The GT System is a fully developed, clinically tested set of instruments and materials that are designed to optimally work together.

Each Greater Taper File, regardless of tip size, has corresponding:
- GT gutta percha points
- GT paper points
- and GT obturators that ideally fit in the shapes created by GT Files.

These flowcharts are your guide to creating a predefined preparation shape using the GT Files in a full range of root canal anatomy.

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The objective of negotiation is to create a glide path to and beyond the terminus, remove the pulp from the primary canal, to determine length (+ or - 1/2mm of accuracy), and to cut a #15 file or larger to length, prior to rotary instrumentation.

Negotiation can be simple (requiring only 1-3 instruments) or difficult. If it is a simple canal, increase in file size until a #15 K-file (or larger) binds at length. If it is a difficult canal, serial step-back recapitulation through the file series, of #08, 10, 15, 20 and 25 will be necessary to get the #15 file to length.

Use lubricants to fill the access cavity such as ProLube, Glyde, or RC Prep throughout negotiation until a #15 K-file or larger gets to length. This is critical in preventing apical blockage with pulp tissue!

Use an apex locator with all negotiation files as they approach estimated length. With the safe shapes cut by GT Files, using an apex locator will often supplant the need for a length determination x-ray.

File motions for negotiation are "watch-winding" and "push-pull." Watch-winding, with its apical pressure and 90° back-and-forth motion, is done first as it pulls the negotiating instrument into the canal. When the file resists further apical movement, using a couple of push-pull filing strokes will usually loosen the file, allowing it to advance further in the watch-winding mode. Watch-wind, push-pull, watch-wind, push-pull, etc.

Avoid over-using any given file size when encountering tight resistance to apical file placement. Instead, use 1 or 2 larger files in the series, then recapitulate with the smaller files. Each recapitulation through the series of negotiating instruments will allow all files to passively drop closer to the terminus.

If you encounter loose resistance to apical file placement, it indicates an "impediment" in the canal which requires more sophisticated procedural steps (see Chart 6).

Be patient, clever, and persistent. Negotiation is one of the most difficult and artful aspects of root canal therapy. In tough molars, you may be lucky to get to length in all canals in the first two-hour appointment. Canals don't calcify apically, there are only impatient clinicians who give up before they get to length.
Cutting the Initial Shape in Medium and Large Canals

20 Series

- The canal must be negotiated to its terminus, and the pulp must be removed from the primary canal. Rotary shaping files must have straight line access into canals.
- Always start crown-down shaping with a 20-10 GT File.
- Use files with light, consistent pressure dropping down to a smaller taper size file when resistance is met.
- Do not use a "pecking" motion. It is ineffective with this blade design.

Procedural Flow

- Crown-down Shaping

- Patency Zone
- Canal Terminus

Example Canal Length (mm)

- 20
- 15
- 10
- 8
- 6
- 5
- 4
- 3
- 2
- 1
- 0

Orifice Level

- 5.25 - 6% NaOCl

SUGGESTED RPM & TORQUE LIMITATION SETTINGS for the GT Rotary Files

<table>
<thead>
<tr>
<th>GT File Taper</th>
<th>Speed RPM</th>
<th>Torque ATR Tecnika</th>
<th>Torque Aseptico DTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>.04 and .06 in difficult canals</td>
<td>150</td>
<td>25%</td>
<td>174 g-cm</td>
</tr>
<tr>
<td>.10, .08 and .06</td>
<td>300</td>
<td>35-45%</td>
<td>312 g-cm</td>
</tr>
<tr>
<td>.12 Accessory Files</td>
<td>800*</td>
<td>85%</td>
<td>595 g-cm</td>
</tr>
</tbody>
</table>

*For orifice flaring, .12 Accessory Files can be used up to 5000 RPM without torque limitation.

- Always begin with a 20-10 GT File, regardless of canal morphology.
- Run at full suggested RPM entering and exiting the canal.
- Insert the rotating file into the canal until a light bind is felt, then, holding a light pressure on the handpiece, watch the file walk into the canal. "Pecking" or in-and-out motions are ineffective with GT Files.
- Usually within 3-4 seconds the spinning file will stop cutting in an apical direction. Immediately remove the file.
- Observe the file upon removing it from the canal. If the flutes are full of debris, simply clean it and re-enter the canal. If the flutes are not full of debris, the current file is meeting a curvature around which it is too stiff to traverse. Change to the next smaller file for further crown-down shaping. If the flutes are deranged, replace the file with a new one.
- Frequently in medium and large canals, the 20-10 GT File, by itself, will cut to length after several cleaning and cutting cycles.
- Carefully check the tip flutes of the first GT File taken to the terminus. If there is no dentin debris in the last 1-2mm of the file, the apical diameter of the canal must be larger than the file tip, indicating the need for a 30 or 40 series GT File (even before gauging confirms it).
- Apical gauging must follow every initial shaping procedure to measure the apical diameter of the canal prior to the final shaping file selection (see Chart 3). This will assure apical continuity of taper and thereby improve apical accuracy of obturation.
Cutting the Initial Shape in Small Canals

- No Pecking! Use a light steady pressure until 4 seconds passes or the file stalls in its progress — then remove it immediately.

