Understanding the ŒBalanced Forces¹ Technique

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Whether you use K-type hand files exclusively, or occasionally use K-files files in conjunction with rotary instrumentation, the ³balanced forces² technique can help you reduce instrument breakage, minimize canal straightening, and eliminate apical zipping. The balanced forces technique applies a slightly different ³twist² to canal preparation with K-type files.

James B. Roane, DDS, MS, associate professor in endodontics at the University of Oklahoma in Oklahoma City, developed the ³balanced forces² technique in 1981.

In 1985. he presented the technique to the world in an article published in the *Journal of Endodontics*. Unfortunately, for most people, the article was difficult to study and understand.

Eugene Pantera, DDS, MS, associate professor of endodontics and assistant dean for continuing education at New York State University at Buffalo, presented a simplified update to balanced forces at the 50th annual meeting of the American Association of Endodontists in Chicago.

After listening to the audiotape that was recorded at the endodontic meeting in Chicago, I called Pantera to ask if he could help me explain balanced forces to our readers.

According to Pantera, the ³balanced forces² technique is widely misunderstood, and one of his on going goals is to help more people understand this excellent technique.

Primary Objective of the Balanced Forces Technique

The initial goal of all endodontic therapy is to eliminate the root canal system as completely and efficiently as possible, without ledging, zipping, stripping, or straightening the canal.

One treatment that removes all of the endodontic disease from the tooth is extraction, but that¹s a bit extreme. Our goal should be to clean out as much of the material in the root canal system as possible short of removing the tooth.

Size of Apical Preparation

The size of the apical preparation and where the preparation terminates depends on your personal philosophy and what you were taught in your endodontic training. This knowledge is then combined with what you learn in day-to-day practice.

Pantera says that we could argue for days about the ideal point in the root canal to terminate the preparation, but rather than open that can of worms, let¹s just say that with ³balanced forces² you can prepare the canal to any depth you choose.

The apical diameter of the canal is another matter. Most of us were taught that the average apical opening starts out about size #15 or smaller, but a recent study reveals that the average apex is usually size #20 or slightly larger. If you only enlarge the apex to a #20, you will have done very little apical preparation, and you will most likely leave necrotic material in the canal.

We used to believe that the more a canal curved, the smaller the diameter of canal we had to leave. We were told that we could not safely pass large instruments beyond the curve. With ³balanced forces,² however, you can predictably take a #45 file around most curvatures. (This is also true with rotary nickel titanium files, incidentally.)

Why a Larger Preparation?

There are several problems associated with inadequate enlargement of the apex: First, your apical preparation will be ineffective unless the canal is enlarged one or two sizes larger than its initial diameter.

Second, the irrigating material is less effective, and removal of debris and irritants is incomplete with small apical preparations. This, in turn, creates an adverse influence on the final seal.

Third, it is very difficult to deliver obturating materials to the apical third of a small, diameter canal.

Apical patency?

Pantera estimates that more than half of all endodontists believe that it is important to maintain apical patency. ³Otherwise, we tend to leave a lot of debris behind,² says Pantera.

He also states that a patent apex causes *less* post-op discomfort. ³The body can tolerate some debris out the apex, but it¹s what we leave in the canal that causes most problems.²

Balanced Forces Technique

The ³balanced forces² technique allows us to enlarge beyond the canal curvature without creating undesirable results.

To understand the technique, we must first understand the cutting forces associated with K-type files.

A K-type file has an angle of attack that is equal in either direction. Compared to other types of files, K-files are not very efficient, but there is no loss of cutting efficiency regardless of the direction they are rotated. K-files also cut on insertion and withdrawal.

Most K-files are made from a triangular piece of wire that is twisted during the manufacturing process. The ³Flex-R² file, however, was designed to be used with ³balanced forces,² and is made from a diamond-shaped wire. The result is a more flexible file with less cross-sectional area and increased flute depth.

The flex-R is a triangular cross-section file which is ground in a helical position rather than ground in a vertical orientation and twisted to create the helical spiral. The triangular cross section is more flexible, has more flute space and less cross-sectional area than either a diamond or a square one.

The diamond-shaped file has less angular deflection in a curved canal than a square or triangular file.

The preceding statement is neither relevant nor true.

All K-files function much like wood screws. If you turn a wood screw clockwise, it goes into the wood. If you turn the same screw counterclockwise, it comes out of the wood. This comes as no surprise, but...

If you place a screw into the wood with a slight clockwise motion, and then turn counterclockwise as you push down, the screw will ³strip² the threads it originally cut into the wood. The same thing happens in a root canal.

Here's the technique:

€ Turn the K-file 1/4 turn clockwise, which seats the file with a slight screwing-in motion.

This clockwise motion should be as limited as possible. It sets the cutting load and the greater the angle of rotation the greater the working load, hence the probability of instrument damage and fracture when cutting ensues during the following counterclockwise movement.

€ Turn the file 1/2 turn counterclockwise as you hold it in place with inward pressure. You will exceed the shear strength of the dentin, and a ³stripping² action occurs. You will often hear a slight ³click² as this occurs.

If you feel and or hear this clicking you are setting the file too deep with your clockwise motion. Reduce the angle and lighten the force you are using.

€ Turn the file one full turn clockwise to load the debris onto the file, and withdraw.

Do this only after several clockwise and counterclockwise motions have carried the file to the intended working depth or the file has become resistant to further apical movement.

€ After the file is free, you can turn it several complete rotations to further clean out the debris.

