Conservative Dentistry / Lecture #7

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This lecture will be about **Rotary Instrumentation** in Root Canal Treatment.

First of all, why do we do Root Canal Treatment?

1- To eliminate infections (if infected) and that is the **Primary Objective**

2- To prevent infections (if the tooth is still vital and not infected)

3- To relief pain even if the symptoms are no longer presented root canal treatment must be done or the tooth will end up with an acute apical abscess and this the **Secondary Objective**.

Root canal treatment can be done for:

1- **A vital pulp**

Remove the inflamed pulp tissue and prevent infections on the long run.

2- **Necrotic pulp**

Disinfect the infected space.

*Root canal Treatment mainly is **chemomechanical disinfection** and **Fluid tight seal** to prevent re-infection.

Chemical (Sodium hypochlorite irrigation) and mechanical (files getting into the canal with different sizes gradually) disinfection are **BOTH** important.

Fluid tight seal is the root canal obturation and the coronal seal

And all of these will result in a successful root canal treatment.

Methods used in Root canal treatment:

1- Manual Instrumentation:

This is the conventional way using the **STEP BACK** technique that is done after reaching the master apical file, then 3 larger files are used respectively each time reducing the working length by 1mm in order to create a **TAPERED CANAL**.

What is the point of STEP BACK technique?

By manual instrumentation there will be parts of the canal that the file didn't touch, so we have to rely on something else to clean them.

The taper of the file used is 0.02 (2%) and the taper of the canal increases by 0.05 (5%).

If the step back technique was used by reducing 2mm instead of 1mm then the canal will have 2.5 taper.

Remember!

The more the canal is tapered the less the step.

2- Rotary instrumentation:

It is a machine that has a handpiece with a file that rotates.

The machine is set on a certain speed preferably 250-300 and the torque is also set preferably 1.8

Most of these instruments work on the **CROWN DOWN** technique, starting preparation coronally and then apically which means starting with a large file TAPER 0.08 then 0.06 then 0.04 until the full working length is reached.

3- Reciprocating system:

"The single file system"

It's way of functioning is very similar to **BALANCE FORCE** technique that is used with manual instrumentation "QUARTER of the turn is CLOCK WISE and THREE quarters of the turn is COUNTER CLOCK WISE"

It needs constant irrigation.

4- Self-Adjustive File:

It is a HOLLOW mesh that enters the canal and takes the canal shape of all its aspects and even its irregularities.

It doesn't rotate, it vibrates and it has a very rough surface (like sandblasting)

It needs constant sodium hypochlorite irrigation.

It was used first as a preparation system.

Back to the Rotary instrumentation, the **ProTaper System**:

Two generations:

- Next

- Universal

The file is separated into parts:

1- The working part which is 16 mm

2- Black bands (different lengths 21mm, 31mm)

The first band is at 10mm and the second band is at 19mm if the file length is 21mm then there is no third band.

If the file is 25mm or 31 mm then the third band is at 20mm

If the file is 25mm it has a fourth band at 22mm

If the file is 31mm it has a fifth band at 24mm.

So there is no need to measure the length each time and this is more accurate because most of the Endo Rings are distorted don't give the right measurement.

The files in this system are **COLOR CODED**; purple, white, yellow, red, blue and black.

There is **NO GREEN** color in ProTaper system.

D0 is the diameter of the tip.

ProTaper: means **PROGRESSIVELY** taper which means the taper varies along the length of the file.

#20 file means the tip size is 20 and the taper is 0.08

When we refer to taper we refer to the APICAL taper (3mm)

Shaping files: (Eiffel tower shape)

The taper is small at the tip and increases along the length of the file.

Sx: is not color coded, its diameter is **0.19** and the taper is **0.04**

S1: purple, its diameter is **0.17** and the taper is **0.02**

S2: White, its diameter is **0.2** and the taper is **0.04**

Memorize the numbers.

Finishing Files

Taper is large at the tip and decreases along the length of the file.

