

ENDODONTICS

Ni-Ti Goes Gold

“Ten Clinical Distinctions”

The purpose of this article is to specifically evaluate the new ProTaper Gold®: “A One-Year Clinical Performance Retrospective.”

Ni-Ti file systems have come and gone. Mostly gone. Since the introduction of the first files around 1993,¹ industry, scientists, dental companies, and clinicians have all been looking for the *magic file*. While there is no magic Ni-Ti shaping file per se, the new ProTaper Gold® (PTG) Shapers and Finishers (DENTSPLY Tulsa Dental Specialties [DTDS]) are making endodontic shaping magic particularly in canals that are calcified or curved to varying degrees (Figure 1).^{2,3} Why? It is true that PTG files produce predictable and safe results, but their *true magic* is in the positive and energizing *experience of actually producing* the result. It is a bold and audacious statement, however, to say that PTG is magic, so claimed accomplishments must be backed up with evidence: scientific evidence, market evidence, and clinical evidence. This paper is a report on the proof of *clinical* evidence.

I have divided this article into the 10 critical performance distinctions for evaluating Ni-Ti systems in the practice of clinical endodontics.⁴

No. 1: Predictability

If you are reading this article, you yearn to do endodontics better and easier. If there were ever a lure of my writings over the years, it has never been about cheapest or fastest. In every article I have ever written, my goal has been to focus on value and performance.⁵⁻¹¹

As dentists, we are self-selected. The Hippocratic Oath of *Do No Harm* means that we are trained to make things better, not worse, and not a just a little better. We are not trained to see how much we *can get away with* but rather how much *we can get*. Predictability is about how much we *can get*. Predictability is about past tense—how well *did* I do in the last 20 years? And, pre-



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dictability is also about the future—how well *will* I do in the next 20 years? Predictability is about increasing the probability of success. It is also the knowingness and confidence that if we do certain things, we will get certain results. As dentists, our greatest fear is when we don't know how a procedure is going to turn out. We have all had that sick feeling of a casting not fitting or breaking an endodontic file in a tooth. We are built to embrace successful performance. The clinical *proof* of the ProTaper® success story is the most critical distinction of all: Sustainable and transferable predictable predictability (Figures 2a to 2d).

How do you make the top selling file system in the world better? Simple. Make the predictability of performance even better by maintaining existing geometries and introducing new metallurgy so that the clinician (not the file) has even more control! By adding advanced metallurgy to ProTaper Universal (PTU), a new era of predictability and safety has been born: PTG has redefined the endodontic shaping experience. PTG is the system that changed the file. Learn more about the performance of ProTaper Gold® at TulsaDentalSpecialties.com and JohnWestEndo.com.

Take-home message: ProTaper Gold produces consistently *predictable* shapes for *predictable* cleaning and obturation that is easier and *safer* than ever before.¹² Predictable endodontics requires precision performance that, in turn, gives dentists the desired confidence *before* treatment and the control *during* their clinical endodontic procedural mechanics.

No. 2: Safety

In sports, it is referred to as “bending but not breaking.” If the new PTG's most important critical distinction is improved *predictability*, then the critical distinction of safety ranks a close second.

The more flexible PTG proudly produces greater torsional resistance and less cyclic fatigue, which is the same safety focus that inspired the successful Ni-Ti reciprocation files. In addition, a progressive series of rotary files allows less work required per file versus a single file having to do all the work. The great news is rotary has become remarkably safer (Figures 2e to 2i).

Take-home message: PTG's advanced metallurgy has discovered the perfect mix of safety, flexibility, and predictability in shaping. Today we are experiencing a newfound level of confidence because PTG enables files to effortlessly crawl along the smooth walls of existing glidepaths.

