

### **Recent Advances In Endodontic Motors And Handpiece – An Overview**

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#### **Abstract**

Rotary systems were developed with the following objectives: simplicity, speed, safety in addition to stress reduction for both the clinician and patient. For the use in endodontic treatment, NiTi rotary instruments are available in different designs and tapers. Therefore, rotary instrumentation represents a significant evolution in endodontics which increasingly results in a faster, safer and better quality preparation. The use of rotary systems demands a thorough previous training as it reduces the operator's tactile sense.

#### **Introduction**

Endodontic instrumentation has advanced significantly in recent years with a range of powered rotary and reciprocating systems that can make root canal treatment easier to perform. Endodontic electric motors are a part of this advancement as they provide clinicians with the ability to use endodontic files with constant and precise torque suited to the canal being treated. Many of these systems offer programmable settings, automatic reverse functions designed to reduce file breakage, and some even feature integrated apex locator. Some

electric dental handpiece systems can even be used for endodontics along with a full range of other function

#### **Structure of A Handpiece**

TURBINE – a turbine is made up of various components s/a chuck, Impeller, Rotor, Bearing, Rings.

#### **Different Types of Handpiece**

Engine driven instruments can be used in four types of contra angle handpieces, which can be classified based on their motion:

- Rotary hand piece either latch or friction grip
- Reciprocating / quarter turn hand piece
- Vertical stroke
- Flexible systems

In addition, there are battery powered slow speed hand piece that can be combined with apex locator.

#### **Rotary Contra – Angle Hand Piece**

Round, tapered different diamond points are used with this type of handpiece. It is used to create coronal access to canal orifice. Used with different rpm.

These electric motors are specifically designed to power the new NiTi instruments in root canal preparations .The speed varies from 300 rpm suggested for the NiTi Profiles to the 2000 rpm recommended for the light speed instruments.

### Reciprocating Hand Piece

It accepts only latch type instruments. In this type of handpiece quarter turn motion is delivered 3000/min. In 1981 kerr has introduced the M4 safety hand piece which has a 30 degree reciprocating motion and a unique chuck that locks regular hand files in place by their handles.

Example of reciprocating hand piece is Giromatic , Intraendo 3 LD and Endolift.

### Vertical stroke handpiece

#### 1. Hand pieces

Handpiece	Manufacturer	Mode Of Action
Conventional		
Racer	Cardex , via W & H ,	vertical
Giromatic	MicroMega , Besancon ,France	Reciprocal rotation (90)
Endo – Gripper	Moyco Union Broach Montgomeryville,PA,USA	Reciprocal rotation
Endolift	Sybron Endo , Orange , CA ,USA	Reciprocal rotation + vertical
Endolift M 4	Sybron Endo	Reciprocal rotation
Endocursor	W & H	Rotation 360
Intra – Endo 3 LD	KaVo , Biberach ,Germany	Reciprocal rotation ( 90 )
Alternator		Reciprocal rotation ( 90 )

In 1984 levy introduced a hand piece that is driven either by air or electrically that delivers a vertical stroke ranging from 0.3 to 1 mm . The hand piece also has a quarter turn reciprocating motion that “kicks in” , along with the vertical stroke , when the canal instrument is under bind in a tight canal .If it is too tight , the motion ceases , and the operator returns to a smaller file.

Examples are :- Racer and Canal Finder system.

### Flexible System

Flexible system is the combination of both lateral & vertical movements.

Dynatrak	Dentsply DeTrey ,Konstanz , Germany	Reciprocal rotation ( 90)
<b>FLEXIBLE</b>		
Excalibur	W & H	Lateral oscillations ( 2000 Hertz , 1.4 – 2 mm amplitude )
Endoplaner	Microna , Spreitenbach ,Switzerland	Vertical oscillations + free rotations
Canal – Finder – System	S .E.T., Gro ‘benzell , Munich	Vertical movement ( 0.3 – 1 mm ) + free rotation under friction
Canal – Leader 2000	S.E.T.	Vertical movement ( 0.4 – 0.8 mm + partial rotation ( 20 – 30)
Intra-Endo 3- LDSY	KaVo	Vertical motion free rotation
IMD 9GX	HiTech , Unknown	360 degree - rotation with variable , torque dependent rotational speed (min 10/min )