- If the file is full of debris, clean it and use again, if appropriate. If the file is not packed with debris, move to the next smaller taper size and continue cutting the initial shape.

- In unconstricted canals in small roots, the 20-.08 GT File may cut to length without needing to use the 20-.06 or 20-.04 GT File.

- Conversely, in constricted canals in small roots it may require the use of all four 20 Series GT rotary files to achieve length. In the unusual case that the 20-.04 resists cutting to length, confirm patency with a #10 K-File. Then a #20 NiTi K-File, with its .02 taper, will invariably cut to length with the Balanced Force technique. Once a #20 NiTi K-File is taken to length, the 20-.04 Rotary GT File will cut to length in most cases, allowing gauging to be done.

- Apical gauging must follow every crown-down shaping procedure to measure the apical diameter of the canal, prior to cutting the final shape (see Chart 3).

- If the 20-.04 GT Rotary File resists cutting to length in apparently straight roots, this would indicate a severe hidden curvature. Beware!
Measuring the Terminal Diameter of Canals (Apical Gauging)

- The function of apical gauging is to measure the apical diameter of the canal prior to cutting the final shape. This is necessary to insure that the final tapered preparation extends all the way to the terminus of the canal (Apical Continuity of Taper).

- Use NiTi K-Files for gauging. The flexibility allows for much more accurate apical gauging in curved canals than with stainless steel, insuring the apical accuracy of obturation.

- No effort is made to cut dentin during apical gauging. The gauging instruments are inserted straight in and are pulled straight out, with no rotation. These K-files are being used as round "feeler gauges," and as such, binding an instrument of a specific diameter at the terminus or short of the terminus is a way to indirectly read the apical geometry of the canal.

- Always use 17% aqueous EDTA as an irritant during gauging to remove the smear layer. It takes about the same time, a minute, to accomplish both of these objectives.

- If you feel that the file that binds at length could go through the terminus if pushed or rotated, you’re right, it probably could! But don’t push, recapitulate through the series of gauging instruments and see if the same size file binds at length the next time through.

- After apical gauging, you may need to adjust the shape to create apical continuity of taper (see Chart 5). However, when the #20 K-File binds at length, final shaping can be completed with a 20 Series GT File.

In this typical small root case the #15 K-file passively drops through the root canal terminus.

In this small canal the #20 K-file gauging instrument binds at length.

The #25 K-file gauging instrument binds .25mm short of full length.

The #30 K-file gauging instrument binds .5mm short of full length, confirming there is an apical constrictre and that there is shape coronal that point.
Selecting the Ideal Final Shaping File

Choose a final shaping file from the following list after first deciding if the given root is small, medium or large. The degree of taper chosen will be primarily determined by the curvature of canals in small roots. The tip diameter of the final shaping file is chosen to be the same or slightly larger than the gauging file that bound at length.

<table>
<thead>
<tr>
<th>Small Roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>mandibular incisors</td>
</tr>
<tr>
<td>2 &amp; 3 canal pre-molars</td>
</tr>
<tr>
<td>mesial roots of lower molars</td>
</tr>
<tr>
<td>buccal roots of upper molars</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medium Roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>distal roots of lower molars</td>
</tr>
<tr>
<td>palatal roots of upper molars</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Large Roots</th>
</tr>
</thead>
<tbody>
<tr>
<td>lower cuspids</td>
</tr>
<tr>
<td>upper anteriors</td>
</tr>
<tr>
<td>one canal pre-molars</td>
</tr>
</tbody>
</table>

Root Size Identification

- Once a 20 Series GT File has been cut to length and the terminal diameter has been gauged, a Final Shaping File must be chosen to complete the shape.

- Choosing the Final Shaping File requires selecting a GT File with an appropriate amount of taper for that root. If the taper size of the GT File cut to length during initial shaping is appropriate, you’re done! The appropriate taper of the Final Shaping File is dictated by the root width and canal curvature. Be aware that many canals have hidden curvatures (especially when 2 canals in the same root merge and exit through one apical portal of exit). In some of those cases, one canal has a smooth curvature and the other has an abrupt, radical curvature.

- Careful consideration should be taken when selecting the taper of the Final Shaping File. By choosing too large of a taper in a curved canal, file separation or strip perforation may result. Conversely, by choosing too small of a taper in a larger canal, you will get less effective irrigation, less effective condensation of the filling material, and less predictable apical control in obturation.

- Notice that in difficult canals, the 20-.04 GT File will usually cut to length, but the 20-.06 GT Rotary File may balk at going to length. Extreme caution should be exercised here, as hidden severe curvatures are often the cause. In this case, bringing in a new 20-.06 GT Rotary File is prudent, or if the file resists placement to length, introduce a 20-.06 GT Hand File. (Dental school programs often teach students to use Rotary GT Files 1-2mm’s short of the terminus and GT Hand files to length — an extremely safe technique.)