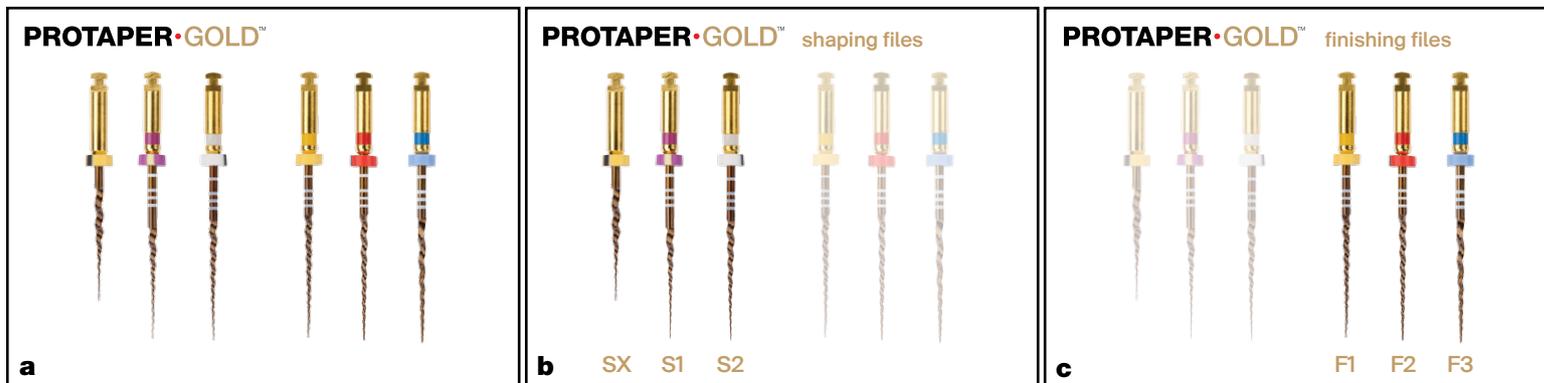


Figure 1 (a) The essence of ProTaper Gold® (PTG) series: SX, S1, S2 *Shapers* and F1, F2, F3 *Finishers*. **(b)** The 3 precisely progressively designed Shapers are used in a *brush/follow* motion in order to first remove access dentinal triangles and coronal restrictive dentin. **(c)** The 3 specifically and regressively designed tapered Finishers are used in a *follow/brush* motion in order to prepare predictable and consistent shapes for easy 3-D cleaning/disinfection and predictable 3-D obturation.

No. 3: Efficiency

PTG is less efficient, making it *more* efficient. How can that be?

The Merriam-Webster dictionary defines *efficiency* as the “ability to do something or produce something without wasting materials, time, or energy.” One of the 3 hallmarks of ProTaper® has always been the quality of *efficiency*.

ProTaper® was the first popular “cutting file” in the marketplace. When originally introduced, Ni-Ti shaping files had blades with flat edges called radial lands, but their *efficiency* waned. Now fast forward 20 years to 2015; PTG clinicians are experiencing a softer and at first seemingly less efficient metal that instead serendipitously fosters a profoundly greater sense of smoothness, friendliness, and ease. The net result is that PTG is actually more efficient due to its effortless shaping capacity, leaving the clinician energized versus sometimes emotionally exhausted at the end of their endodontic shaping, cleaning, and obturation procedures.

In addition, PTG offers an economy of files that equally distribute the shaping workload. PTG metallurgy has such a profound ability to “follow” the shaped funnel of each preceding file that clinicians have an unexpected and positive experience. There is a feeling of “file acceptance.” The sense is that the previous instrument has “paved the way” for the next file. To make your own unbiased and subjective test of the *efficiency* distinction for yourself, compare

your current preferred Ni-Ti system with PTG. Put them head to head. Author Eckhart Tolle may have said it best: “Awareness is the greatest agent of change.”

Take-home message: The softer and more flexible PTG is experientially super-efficient. It does not make mistakes. This efficiency attribute is achieved because the file does the shaping *for* the dentist by easily *following* down a canal versus more indiscriminately cutting down a canal! The dentist does not have to do the work; the flexible PTG design does it for you instead.

No. 4: Versatility

“ProTaper *Gold* is synonymous with ‘versatility’ because it takes away the *fear factor*,” explains Dr. Jordan West. PTG offers the greatest versatility of any Ni-Ti file system in the world. I will prove my point.

