Advanced ESX® Instrumentation: Segmental Crown Down & Hybridization of Tapers

Introduction:

All human root canals are not created equal. The variety of root canal shapes we face on daily basis are as unique as the individual patients who present them. Preparing such variety of shapes and canal morphology efficiently by using the minimum number of files has been the goal of endodontic therapy. However, a magic file or formula is yet to come forward that would make root canal shaping a universal sequence for all canal shapes and types. Even the single NiTi file techniques are mere finishing files, and in many cases, considerable instrumentation is required with other files prior to finishing the shape with them.

The ESX Rotary NiTi Instrumentation System (BrasselerUSA, Savannah GA) is the latest root canal instrumentation system introduced to the market with the goal of minimizing the number of files during root canal instrumentation while, concurrently, trying to improve simplicity of technique. However, this system has been armed with two specific instrumentation protocols: the Basic and Advanced ESX Techniques that try to address the varying degrees of case difficulty. Each technique has its own specific sequence of use for hand and rotary files based on the level of complexity which results into the use of 2-5 rotary and hand files per case based on a given canal morphology [1].

The clinical case discussed in this article demonstrates the application of the Advanced ESX theory for managing molars. However, a brief review of the Basic Technique is required first.

Basic ESX Technique:

The Basic Technique can be summarized as instrumentation of a canal to the full Working Length (WL) to a minimum of size 15/.02 hand file, followed by instrumentation to that length with the ESX Expeditor File (15/.05) using the Single Stroke and Clean (SSC)™ operator motion [2]. Once the Expeditor File has reached the apex, a single ESX Finishing File (either sizes 25/.04, 35/.04, 45/.04, or 55/.04) will finish the case to the Apex (using SSC motion). The key point here is that both the Expeditor and the ESX Finishing Files are used with a Single Stroke and Clean (SSC)™ operator motion, a motion that helps reduce the torque on the files. Furthermore, the ESX finishing files have a patented file tip called the “Booster Tip,” which helps skipping file sizes when combined with SSC motion. Therefore, the Basic ESX technique for most basic canal anatomies (most anteriors and premolars) is a two file technique (Expeditor + one Finishing File.) The Choice of which Finishing File to use has been determined by the level of engagement experienced by the Expeditor on its journey down to the apex. If significant engagement (~more than 5 strokes to apex,) then a 25 Finishing file is used. If moderate

engagement with the Expeditor, then a size 35/.04 is used and if minimal engagement, then the 45/.04 is used. If additional enlargement is needed after 45 reaches the apex (remaining tissue in file flutes,) then a 55/.04 can be used to finish the preparation [3]. Therefore, the Basic Technique algorithm can be shown in figure 1.

Advanced Technique:

The Advanced ESX Technique is used in most molars and some premolars and anteriors. These are generally cases that are somewhat narrower or curved. For ESX Purposes, we define Advanced cases with the following indication:

"Advanced canals are defined as those canals where working a number 15/.02 hand file straight to the apex (to Working Length) is not easily accomplished." Otherwise, if the #15 hand file does not go straight to the apex fairly easily after access opening and minimal orifice shaping, you're facing with an Advanced Case and require to use the Advanced ESX Technique (Figure 2).

Since at least one canal in a multi rooted tooth is either narrow, calcified or curved, we can make a general statement that multi rooted teeth are, for the most part, advanced cases and require the Advanced ESX Technique. Remember that the technique indication is set by the lowest common denominator of a case, meaning the toughest canal in a multi rooted tooth. Therefore, most molars, are advanced.

Since the difficulty in Advanced cases is working the apex to a size 15/.02, the purpose of the Advanced Technique is to safely and efficiently prepare the apex to the 15/.02 size, thus allowing the Basic Sequence to take over and complete the preparation. This can be shown in the following way:

Advanced Technique —> 15/.02 to working length —> **Basic Technique**

The Advanced Technique utilizes 3 additional files before the Expeditor and the ESX Finishing Files. Scout ESX Files sizes 15/.02 and 15/.04 in conjunction with the help of the ESX Orifice Opener (20/.08) work together with an increasing taper while keeping an ISO 15 tip to enlarge the canal (Figure 3.) This creates a phenomenon of Hybridization of Tapers, where files with the same tip sizes but varying constant tapers slowly remove dentin laterally and incrementally in a crown down fashion (Figure 4.)

