

# Claimed Advantages of Reciprocation

- Fewer files
- Cost efficient
- Clinical time efficient
- Reduced clinical steps
  - No need for stainless steel files/ glide path
- Reduced reliance on operator experience
- Can be used in re-treatment cases
- Comparable cleaning effectiveness to rotation systems

# Possible disadvantages of reciprocation

- Increased dentinal cracking
- Increased apical extrusion

# Antibacterial Effectiveness

Clinical Comparison of the Effectiveness of Single-file Reciprocating Systems and Rotary Systems for Removal of Endotoxins and Cultivable Bacteria from Primarily Infected Root Canals.

- In-vivo study with 4 groups of 12 single rooted teeth
- Groups: WaveOne, Reciproc, Protaper, Mtwo
- Measured Endotoxin and culturable bacteria pre- and post-treatment
- No significant difference between groups

Limitations: No control. Query accuracy of measurement techniques for LPS

# Antibacterial Effectiveness

- Introduction: This clinical study was conducted to compare the effectiveness of single-file reciprocating systems and rotary systems in removing endotoxins and cultivable bacteria from primarily infected root canals. Methods: Forty-eight primarily infected root canals were selected and randomly divided into 4 groups: WaveOne (Dentsply Maillefer, Ballaigues, Switzerland) (n = 12); Reciproc (VDW, Munich, Germany) (n = 12), ProTaper (Dentsply Maillefer) (n = 12), and Mtwo (VDW) (n = 12). Samples were collected before and after chemomechanical preparation. The irrigation was performed by using 2.5% sodium hypochlorite. A chromogenic limulus amoebocyte lysate assay test was used to quantify endotoxins. Culture techniques were used to determine bacterial colony-forming unit counts. Results: In the baseline samples (ie, samples collected before chemomechanical preparation), endotoxins and cultivable bacteria were recovered from 100% of the root canal samples. No differences were found in the median percentage values of endotoxin reduction achieved with reciprocating systems (ie, WaveOne [95.15%] and Reciproc [96.21%]) and with rotary systems (ie, ProTaper [97.98%] and Mtwo [96.34%]) ( $P < .05$ ). Both single-file reciprocating systems (ie, WaveOne [99.45%] and Reciproc [99.93%]) and rotary systems (ProTaper [99.85%] and Mtwo [99.41%]) were effective in reducing the cultivable bacteria (all  $P < .05$ ). Moreover, the culture analysis revealed no differences in bacterial load reduction ( $P > .05$ ). Conclusions: Both single-file reciprocating systems (ie, WaveOne and Reciproc instruments) and rotary systems (ie, ProTaper and Mtwo instruments) showed (J Endod 2014;40:625–629)

# Antibacterial Effectiveness

- Conclusions:

Similar effectiveness in reducing endotoxins and cultivable bacteria from primarily infected root canals, but they were not able to eliminate them from all root canals analyzed.

**(J Endod 2014;40:625–629)**

# Apical Extrusion

- Ex-vivo study
- 4 groups of 20 mandibular incisors
- Reciproc, WaveOne, Protaper, Mtwo
- Teeth mounted in pre-weighed glass vials and weight of extruded debris measured. Also measured time to prepare tooth
- Results:
  - WaveOne + Reciproc extruded more debris
  - WaveOne + Reciproc quicker preparation time
- Limitations of study: is this method a valid depiction of the in-vivo reality. What about the effects of apical pressure from the vascular system?
  - Could apical extrusion be reduced by spending longer using the reciprocating file systems – i.e. remove after each peck?

# Apical Extrusion

**Introduction:** The purpose of this in vitro study was to assess the amount of apically extruded debris using rotary and reciprocating nickel-titanium instrumentation systems. **Methods:** Eighty human mandibular central incisors were randomly assigned to 4 groups (n = 20 teeth per group). The root canals were instrumented according to the manufacturers' instructions using the 2 reciprocating single-file systems Reciproc (VDW, Munich, Germany) and WaveOne (Dentsply Maillefer, Ballaigues, Switzerland) and the 2 full-sequence rotary Mtwo (VDW, Munich, Germany) and ProTaper (Dentsply Maillefer, Ballaigues, Switzerland) instruments. Bidis-tilled water was used as irrigant. The apically extruded debris was collected in preweighted glass vials using the Myers and Montgomery method. After drying, the mean weight of debris was assessed with a microbalance and statistically analyzed using analysis of variance and the post hoc Student-Newman-Keuls test. The time required to prepare the canals with the different instruments was also recorded. **Results:** The reciprocating files produced significantly more debris compared with both rotary systems ( $P < .05$ ). Although no statistically significant difference was obtained between the 2 rotary instruments ( $P > .05$ ), the reciprocating single-file system Reciproc produced significantly more debris compared with all other instruments ( $P < .05$ ). Instrumentation was significantly faster using Reciproc than with all other instrument ( $P < .05$ ). **Conclusions:** Under the condition of this study, all systems caused apical debris extrusion. Full-sequence rotary instrumentation was associated with less debris extrusion compared with the use of reciprocating single-file systems. (J Endod 2012;38:850–852)