There are no problems in endodontics; only *situations* requiring smart thinking, smart strategy, and smart instruments. PTG is the most versatile Ni-Ti System in the world because it *is* smart. The original ProTaper sequence of Purple, White, Yellow, and often Red and Blue as needed, allows the clinician to progressively shape in such a way that each successive instrument has equal and yet minimal shaping to do (Figure 1a). Therefore, regardless of nature’s natural anatomy, the color sequence is constant and makes “what to do next” a no-brainer!

Some clinicians are discovering that there are certain cases where a single Shaper may be sufficient to remove restrictive dentin fol-

lowed by a single appropriate Finisher or the sequence of Finishers as needed.

The big thing to me is when I don’t have to *think* about if the file is performing, I can think about all the other things that matter, such as irrigation, patency, restraint, cone fit, 3-D obturation, patient comfort, my comfort, dental assistant comfort, and all the rest of the endodontic parts that matter.

Take-home message: PTG is the world’s most versatile Ni-Ti system. In certain cases it can be used as a single file or a series of files. What does this mean to you and me? More options, more choices, more control!

No. 5: Simplicity

Simplicity has always been the hallmark of PTU and continues as the hallmark of PTG. The mindset is the same: Purple, White, Yellow, Red. Dentists who have enjoyed the predictability of ProTaper have always felt that the thinking and planning was already done for them by dedicated engineers and designer clinicians who wanted to produce consistent results.

PTG makes sequencing as simple as it has ever been with the added critical distinction of exceptional rotary safety.

Take-home message: The PTG shaping technique requires little or no learning curve. There is nothing as simple as Purple, White, Yellow, and Red as needed. The sequence has never changed; only the safety and performance. Remember, this is a shaping system that can be immediately implemented into your practice today.



Figure 2. (a) Pretreatment image of severely curved and calcified MB canal in maxillary right first molar. (b) PTG F2 safely shaping canal to the physiologic terminus. (c) Conefit. (d) Backpacked root canal system demonstrating Schilder's fourth mechanical objective: *Flow* meaning the position of the apical portal of exit position is maintained without internal or external transportation. (e) Pretreatment of mandibular second molar with abrupt apical mesial canal curvature. (f) Original anatomy maintained using PTG. *Courtesy of Dr. Jordan West (Tacoma, Wash).* (g) Pretreatment of maxillary first molar. (h) Pack image. (i) Eight-month recall, which is the longest documented PTG post-treatment result. Attachment apparatus healed and lamina dura is again present. The patient is asymptomatic. *Courtesy of Dr. Jordan West (Tacoma, Wash).*

No. 6: Maximally Appropriate Endodontics

So what is meant by the phrase *minimally invasive endodontics*?

Prior to natural or traumatic canal calcific metamorphosis, nature makes the width of root canals from between one fifth to one third the width of the root at its coronal extent (Figure 3a to 3f). The purpose of endodontic shaping is to produce funnel-shaped preparations that reproduce this coronal dimension and connect the coronal dots with the dots measuring the apical constriction. PTG's Finishers reproduce these original nature's canal shapes: not too big and not too small, but just right (Figures 3g and 3h).

Because PTG can be precurved, and due to shorter handles, dentists can more easily slide into the mesial endodontic accesses of patients with restricted openings and therefore design the most tooth conserving accesses possible.

Take-home message: PTG shapes are actually more *appropriate* than ever before. The coronal shapes produced from PTG are essentially just like Mother Nature makes. These shapes create cleaned contents and produce perfect preparations for the 3-D endodontic seal.

Until *minimally invasive* means not invasive at all, *maximally appropriate* is not only appropriate, but meets the desired finishing criteria for endodontic predictability.¹³

No. 7: Confidence

PTG looks different and feels different. The feeling of confidence is what it's all about. The feelings of easy, safe, and effortless are qualities that are hard to prove. However, these priceless feelings are unmistakable and profound.

