually as a straight wire bracket for less friction allowing the bracket to slide down the wire with less force. Bracket slot opens from .022 to .028 as tooth is tipped which also decreases friction.
- Methods of creating rotational forces can:

1) Use a module but it relaxes and the plus bracket is not as wide as a straight wire bracket so there is less coupling force.

2) Use auxiliaries such as a rotating spring through the vertical slot to rotate the tooth clockwise or counter-clockwise as desired.

Fig. 14

3) Use a .014 NiTi in the deep, wide tunnel to produce a coupling force.

4) Place bends in wire (not preferred with this system).

❸ TNL Bracket design (Fig. 14):

- Is a mini-twin straight wire bracket with a deep tunnel and a vertical slot.
- Methods of creating rotational forces are: 1) Can use a module 2) Can use auxiliaries such as side-winders and rotational springs 3) Can use a .014 NiTi in the

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Fig. 15

Fig. 16

deep tunnel 4) Can use the same bends as a straight wire bracket.

The takeaway: Modules relax, NiTi wires never relax, keeping constant light coupling force on the teeth.

Case Study

Patient History (Figs. 15 & 16)

- 38-year-old male
- Already had braces, but did not like his underbite. Patient had been told that the only way to improve it was with orthognathic surgery, which he declined and decided to live with the underbite.
- This was my first case with TNL Brackets.

"In Class III patients, I often leave the upper first bicuspid brackets off because I normally have to place NiTi open coiled springs to procline the upper anterior teeth, then later I pull the posterior teeth forward two at a time."

Diagnosis/Model analysis

- mild underbite
- molar and canine Class III
- mandibular model discrepancy of +1

Ceph analysis

- Lower 1 to A.PO +4.6 m.m. (norm +2)
- Witts –3.9 m.m. (indicating skeletal Class III)

Fig. 17


Fig. 18


Fig. 19


Fig. 20

- E-Plane –7/-2 (indicating concave facial profile, so non-extraction if possible)
- Por. To N/A/B is 91/95/117 (indicating that lower jaw is too far forward)

Total discrepancy	
Lower 1 to apo:	+5
Correct to +2:	-3
Times 2:	-6
Model disc.:	+1
Total	-5 (indicating potential 4 bicuspid extraction case)

Treatment Decision

- Decided to treat non-extraction due to age, patient profile and patient desires.
- Decided to use TNL Brackets due to their ability to easily create buccal and anterior labial torque.
- If we cannot correct underbite to patient's desires, we can strip space in lower arch to move lower teeth distally.

Workup Images

Images With Appliances Placed (Fig. 17)

- Placed molar tubes and brackets
- Start of case with .014 straight NiTi wires
- Note: In Class III patients, I often leave the upper first bicuspid brackets off because I normally have to place NiTi open coiled springs to procline the upper anterior teeth, then later I pull the posterior teeth forward two at a time.

First Visit (Fig. 18)

- When teeth were straight enough (1 month later), placed .014 NiTi in deep tunnel in upper arch. Idea is that we want to torque anterior teeth labially. We then placed .020 stainless steel wires in archwire slots.
- Patient now wearing 4-ounce Class III elastics.

One Month Later (Fig. 19)

- Placed .019 x .025 stainless steel wire in upper arch, same wire in lower.
- Continue with Class III elastics.
- Upper anterior crowns are now being torqued labially by power from the .014 NiTi auxiliary wire through the deep tunnels.

Total Treatment Time: Five Months (Figs. 20 & 21)

- Same wires

"Could have taken braces off in 7 months, but held teeth in place for two additional months for less chance of a relapse."

- No longer has underbite
- Note: I did not have to use an open coiled springs
- Molar Class I
- No more underbite
- Could have taken braces off in 7 months, but held teeth in place for two additional months for less chance of a relapse.
- Ceph analysis: Lower 1 to apo +2.7 mm, Witts, -.6 mm.

Bracket systems used in my office

Straight Wire: I use these brackets for simple alignments.

Tip-Edge: I like this bracket system for correcting deep overbites and overjets, as well as most of my extraction cases.

TNL brackets: I have been using for all my underbite (Class III) cases because of how easy it is to create labial torque plus my adult cases. These patients often need a lot of de-rotation and I can create a lot of constant light coupling force with these brackets.

To learn more about the TNL bracket system, call Impact Orthodontics, Inc. at 219-326-1337 or e-mail impactortho@frontier.com and ask for the white paper on the TNL tunnel bracket system.