F1: **Yellow**, diameter is **20mm** and the taper is **0.07**

F2: **Red**, diameter is **25mm** and the taper is **0.08**

F3: **Blue**, diameter is **30mm** and the taper is **0.09**

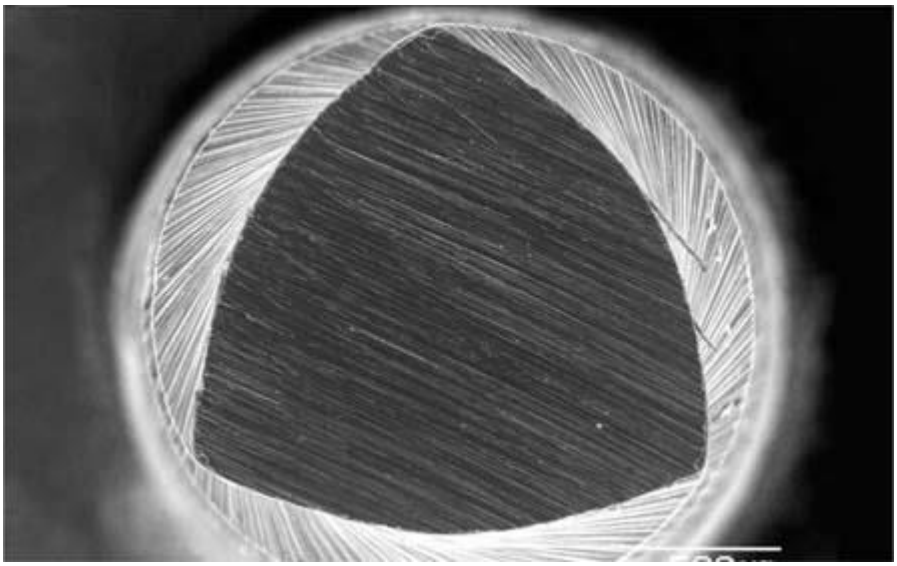
F4: **Black**, diameter is **40mm** and the taper is **0.06**

F5: **TWO yellow bands**, diameter is **50mm** and the taper is **0.05**

F4 and **F5** are mainly used in **canines**.

Cross section of files shape:

ProTaper files Sx-F2



Its eccentric, it’s not really centralized along the long axis of the file with rounded transition angles.

Protocol of using the ProTaper system:

1- A good access cavity.

2- Always start with hand files #10, #15 and #20 to create a gliding path.

It's better to use the #20 file in order to be on the safe side!

3- Shaping files starting with S1 it's going to be short won't reach the full working length but it will create the CORONAL FLARING.

4- Sx is used because it has a bigger taper and will help in determining the working length.

REMEMBER!

If the canal is infected, don't go to the full working length from the beginning because this will lead the bacterial debris to get impacted down at the apical area.

After finding the gliding path, reach the working length with the hand files using the **CROWN DOWN** technique then use the ProTaper files but don't reach the full working length.

The first 2 files of the ProTaper won't reach the full working length (those file don't work apically) because of their shape and design.

The first 2 files will prepare **CORONALLY** (if the hand file #20 reached the apex you start the coronal preparation) with the **IN & OUT** technique until the tip is loose

S2 file prepare **the middle third** of the canal so it's okay to keep going in and out with this file.

Sometimes the root length is 18mm or 19mm or 20mm so it can easily reach the full working length.

But sometimes the canals are extremely long or severely curved, so the load is split between two files, how?

Use S1 till 15mm or 16mm → irrigate →S2 → irrigate →then S1 till the full working length is reached → then apical preparation with F1.

F1 will **not work coronally** since the canal is already prepared coronally, but the tip is working with **PECKING ACTION** till the full working length is reached.

The moment the full working length is reached, STOP and don't keep going in and out because the file is working apically and this will lead to over preparation.

Continue with F2→ F3 → and so on

MOTORS:

What makes the rotary motors special is the **TORQUE**.

TORQUE: is created when an object is twisted in two directions.

When a lot of torque is applied on an object it will break.

So if a **very high torque** was set on the motor it will lead to **file breakage**. Why?

Because the file is rotating, the tip is bonded to the canal and the shank is still rotating, the motor will not stop then eventually the torque will go to a high level where the file SNAPS.