In my years of measuring endodontic performance, it was not until PTG that someone like Dr. Jordan West observed that rotary shaping has been transformed from "fear to fun, especially in wicked curves" or Dr. Jason West's remark after his almost 15 years of endodontics that PTG is a "game changer." Endodontist Dr. Tom McClammy, who will soon be opening his advanced

endodontic training center in Scottsdale, Ariz, reports:

"When PTU was released for clinical use, I remember coining the term *Nickel-Titanium Nirvana*. PTU has been my go-to file in most clinical applications for well over a decade. Now with the ever-changing advancements in metallurgy and technology, PTG is in our hands. *Wow!* The term *Gold* speaks for itself, but the performance of PTG clinically is off the charts. We still have the shaping efficiency and now the superior flexibility to safely negotiate the multiplanar curvature of root canal systems. Nature seldom makes a straight line and never makes 2 of the same. With PTG, we are experiencing the golden age of shaping

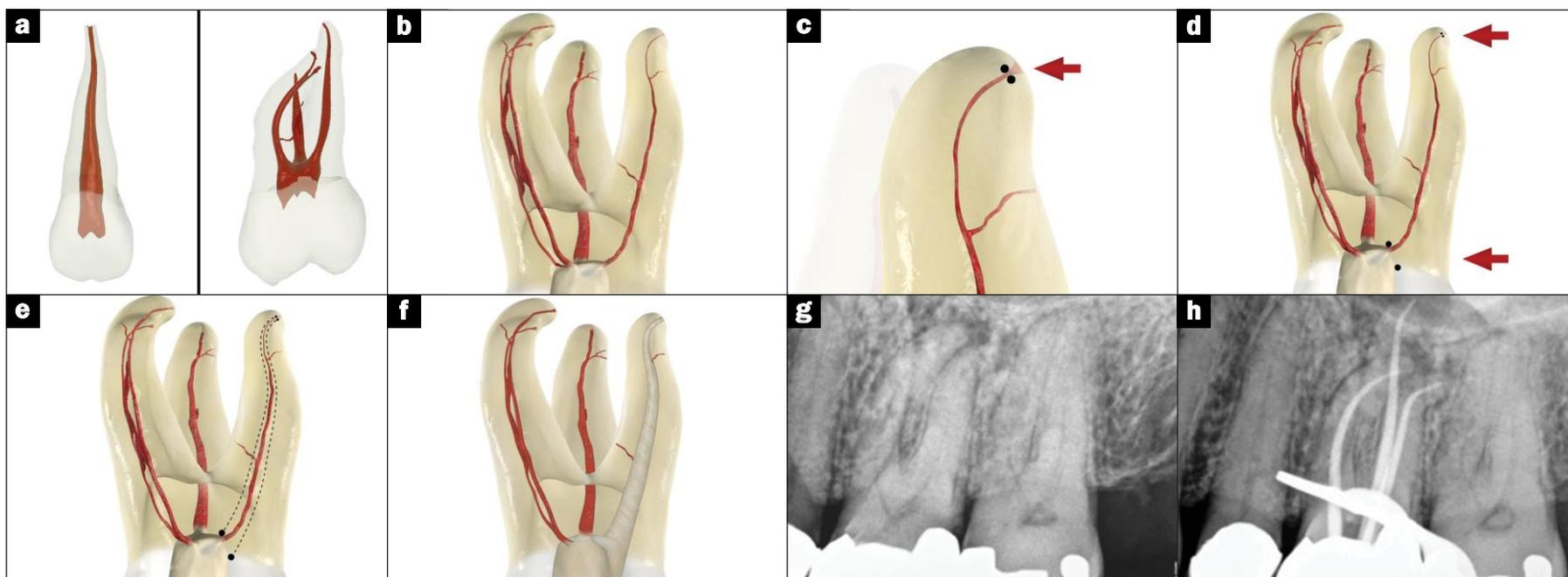


Figure 3. (a) Note: ToothAtlas.com reveals natural width of central is about a third the width of the root while the DB canal of the maxillary molar is about one fifth the width of the root. The shaping width goal of endodontics is simply to give nature back her original dimensions. I call this “Maximally Appropriate Endodontics.” The ferrule location that matters is not even mesial-distal; it is buccal-lingual. Shaping width claims of various Ni-Ti systems should be evaluating CBCT buccal and lingual remaining tooth; not mesial-distal! (b) Animation of aging or calcifying DB canal that needs to be shaped to between one fifth to one third the width of the coronal portion of the canal. (c) Arrow points to the 2 apical dots that represent the minimal physiologic constriction. (d) Appropriate coronal PTG shaping width indicated by dots need to be connected with the apical dots for proper funnel-shaped canal. (e) Dots connected demonstrating outline of desired “maximally appropriate” funnel shape. (f) Animated proper DB shape. (g) Pretreatment of maxillary left first molar. (h) Three “Maximally Appropriate” cone fits. (Figures 3b to 3f courtesy of Advanced Endodontics.)