#### Different Types Of Torque Controlled Endomotors

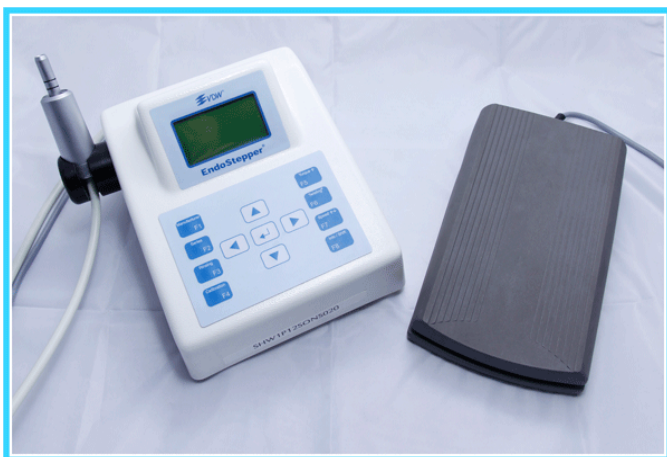
- Endostepper ( VDW , Germany )
- NouVAD TCM ENDO motor ( SybronEndo )
- ProTorq motor hand piece ( Dentsply Tulsa )
- Endosequence ( NSK )
- Tri auto ZX ( J . Morita
- EndoTouch TC2 (Sybron Endo)
- ATR Tecnika Digital Torque Control Motor (Dentsply Tulsa )
- X - Smart ( Dentsply , Mallifer )
- X - Smart Dual ( Dentsply , Mallifer )
- X - Smart Plus ( Dentsply , Mallifer )
- E 3 Torque Control Motors ( Dentsply Tulsa )
- Canal Pro CL – Cordless Handpiece (Coltene )
- Tri auto ZX 2 (J Morita)
- Endo-Mate (NSK)
- Endoradar (woodpecker)
- X-smart IQ (Dentsply, Mallifer)
- R-smart plus (Reborn endo)
- Canal pro CL2 (Coltene)

### 1) Endostepper (VDW Germany )

A step motor with computer controlled electronics , which allows fine adjustment of the torque values for each and every instruments of different brands.

#### Advantages

- Low torque value means low applied pressure on the root canal instrument.
- Produces minimal mechanical stress with passive instrumentation.
- Low torque instrumentation is helpful in detecting canal blockage without the risk of intracanal fracture.



### 2) Novvag Tem Endo Motor (Sybron Endo)

Its torque value ranges from 0.4 – 5 Ncm.

With 1:1 gear reduction the speed is 1200 – 16000 rpm

With 8:1 gear reduction the speed is 150 – 2000 rpm

With 16:1 gear reduction the speed is 75 – 1000 rpm

With 20:1 gear reduction the speed is 60 – 800 rpm



### 3) ProTorq motor hand piece ( Dentsply Tulsa )

ProTorq's max torque/max speed feature allows for greater flexibility between low and high speeds while its auto reverse function keeps torque levels in check. Complemented by the ProTorque 18:1 reduction contra-angle , a 150-20,000 speed range.



### 4) Endo Sequence TM (NSK)

It is a single cordless micro motor, with the application of Micro Chip technology with the capability of delivering 5 torque. With the 10:1 head, the speed ranges from 200 rpm to 1000 rpm. For endodontic procedure , the "TC" button automatically activates the very fine torque control and auto reverse functions especially for application of NiTi instrument and other instruments.



### 5) Tri auto ZX (J.Morita )

An entirely new in rotary handpieces is the Morita Tri auto ZX , a cordless , battery powered , endodontic , slow speed ( 150 – 280 rpm) with a built in apex locator.It uses rotary nickel titanium instruments held by a push button i.e.chuck.The Triauto ZX has 3 automatic functions :-

- The handpiece automatically starts when the file enters the canal and stops when the file is removed.
- If too much pressure is applied the hand piece automatically stops and reverses rotation.
- It automatically stops and reverses rotation when the file tip reaches the apical stop as determined by the built in apex locator.



### 7) ATR Tecnika Digital Torque Control Motor ( Dentsply Tulsa )

The ATR (Automatic Torque Reduction ) Tecnika Digital Torque Control Motor is a rotary instrumentation system for endodontics marketed by Dentsply Tulsa.The central control unit has a liquid-crystal-display ( LCD ) screen that identifies the current function and annotates torque value , reduction setting ; RPM speed , auto-reverse status , and file selection.The speed range is purported to be from 1600 to 12,800 rpm ,with gear reduction options of 15:1 , 16:1 , 18:1 , 20:1.38



### 6) EndoTouch TC2 ( Sybron Endo )

It has large LCD display with new digital operating interface , simple 5-key operation. The auto reverse and alarm functions indicate the load is about to reach the pre-set torque level , allowing you to unload the file even before the autoreverse sets in.It has Push-Button / Swing Latch Head with 16:1 gear reduction handpiece.Motor speed ranges from 2000-9000 rpm.