Hybridization of Tapers:

In this article, the use of files with the same tip size but varying tapers is referred to as Hybridization of Tapers [4]. As mentioned above, Advanced cases are those where a size 15/.02 file does not easily reach the apex. In these cases, smaller hand files (sizes 6/.02, 8/.02, or 10/.02) are used to explore the initial Available Length (AL). This available canal length is noted. Available length is the space that a size 10 hand file can achieve by simply placing the file in the canal and pushing it until it stops.

Once AL is noted, the ESX orifice opener (20/.08) is used to open up the coronal third of the root, making sure that the file does not pass beyond AL. Hybridization of Tapers is then initiated using the Expeditor and the two ESX Scout Files (15/.04 & 15/.02) in descending taper (from

15/.05 to 15/.04 to 15/.02) until AL is reached. In most cases, this sequence will instrument anywhere between half to two thirds of the root even in complex anatomies. After AL is reached, an apex locator and a radiograph is used to determine the actual Working Length (WL) by negotiating beyond the AL and to WL using small enough files.

Once the working length has been noted and confirmed with a file radiograph, this Hybridization of Taper sequence (15/05—>15/04—>15/02) is used in a crown down fashion until WL is achieved with the Expeditor (15/.05). It's important to note that each file is used with a Single Stroke and Clean motion to engagement (not resistance) followed by switching the subsequent smaller taper file all the way to WL. This motion is the safest way to use instruments and will dramatically reduce torque on each file. Once the Expeditor has reached WL, the case is completed like the Basic Protocol by using an ESX Finishing File. Most Advanced cases are completed with either a size 25/.04 or 35/.04 ESX Finishing Files. (Figure 5)

Segmental Crown Down:

Excessively difficult cases require even more diligence than typical advanced cases (Figure 5). In such cases, referred to as Advanced^{2} (Advanced squared!) the canal is broken down to several segments (either thirds or fourths), and each segment is instrumented sequentially in a crown down fashion [4]. Therefore, small size instruments (sizes 6, 8, and 10 Stainless Steel Hand Files) are used to explore and determine AL followed by the use of Hybridization of Tapers to that AL. Once the first AL is reached a hand file is used again to determine the next AL followed by the same sequence of Hybridization of Tapers. This process of exploration followed by Hybridization of Tapers helps crown down the canal in several segments in a safe and effective manner. The use of stainless steel hand files to first explore the canal is important as it allows for these stronger metal files to do the more dangerous part of discovery followed by the more efficient rotary files to enlarge the discovered space laterally.

Conclusion:

The ESX instrumentation system is a versatile instrumentation system that addresses Basic, Advanced, and Super Advanced canal anatomies to be instrumented with the minimum number of NiTi files required for that specific anatomy. This robust algorithm of use respects the complexity of some of the clinical cases the more advanced users run into while reducing the use of unnecessary files in more basic cases. The additional advantages are the incorporation of a bonded bioceramic aobturation technique that helps close the gap in efficiency between both the instrumentation and obturation phase of endodontic cases [5].

References:

1. Nasseh, A. A. Clinical Use of the ESX file system. *Inside Dentistry.* 10:7, 2014
2. RealWorldEndo: https://realworldendo.com/videos/realworldendo-s-single-stroke-and-clean-ssc-motion
3. RealWorldEndo: Part V: https://realworldendo.com/videos/the-esx-rotary-niti-instrumentation-system-6-part-tutorial
4. Nasseh, A.A. 2014: RealWorldEndo Tutorial (Hybridization of Tapers): Link to come
5. Koch K, Brave D, Nasseh A., Bioceramic Technology: Closing the Endo-Restorative Circle, Part II, *Dentistry Today*, 2010:29(3):98, 100, 102-105

Figures and Captions:

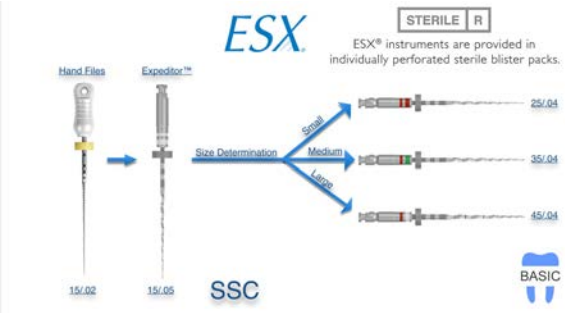

Figure 1)Shows the ESX Basic Technique demonstrating the fact that once the root canal has been instrumented to a size 15/.02, it will then be enlarged to 15/.05, followed by finishing with one of the ESX Finishing files. All files are used with the Single Stroke and Clean (SSC) Motion.

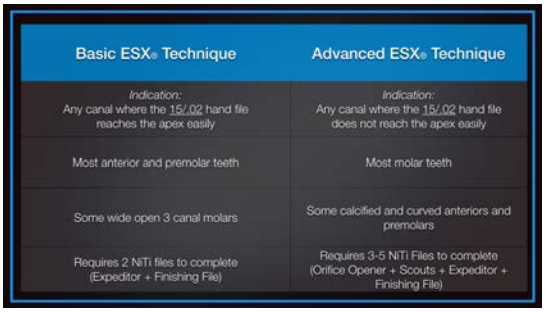

Figure 2)Shows the indications for each the Basic and Advanced ESX Technique/Protocol in a given canal shape.

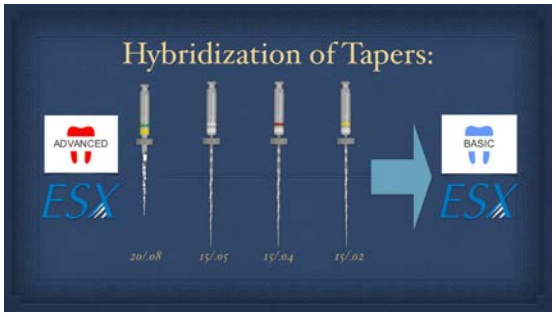

Figure 3: Shows the Advanced Technique Files. After exploration with a size 10 hand file and the ESX Orifice Opener (20/.08), the Scout files 15/.04 and 15/.02, and the Expeditor 15/.05, create a sequence of files with the same tip and varying tapers that predictably and efficiently shape the root canal space that was originally explored with a size 10 hand file.

Figure 4: Molar cases are all considered Advanced Cases. here, since a medial canals were narrow, Available Length (AL) was only half the final Working Length (WL) of those roots. After determining AL and using Hybridization of Tapers to AL and determining the WL, the case was completed easily with one more round of Hybridization of Tapers until WL was achieved. The case was then finishing with a single ESX 35/.04 finishing file. All instrumentation was done with the Single Stroke and Clean Motion.

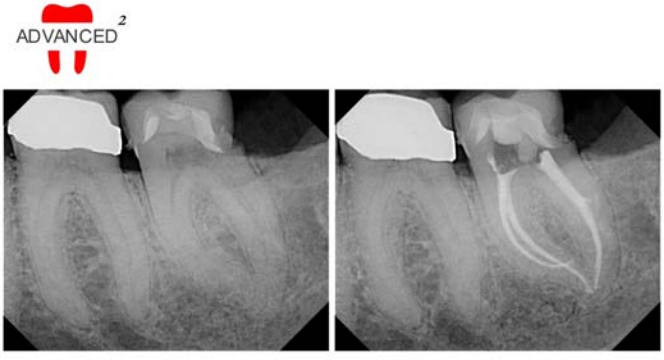

Figure 5: Complex molars require the use of Hybridization of Tapers in a special crown down manner called Segmental Crown Down. Here, the canal is divided into thirds and each third is first explored to Available Length and then widened to that length before the next AL is reached. So on and so forth until Working Length is achieved.