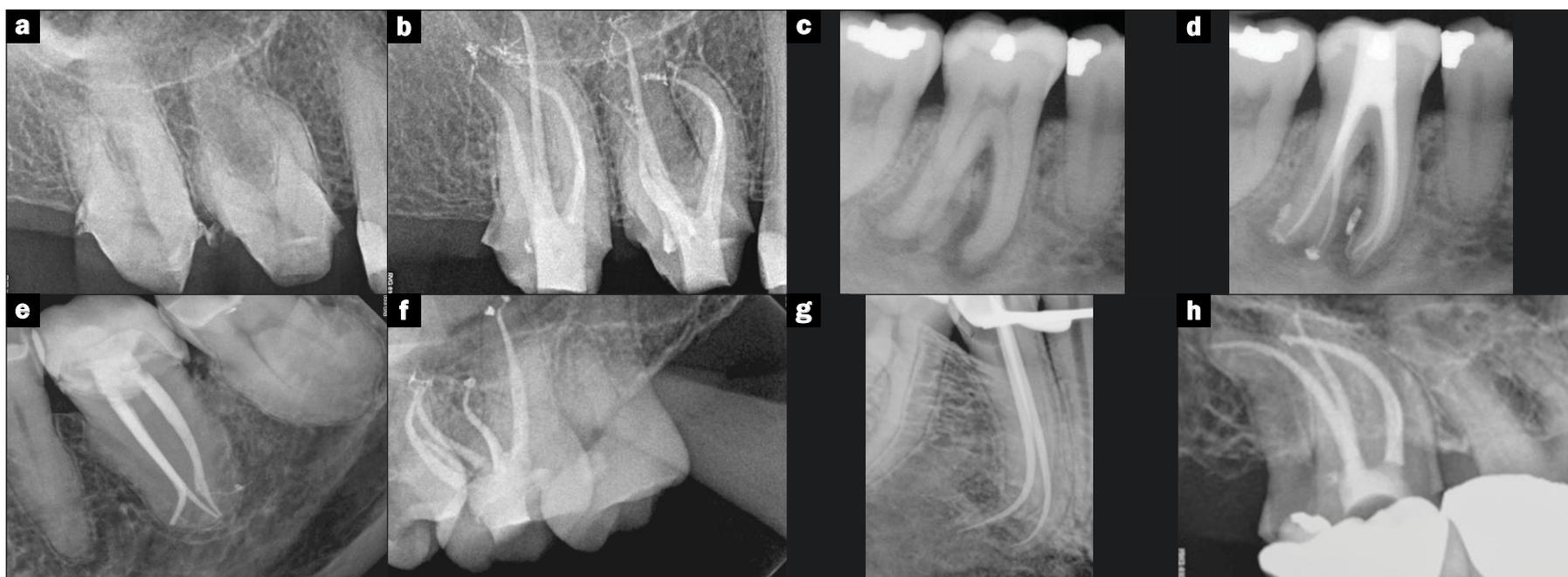


Figure 4. (a) Pretreatment image maxillary right first and second molar. (b) Exquisite PTG finishes of 2 in a row. Courtesy of Dr. Tom McClammy (Scottsdale, Ariz). (c) Pretreatment image of mandibular right first molar. (d) Elegant PTG shapes. Courtesy of Dr. Scott Doyle (Minneapolis, Minn). (e and f) PTG shapes and elegant obturations. Courtesy of Dr. Wyatt Simons (San Clemente, Calif). (g and h) Curved canals need curved shapes. The premolar and molar were both safely and predictably prepared with PTG.

canals in 3 dimensions safely, securely, accurately, and with all the minimally invasive techniques at our fingertips. Nothing could be sweeter (Figures 4a and 4b).”