### 8) X smart ( Dentsply , Maillefer )

It is also used to operate more standard root-canal in the process of root canal treatment based on the micro-electronic control technology. Rotation speed and torque can be adjusted .Operates on battery or electrical power , with 9 adjustable program selection . It has a 16:1 contra-angle , with an autoreverse mode.

Speed range : 120 – 800 rpm.39

Torque : 0.6 – 5.2 Ncm



on/off button on the motor handpiece. The speed range is between 250 and 1200 rpm and the torque is between 0.6 and 4 Ncm. The motor works in both reciprocating motion and continuous rotation .It has preprogrammed settings for WaveOne , ProTraper Universal , PathFile , Gates and RECIPROC , as well as eight free programs for individual settings .A warning sound helps in keeping track of the file stress and the auto-reverse rotation at the torque limit reduces the risk of file breakage.



### 9) X-Smart TM Dual ( Dentsply , Maillefer )

It is an advanced version with changes in the torque and the 0.6 – 4.0 N.cm + “nl”-5.5 Ncm and has 2:1 contra-angle handpiece. This motor can be used with 3 modes - motor ( individually ) , apex locator ( individually ) and dual mode i.e. Motor & Apex Locator.

X-Smart™ Dual Endodontic Motor  
**X-SMART™  
DUAL**



### 10) X-Smart Plus ( Dentsply , Maillefer )

It is a new generation X-Smart endomotor from DENTSPLY Maillefer , the X-Smart Plus .The X-Smart improved user interface and retains the familiar X-Smart features such as the miniature contra-angle head and the

### 11) E3 R Torque Control Motors ( Dentsply Tulsa )

This is a torque control motor designed for rotary and reciprocatory instruments. It has preprogrammed settings for Dentsply Tulsa speciality files and 15 other programmable settings.

Features include :

- Large clear easy to read display
- 6:1 contra angle handpiece
- 250-1000 rpm settings in rotary mode
- Torque settings in rotary mode is 20-410 g-cm
- Autostop , reverse and forward in rotary mode.

### 12) CanalPro CL – Cordless Handpiece ( Coltene )

It is a thin ergonomic design with LCD panel and has upto 5 programs with auto reverse modes. The 6 head positions allows of contra angle to be adjusted to preferred positions.

- Energy saving , turns off when not in use for 10 minutes.

- Contra angle head is autoclavable at 1350C.
- Rotation Speed (min- 1 ) : 140 – 550.
- Torque Level ( N.cm ) : 0.3 – 3.0
- CanalPro CL Contra Angle 16:1



### 13) Tri Auto ZX 2 (J Morita)

As the successor to the original Tri Auto ZX cordless endo motor, Morita continues to offer the only endodontic system combining both systems in one handpiece. Morita's safety functions: Optimum Torque Reverse (OTR) and Optimum Glide Path (OGP) are new to the Tri Auto ZX2. OGP simplifies glide path creation whilst the OTR function reduces potential file breakage and microcracks by reversing the rotational direction when the torque level is reached



### 14) Endo-Mate TC2 (NSK)

A large LCD, simple 5-key operation and a lightweight, cordless handpiece assure easy use even during the most delicate endodontic procedures. The Auto Reverse & Alarm Function alerts you with an audible sound to let you know that the load is about to reach the preset torque

level allowing you to unload the file even before the Auto Reverse is setting in. 5 programs for different file systems. TC2 supports most major brands of Ni-Ti files.



### 15) Endo-Mate DT (NSK)

ENDO-MATE DT has been developed for use with most major brands of Ni-Ti files. The preprogramming function allows highly efficient treatments using different file manufacturer's procedures. The control unit has been designed to be lightweight and compact. It is fitted with a rechargeable battery providing high mobility. The lightweight and slim handpiece allows high performance.



### 16) Canal Pro CL2 (Coltene)

- Ergonomic design and control
- Big, user friendly LCD area
- Multiple speed settings, Torque Level, Auto-reverse mod and Translation ratio
- Rotation Speed: 120 ~ 500 rpm
- Torque Level: 0.3 ~ 3.0 Ncm

## **Conclusion**

As technology is advancing in instrumentation, it is crucial to know different generations in rotary instruments and their sequence of instrumentation. Hence, to avoid procedural errors, the present article highlighted the information regarding available rotary systems for ease of understanding.

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