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Cutting the Final Shape

- Apical gauging informs the dentist whether the taper goes to the end of the canal. When the terminal diameter of the canal is greater than the tip diameter of the GT File cut to length, there is an apical discontinuity of taper. Discontinuity of taper results in apical parallelism, a set-up for mediocre obturation results. When the taper extends to the terminus, apical obturation efficacy and accuracy radically improves.

- This canal has a terminal diameter of .3mm. It was shaped with a 20-.10 GT File, which has a tip of .2mm. When the #30 K-file binds at length during gauging procedures it has proven there is a non-tapered segment in the end of the canal (apical parallelism).

- To extend the taper to the terminus, a 30 Series GT File (.3mm tip diameter to match the canal terminus) with the same .10 taper is cut to length. The 30-10 should cut easily to length, however some curved canals may first require recapitulation with a smaller-taper 30 Series GT File before a 30 Series file of the same taper will cut to length.

- Gauge again. When the gauging file that binds at terminal length has a tip diameter that matches the tip diameter of the GT file that was cut to length, you are done! If not, cut a GT File of the same taper but with a larger tip size to length and gauge again. Continue gauging and extending the shape if necessary until apical continuity of taper is confirmed.

- If a #20 K-File binds at length during gauging, the final shape is done if the taper of the largest 20 Series GT File cut to length is big enough for that canal. If the taper cut into the prep is too narrow, simply cut a 20 Series of the appropriate taper to length, gauge to confirm, and you are done.

- If the terminus was gauged larger than a #20 K-File, choose the appropriate Final Shaping File from the 30, 40, or .12 Accessory GT Series (with appropriate taper) and attempt to cut it to length. If the file balks, drop down one taper size and cut to length, then the Final Shaping File will usually cut to length.

- Apices larger than .9mm are considered "open apex" cases, and are filled with ProRoot MTA and therefore do not require a tapered resistance form.
Managing the Apical Impedment

Procedural Flow

Crown-Down (1mm short of Impediment)  
Pre-bent Hand GT File Apical Impediment Technique  
Apical Gauging (Pre-bent SS K-Files)

- Patency Zone
- Canal Terminus
- Impedent

Example Canal Length (mm)
- #10K File Test Fails - Adjust Stop
- 20-10 GTR - 1mm short
- #10K File Test

- NaOCl
- Reverse Balanced Force
- EDTA

- There are 6 Primary Types of Impediments:
  1. Straight Canal with Irregularity
  2. Curved Canal with Irregularity
  3. Abruptly Bent Canal
  4. Blockage — Previously Treated
  5. Leding — Previously Treated
  6. Separated Instrument — Previously Treated

- Impediments are identified by the tactile sense felt through the file handle of loose resistance to apical file placement, as the tip of the instrument bumps against the impediment. Tight resistance to apical file placement indicates lateral binding of the file in a canal region narrower than that instrument.

- The #10 K-file Test is a simple way to identify canal forms too irregular to fully shape with rotary files. This test is accomplished with a brand-new #10 K-file measured to length, which is pushed through the previously negotiated canal. If the unbent #10 K-file goes to and through the terminus, rotary shaping can be taken to length.

- If the #10 K-file hangs up on an impediment, rotary files cannot be taken to that length or a ledge will result. Shorten the stop to the reference point and measure. That is the distance to the impediment.

- Subtract 1mm (for safety) from that length, measure the 20 Series GT Rotary File to this shorter length, and cut a shape to that point.

- Then use pre-bent GT Hand Files to shape the canal beyond the impediment and pre-bent stainless steel K-files to gauge it afterwards. If difficulty is encountered in cutting the GT Hand File past the impediment, the pre-bent stainless steel files can be used to do serial step-back shaping beyond the impediment, prior to cutting the final shape with a GT Hand File.

- The GT Hand File is over-bent at least 180° with Endo-Bender Pliers to overcome NiTi shape-memory and to create a residual bend of 30-45°. Sometimes 2 to 4 attempts are required before a residual bend will be imparted. Using a teardrop stop, align the point toward the file bend and you are ready. A careful watch-winding motion is used to direct the bent file tip away from and beyond the impediment. As soon as the file tip is beyond the impediment, the direction of the pre-set bend is no longer important.

- GT Hand Files have reverse-cut flutes so they are used with a Reverse Balanced Force motion. First engage the file by rotating CCW to the binding point, then with the blades embedded in the canal walls, apply firm apical pressure to the file handle and rotate it at least 360° CW to accomplish the cutting stroke at this level. Do not pull the file out, simply rock it back into the canal in a CCW direction, starting another engagement and cutting cycle. Three to five engagement and cutting cycles are typically done before removing, cleaning, and reintroducing the file to advance further into the canal.

- After the GT Hand File has been cut to length, the canal will often pass the #10 K-file Test. Even when it doesn’t, filling material will usually move beyond the impediment. If a gutta percha cone will not fit to length, consider using carrier-based obturation since the filling material will move at least one millimeter ahead of the carrier.