So these kind of motors will give some kind of protection, when the file is stuck in the canal and the shank is still rotating it will reach a certain torque then it will **stop** and **rotates back**.

The slow speed hand piece in the dental chair is air driven, the speed and torque can't be controlled and usually it is very rough and aggressive.

An Electric motor with torque control and Auto-reverse function is the kind of motor that is used.

Don’t use a motor that reaches a certain torque and then stops, this could even be worse the file will get stuck in the canal and won't get out!

In ProTaper system; every single file has recommended settings

S1 the torque is set between 2-3

S2 has the lowest torque is set which is 1.5

If the torque was set on 3 and the file S2 was used, it might BREAK!

There are certain systems that change the torque automatically.

ProTaper system has certain files for **retreatment** cases , they are called the **(D) files**

D1 → 30/.09 it removes Gutta Percha from the coronal part

D2 → 25/.08 →middle part

D3 → 20/.07

In ProTaper system there are files that have a really small taper 0.02 that are used in severely curved canals to achieve a glide path.

The ProTaper systems have rotary files, hand files, matching paper points and matching Gutta Percha.

There is a special Gutta Percha type that comes with a carrier and it's heated in a small oven just before obturation, then it's placed in the canal and the handle should be broken.

This type is REALLY BAD because:

1- It will not seal the canal properly.

2- It is really hard to remove it if the tooth needed a re-treatment.

HOW TO ASSESS ROTARY INSTRUMENTS?

1. Material:

Ni/Ti system/ M-wire system/ Gold-wire system.

Stainless steel files can't be used in the rotary instruments because it's NOT ELASTIC.

2. Number of files:

There are systems with one file, but it only works for straight forward cases.

Example:

In the upper first molar, the palatal canal is prepared to a size that differs from the size that is needed to prepare the MB2 so this system won't work on this tooth.

3. Cost:

ProTaper is expensive.

4. Tip:

Active/ Non-active (cutting/ non-cutting)

The **advantage of the cutting tip: it's faster** but more aggressive and it force is applied a new canal will be created!

It's better to use the non-cutting tip.

5. Research:

Read some researches and articles before you buy any system.

6. Rake angle:

The angle between the surface itself and the cutting part of the file, if its

a. 90 degree → neutral
b. More → positive /cutting (act as a blade), more efficient , more dangerous and very aggressive.
c. Less → negative / non cutting (scraping), safer but produces more debris.

Hero system has a **positive** rake angle that cuts into the dentine.

ProTaper (F3, F4, F5) has a **negative** rake angle.

K3and profile GT-files light speed all have **negative** rake angle.

The shape of the canals is **NOT ROUND** all the time, most of the times it is oval so the file might be touching two surfaces and the other two might not be prepared

The initial binding file: is the first file that binds at the apex.

The advantage of larger size preparation is to **create more room** for the irrigation materials, medicaments and the obturation materials.

DISADVANTAGES of larger size preparation:

1. Increase the risk of procedural errors (ledges, zipping, separation) → when the size of the file increase the risk of procedural errors increases.

2. Cutting more tooth structure

How much apical preparation is needed?

After finishing file F1 (the yellow one)
Use size 20 k-file → the file will reach the apical preparation if the file come out with resistant → the canal is ready to be obturated.
If not use F2, F3, and so on.

If the tooth was **VITAL**, it's better to make small preparation, so stop at F2.

If the canal is infected with apical radiolucency then F2 is not enough, a larger apical preparation is needed depending on the case.

REMEMBER:
1. Always irrigate the canal, never work on a dry canal.
2. Always follow the manufacturer's instructions (torque setting).
3. Always make sure that the file is rotating when you insert it in the canal and when you take it out.
(Never put the file inside the canal then turn on the motor and never turn off the motor and pull the file outside the canal)
4. Do not use force try to be gentle.
5. Use the **shaping files** with BRUSHING MOTION, and the **finishing files** with PECKING MOTION.
6. Always check your files, clean the debris, the flutes and always check if there is any sign of deformities on the files.