**Apically Extruded Debris with Reciprocating Single-File and Full-sequence Rotary Instrumentation Systems**  
**Burklein et al. (2012)**

# Cutting Efficiency of Reciproc and WaveOne Reciprocating Instruments

- In-vitro study
- Compared ability of WaveOne and Reciproc to cut through **Plexiglass**
- Used files in mounted handpieces with standardised force, using Reciproc and WaveOne motor settings and measured depth of cut achieved.
- Results: Reciproc more effective in both groups (cut deeper)
- Limitations: **Ridiculous study**. How is cutting through plastic relevant to preparation of teeth. Do we actually want a more cutting efficient instrument or is this more likely to lead to iatrogenic error. No clear relationship between cutting efficiency and improved resistance to cyclic fatigue has been established.



# Influence of Continuous or Reciprocating Motion on Cyclic Fatigue Resistance of 4 Different Nickel-Titanium Rotary Instruments

- In-vitro study
- Employed Reicproc and WaveOne files and compared to (Twisted File, Mtwo,) in a milled simulated canal of 60° curvature. Used different settings on motor for each file; 1 group for continuous rotation, 1 group for Reciproc settings and 1 group for WaveOne. Time to fracture recorded allowing no. of rotations to be calculated
- Results
  - Reciprocating settings increase all files tested resistance to cyclic fatigue when compared to rotation setting.
  - Twisted File most resistant to Fracture. WaveOne most prone to fracture
- Limitations-
  - Study does not conform to clinical reality; when are you going to leave a file rotating at 350 RPM at length within a canal for any period of time. Single use files reduce risk of cyclic fatigue so is this relevant to us as an NHS Group

**(J Endod 2013;39:258–261)**

# Cyclic fatigue of reciprocating file systems

- The resistance to cyclic fatigue was determined by counting the number of cycles to failure in a 60 curve with a 5-mm radius.
- Results: The cyclic fatigue resistance of the 2 reciprocating motion instruments (ie, “RECIPROC ALL” and “WAVE- ONE ALL”) was significantly higher than the continuous rotation in each brand ( $P < .001$ ).
- No significant difference was observed in cyclic fatigue between the 2 different reciprocal motions tested in each brand ( $P > .05$ ).
- When considering the appropriate clinical motion for each brand, no significant difference in cyclic fatigue was found between TF, Mtwo, and Reciproc R25 instruments, whereas the cyclic fatigue resistance of WaveOne files was less than the other 3 brands ( $P < .05$ ).
- Conclusions: Reciprocal motion showed a significantly higher cyclic fatigue resistance in all brands compared with continuous rotation. No differences were found between the 2 reciprocating motions. (**J Endod 2013;39:258–261**)

# Incidence of dentinal cracks in reciprocating versus rotary instrumentation

- Ex-vivo model
- Extracted teeth standardized roots prepared with WaveOne, Reciproc, Mtwo and Protaper
- Teeth subsequently sectioned at 3, 6 and 9mm, stained and viewed with a stereolithographic microscope
- Results:
  - **More complete cracks seen with Reciproc than Mtwo and Protaper**
  - **More incomplete cracks in apical section with Reciproc**
- Limitations – no standardization of irrigant volume between groups. No standardization of root support/ engagement (?whether roots hand held)

**(J Endod 2013;39:501–504)**

# Dentinal cracks with reciprocation

**Conclusions:** Under the conditions of this study, root canal preparation with both rotary and reciprocating instruments resulted in dentinal defects. At the apical level of the canals, reciprocating files produced significantly more incomplete dentinal cracks than full-sequence rotary systems ( $P < .05$ ).

**(J Endod 2013;39:501–504)**