Take-home message: How PTG feels in your hands is what it’s all about. How it feels makes all the difference. To me, the indomitable *confidence factor* is priceless and has made all the work to make PTG come true truly worth it. Oh, and it might take a few canals to get used to the *lighter* feel of shaping, but just a few!

No. 8: Challenging Anatomy: Calcified, Abrupt, Long, and Multiple Curves

The recently innovated PTG flexibility enables the Shaping and Finishing files to literally “crawl” down not only the most calcified canals but also the most curved canals (Figures 4c and 4d). This may sound corny, but the more calcified and the more curved or multiple curved a canal is, the greater sense of success and enjoyment to the clinician. However, I still find the mechanical glidepath

file *ProGlider*[®] (DTDS) can be a confidence builder in expanding the glidepath width of particularly long, narrow, and curved canals for safe rotary or reciprocation shaping.

Put this newfound level of confidence in your own words and share it with your colleagues in the spirit of collaboration. Rising endodontic star Dr. Wyatt Simons shares his newly discovered increased confidence this way:

“I wanted to send you a quick note to let you know how amazing I have found the *ProTaper Gold* files to

perform. Dare I say, a game changer! I am shocked to report how much the *ProTaper Gold* files have impacted my practice. I am doing things I would not dare to attempt with other rotary systems and the results are awe-inspiring. Instead of *ProTaper Gold*, I call it *ProTaper Butter*.” Check out the case in Figure 4e.

A highly respected clinician, educator, and inventor, Wyatt then adds, “What I mean about *ProTaper Gold*[®] being transformative is that I did this case with few to no hand files.



Figure 5. (a) The more challenging the root canal system anatomy, the safer, more predictable, and more precise PTG performs. *Courtesy of Dr. Jason West (Tacoma, Wash).* (b) PTG shapes allow sufficient obturation hydraulics to fill portals of exit regardless of size. (c) Pretreatment of maxillary left central incisor with underfilled root canal system and lesion of endodontic origin. PTG F3 was singular instrument needed to remove gutta-percha and shape the root canal for F3 PTG cone fit and 3-D obturation using vertical compaction of warm gutta-percha technique. (d) Post-treatment and 4 month post-treatment image validating early healing of radiographic endodontic lesion.

Although likely previously possible, I now have the confidence to tackle any shape with less pathfinding/path establishing. Said differently, if I knew a canal had excessive curvature or forks in the road I would always shape the canal to a point that I was more comfortable in bringing rotary systems in. With ProTaper Gold I have no reservations, whether they be curvature, length, splitting, etc (Figure 4f)."

Abrupt apical as well as long canal curvature can present a difficult challenge for any clinician performing endodontics (Figures 4g and 4h). The configuration of abrupt apical canals is often blocked or ledged because *following* skill sets literally cannot be followed! PTG has solved this for me. Here is the technique for treating abrupt apical curvature: create and/or confirm glidepath with No. 10 manual file to the radiographic terminus. Then identify actual physiologic constriction length with the apex locator. Curve the apical one mm of a PTG F1 with orthodontic bird beak pliers. Confirm coronal restrictive dentin is removed. Next, follow canal either manually or mechanically with PTG F1 to reference length. Flush canal with Stropko Irrigator and fit an F1 newly formulated precision micronized formula PTG gutta-percha cone (DTDS) and pack! That's it. The rigidity of PTG gutta-percha preserves the sharp PTG apical turn. Another advantage of PTG gutta-percha is that the intentionally lessened coronal taper prevents false tugback and optimizes clinical dexterity in placing the gutta-percha cone. Finally, PTG gutta-percha has an extended heat wave for better compaction into the shaped and cleaned root canal system (Figures 5a and 5b).

Take-home message: The more challenging the case, the safer, more predictable and more precise PTG performs.



Figure 6. Newly introduced PTG gutta-percha cones are precision machined, have advanced NanoFlow technology, consistent quality, and have the added advantage of an extended heat wave allowing a *shallower deepest point of compaction* in classic vertical compaction of warm gutta-percha techniques.