You might hear any of the following three sounds as you rotate the files using this technique: (Jim Roane refers to this as the pucker factor.)

1. Sound of your gloves snapping.

2. The sound of the dentin shearing

3. The third sound is a file breaking.

Pantera says he has only broken two files, and they were both in retreatment cases as he was trying to remove old gutta-percha.

Pantera says to avoid breaking files, we must use common sense and practice. He advises us to deliberately break a few files in the lab to understand the limits of the files.

Other Points to Consider

€ Work the file in small increments down the canal, using a watch-winding motion. Progress slowly in extremely curved canals to give the forces a chance to dissipate along the file.

€ Nickel titanium hand files are too flexible for the ³ balanced forces² technique. You must have a little resistance or stiffness in the file to feel when it is working. When you are using a stiffer file, you won't use too much force during rotation.

NiTi hand files work with balanced force technique however clinicians experienced in the use of stainless instruments will be less efficient than when using ss files. The flexibility about the files linear axis is interpreted as unwinding of the file thus the clinician is reluctant to apply sufficient force to shape the canal rapidly.

€ The Flex-R files are safe-ended, and we do not have to precurve the files. The safe end will ride around the curvature, and when it reaches the full length, you can rotate the file 360 degrees.

€ You may see a compression of the flutes if too much pressure is applied to the file. Pantera once compressed the flutes so much that the file shortened. He thought he had broken the file, but under magnification he saw he had not. Pantera doesn¹t use ³balanced forces² with any instruments smaller than a size #20, because it isn¹t needed.

Balanced force is still the most efficient motion regardless of the instrument diameter and can be effectively with any size.

€ The greater the curvature, the more likely problems will occur. Be very careful preparing curved canals.

€ If you turn the file too fast counterclockwise, you will not allow the forces to dissipate, the file may unwind and break.

The file will overwind and compress the helical angle and may suffer a brittle fracture from excessive tensile loading.

€ Very little deflection of the file tip (transportation of the canal) occurs with [3]balanced forces,[2] even in curvatures greater than 70 degrees.

€ During preparation, the file wants to straighten out. The larger the diameter of the file, the more it tries to straighten.

€ You can pre-bend the files to negotiate curved canals, but they will usually straighten out before they reach the curve. With safe-ended instruments, prebending is usually not necessary. Safe-ended files reduce the restoring forces that tend to straighten out curved canals.

Safe ended files (Flex-R's biconical design) allows the canal wall to reposition the file tip an orient it around the curvature by dissipating the restoring force over a larger surface at the instrument tip than along its cutting edges.

Straight-Line Access

Straight-line access reduces the amount that the files must bend to negotiate curved canals. You can get larger instruments into curved canals. Many canals curve in two or more directions, and straight-line access eliminates one of the curves.

Straight-line access gives a more direct initial path to the instrument as it heads toward the apex, with less restoring force on the file edges and on the tip of the file.

Apical Control Zone

The[2] apical control zone[2] allows for a patent apex as you prepare the full length of the canal. Typically three different diameters are in the apical control zone.

The first diameter occurs 1/2 mm short of working length.

The next diameter occurs 1 mm back, and the third diameter is prepared 1 1/2 mm short of the apical length. This type of preparation creates an apical [3]stop[2] to obturate against.

Roane uses one of three sizes of gutta-percha points to the apical portion of the control zone; either size 45, 60, or 80.

These sizes are at the 1.5 mm short depth not at the radiographic terminus or foraminal end.

In the first case he uses a #20 file to radiographic length, step- back 1/2 mm with a#25 and #30, followed by a #35 and #40 1 mm back, and he stops 1 1/2mm short with the #45. Roane then fits the master gutta-percha cone to the shortest point and packs apically.

The 60 standard preparation is similar: Use a #30 to the working length, a #40 and #45 1/2 mm back, a #50 and #55 1 mm from the apex, and a #60 to within 1 1/2mm of the apex.

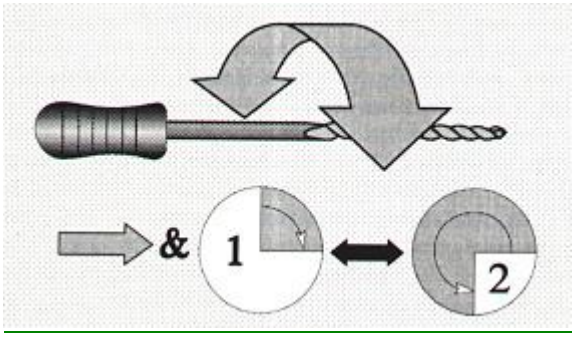
A similar sequence is followed, ending with a #80 in a tooth where that¹s appropriate.

Even this ³simplified² description of the balanced forces technique may seem complicated at first, but with practice it becomes second nature.

Anytime you pick up a K-type hand file, you should think ³balanced forces² before you turn the file in the canal.

From ROOTS - An Alternate description of how to do Balanced Force

This diagram explains the technique.



When file engages, with apical pressure, 1/4 turn (clockwise for all instruments except the hand GTs which is the reverse, go figure, according to Buchanan its easier for right-handed dentists this way!), then again, with apical pressure, 3/4 turn counterclockwise (yes, that way you were told never to turn a file!) with GTs is the reverse!. If done properly, at this time with the larger instruments, you will hear a "click" when the instrument is cutting dentine . Repeat sequence 2 or three time. Then last time, 360 degree turn clockwise (no apical pressure) in order to load on the file all the dentinal debris collected, and remove file from canal (you will notice dentine on the most apical portion of the file)