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ROTARY ENDODONTICS... A Complete Circle.



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INTRODUCTION

Cleaning and shaping the root canal system is of paramount importance in the success of endodontic therapy, which is established by the use of instruments. Although Rotary instruments have gained overwhelming popularity in the last few years, they were introduced to dentistry over 100 years ago. These systems emerged into endodontics with the basic intention of overcoming the primary limitations of hand instruments – *operating time* and *operator fatigue*.

Ever since Rollins, in 1899, introduced the first Rotary instrument, these systems failed to gain momentum for a long period accounting to factors like non-standardization of instruments, quality of steel employed, lack of operator expertise and cost. However, the transition to *Speed* in the present era has forced the re-birth of rotary systems. This article throws an insight on the few popular rotary systems available today employing a variety of designs.

Principles :

Steve Senia analyzed the root canal instruments and listed 6 essential factors, on which, the fundamentals of cleaning

and shaping instruments are based on.

1. Anatomic configuration of the root canal (*straight, curved, smooth or rough*).
2. The material that is cut (*dentin*).
3. The material of the cutting instrument (*Stainless Steel or Ni-Ti*).
4. The manufacturing process used to make endodontic instruments (*grinding or twisting*).
5. The design of the instrument (*reamer, file*) and the technique used (*ream or file*).
6. The fluid used during the procedure (*lubricant or chelating agent*).

Nickel Titanium (Ni-Ti) :

Earlier stainless steel was the material of choice for manufacturing instruments, however, its lack of flexibility posed a difficulty in instrumenting curved canals. To overcome this, *Walia, Brantley & Gerstein* in 1988, introduced Nickel Titanium (Ni-Ti) alloy. Ni-Ti has a low modulus of elasticity that provides enhanced flexibility and possesses the ability to recover from plastic strain when unloaded – "*Shape memory alloys*". However, the primary concern regarding its application in Rotary instrumentation is that they "*Fracture without warning*".



ROTARY SYSTEMS – CHOICES AVAILABLE...**Canal Master :**

The first effort to revive the latent phase of rotary instruments resulted in Canal Master. Introduced in both hand and rotary versions, canal master employed *stainless steel files* having a number of half sizes (Golden medium). Despite its popularity, the rotary versions were not quite successful as they were made of stainless steel.

Light speed :

Manufactured by Light speed Technology and patented by Wildev & Senia, these systems basically employ the same design of the popular canal master excepting that instruments were made of *Ni-Ti* and are available in rotary version. As these systems exclusively operate with a rotational speed of *1000 – 1500 rpm*, a 10:1 gear reduction handpiece is advocated.

They resemble Gates Glidden Drill, comprising of a long shaft with a short flame shaped cutting head, and are supplied in sizes no. 20 – 140 (ISO) including half sizes (22.5, 27.5... upto 60). The *non-cutting taperless shaft* provides more flexibility and less torque, reducing the stress on the instrument. They are used with a step back technique.

Profile series :

Profile series are the first set of instruments used in the *crowns down technique* at *150 – 300 rpm*, employing a 64:1 gear reduction handpiece. Supplied as three basic types of instruments, namely, Orifice shapers, 0.04 taper and 0.06 taper, these systems have a well developed land in a tri helical arrangement for effective abrasion of dentin. However, the negative rake angle provides for optimal cutting of dentin.

Quantec series :

Introduced as a system comprising of 10 Ni-Ti instruments, these instruments are used in *Hybrid technique*. Quantec features a typical *double land*, which is characteristic of the instrument with relieved radial lands to reduce the stress on the instrument, thereby facilitating the flow of irrigants apically and debris coronally. Also, they are supplied in two tip configuration, *non cutting tip* and a *safe cutting tip*, used depending on the clinical situation.

Hero 642 :

Hero (High Elasticity in Rotation) system constitutes three basic instruments - 0.06, 0.04 & 0.02 tapers (642) to be employed in three basic sequences, namely the *blue, red & yellow* used in *mild, moderate & severely curved* canals respectively. These instruments are made up of a bigger and stronger inner core. Despite the *positive rake angle*, these instruments are claimed to have less number of breakages owing to the thicker core.

Protaper :

This system comprises of *progressively tapered Ni-Ti files*. The unique feature of the instrument is its convex triangular cross-section, which reduces the contact area between file and dentin. Balancing the pitch and helical angles has improved the cutting efficiency. However, this system results in highly flared preparations in the coronal third of the canal.

RaCe :

Reamers with Alternate Cutting Edges (RaCe) have claimed to possess anti screwing design and anti metal fatigue surface finish. These instruments are available at variable tapers between 0.02 to 0.10.



ROTARY SYSTEMS...AT A GLANCE						
System	RPM	Gear reduction	No. of Instruments	Technique	Taper	Cross section
Light Speed	1000-1500	10 : 1	22	Step back	-	
Profile	150 - 300	64 : 1	9	Crown down	0.06 & 0.04	
Quantec	150 - 300	64 : 1	10	Hybrid	0.02 - 0.12	
Hero 642	500 - 600	64 : 1	9	Crown down	0.06, 0.04 & 0.02	
Protaper	150 - 300	64 : 1	6	Crown down	Progressive Taper	
RaCe	300 - 600	64 : 1	5	Crown down or Step back	0.02, 0.04, 0.06, 0.08, & 0.10	

MY PERSPECTIVE...			
✓ To be used with caution ✓✓ Satisfactory ✓✓✓ Recommended			
System	Straight canals	Moderately curved canals	Severely curved canals
Light Speed	✓✓	✓✓	✓✓✓
Profile	✓✓✓	✓✓	✓
Quantec	✓✓✓	✓✓	✓
Hero 642	✓✓✓	✓✓	✓
Protaper	✓✓✓	✓✓	✓
RaCe	✓✓✓	✓✓	✓

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