No. 9: Blocks, Ledges, and Transportations

Blocks. I used to think that if I could not de-block a dentin or collagen block after thorough and careful irrigation with delicate attempts to disrupt the block, I needed a *stiffer* Ni-Ti system such as PTU to hopefully follow my way through the block. (A surprise to me!) PTG does what I thought it could not do more predictably, and that is to follow down or through the block. The clinical effect of the softer and more flexible PTG is that the files respect the original blocked path and follow it to the physiologic terminus.

Ledges. Again, I thought a more rigid PTU file could more easily remove a ledge or shelf by pre-curving a PTU F1, for example, follow past the ledge, and brush it away. I could not have been further from the truth; and the truth is that PTG more easily follows around a ledge and more efficiently and predictably brushes away the shelf or ledge and once again

blend the radicular wall into a continuously tapering funnel.

Transportation. Transportation comes in the form of internal and external. Internal transportation simply does not occur if each PTG Finishing file is followed to the physiologic terminus and removed. The Ni-Ti memory of PTG is intentionally lessened, which allows Finishing files to have the capacity to safely rotate at the physiologic terminus for a moment or two though not required or recommended.

Take-home message: PTG gives new predictability in preventing and correcting endodontic blocks and ledges and preventing external transportations.

No. 10: Nonsurgical Retreatment

In my original one-month test of using PTG *exclusively*, naturally PTG was called upon for removing gutta-percha in nonsurgical retreatments. I discovered something that I did not expect...once again PTG was "better, faster, and easier" than using PTU. I was

thinking that the "stiffer" PTU would be more efficient to remove solvent impregnated gutta-percha. I was wrong! I also learned that the most effective way to remove the failing gutta-percha/sealer obturation attempt was a 2-file approach: S2, F1, and in some situations a single Finishing file may be sufficient (Figures 5c and 5d). Because of the PTG "softness," the Shaper and Finisher file geometries more predictably "follow" the softened gutta-percha. In addition, PTG, again because of its advanced metallurgy, follows existing radicular walls more easily without "gouging" or exaggerating existing apical blocks.

Finally, carrier-based obturator retreatments are also safer and easier because PTG follows *alongside* the carrier, versus cutting *into* the carrier, which can prevent the possibility of lifting the carrier toward the access for removal.

Take-home message: ProTaper Gold more safely, predictably, and easily removes gutta-percha in nonsurgical endodontic retreatments due to progressive taper and increased PTG flexibility (Figure 6).

CLOSING COMMENTS

The greatest variable in endodontics is not our preferred Ni-Ti shaping system. My dad, Roy West, a master finish carpenter, who passed away just about a year ago, and who was still coaching me, his grandchildren, and great-grandchildren at 94 years young, always told us, "Do it like anyone else *but* better than anyone else." That anyone else is *you* and *me*. We are the greatest variable and the greatest determinant. We are our only competition...to be better than we are today. Our knowledge, skill, judgment, willingness, and integrity are the pillar values to make the right clinical choices every day. Timeless principles + breakthrough technologies = predictable performance.

Invitation: I humbly invite you to take what I will call the “ProTaper Gold® Challenge.” My personal leap of faith came when I decided to exclusively use and validate PTG for a full month in my private practice. PTG performed more predictably, more efficiently, and more confidently in all 10 critical clinical performance distinctions. I believe that once a dentist experiences ProTaper Gold, that individual will become equally enlightened by the stunningly predictable and safe results. I am willing to bet my reputation as a clinician and an educator on it. But please don’t take my word for it—put PTG to the comparative test and prove it for yourself. Master endodontist, Dr. Scott Doyle from Minneapolis, Minn, did, and he concludes, “The improved flexibility of PTG allows me to shape nature’s wide variety of curved roots with confidence.”

Remember what Albert Einstein said: “The only source of knowledge is experience.”◆

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Disclosure: Dr. West is the co-inventor of ProTaper, ProGlider, WaveOne, and Calamus systems (DENTSPLY Tulsa Dental Specialties).

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