

Assessment of Postoperative Pain After Using Two Different Kinematics Reciprocating and Continuous Rotary Motions

(An in vivo study)

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

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Dedication

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Introduction

Postoperative pain is defined as pain of any degree that occurs after Initiation of root canal treatment. Flare up is subset of post-operative pain representing a high degree of pain which is disruptive to the patient's routine. Although pain may not indicate endodontic failure but its relief is more important to the patient than the Success or failure of the treatment. Knowledge of the causes of interappointment pain is of utmost importance for the practitioner to properly prevent or manage this undesirable condition.

The aim of root canal treatment is to clean, shape, disinfect and obturate canal without any injury to periradicular tissue. Pain is a frequent complication associated with endodontic therapy and it commences within few hours or days after endodontic treatment. Patients may consider postoperative pain and flare up as a benchmark against which the clinician's skills are measured. It might undermine patient's confidence in their dentists or patient satisfaction with the treatment.

There are many common factors contributing to postoperative pain after root canal treatment as inadequate instrumentation, extrusion of apical debris, missed canal, extrusion of irrigating solution, extrusion of intracanal dressing, presence of preoperative pain and periapical pathosis.

Since the vast majority of endodontic problems are microbial in origin. Their removal is considered the most important step in root canal therapy. Main etiological factor to periapical inflammation and postoperative pain during chemomechanical instrumentation is apical extrusion to infected debris.

There are many factor affect amount of apical extrusion to debris as instrumentation technique, instrument design, apical final size, irrigation protocol time of cleaning and shaping. All instrument leads to apical extrusion of debris to some extent.

Instrumentation techniques that depend on preparation of canals in a cervical to apical direction are recommended to reduce the incidence of apical extrusion.

Recently, introduction of nickel-titanium rotary instrument leads to minimal apical debris compared to stainless- steel hand k files.

Review of literature

There are many factors affecting the incidence of endodontic postoperative pain. Extrusion of debris to the periradicular tissues during chemo mechanical preparation is allegedly one of the principal causes of postoperative pain (**Seltzer et al., 1985**)⁽¹⁾.

Forcing microorganisms and their products into the periradicular tissues can generate an acute inflammatory response because following injury, chemical substance will be released or activated which will mediate the inflammation process such as vasodilation and increase in vascular permeability, therefore, the main inflammatory events that lead to developing of periradicular pain appear to be the increase in vascular permeability leading to exudation and edema formation. these phenomena induce hydrostatic pressure that lead to compression of nerve endings and pain generation although some mediators can generate pain by direct action on sensory nerve fibers (**Sigueira et al., 2004**)⁽²⁾. The intensity of inflammation is directly proportional to the intensity of tissue injury. (**Elmsallati et al., 2009**), (**Gambarini et al., 2013**)^(3, 4).

There are two types of factors that can affect such extrusions: firstly, natural physical factors, such as the anatomy of the apical constriction, dentin hardness, and quantity and momentum of flow of the irrigant, and secondly, mechanical factors, such as the selection of the final apical size of the instrument, and instrumentation

techniques. In addition, the size of the irrigation needle and its depth into the canal may affect the quantity of extrusion. (LU et al., 2015)⁽⁵⁾

All instrumentation techniques promote apical extrusion of debris. However, techniques significantly diverge as to the amount of extruded debris, with some techniques extruding less than others. Such differences in the amount of extruded debris may be crucial for the development of postoperative pain, as techniques that extrude more debris allegedly increase the risk for exacerbation of pain to occur. (Fairbourn et al., 1987), (Al-Omari et al., 1995)^(6, 7).

➤ **Apical extrusion of debris:**

- **Bürklein and Schäfer., 2012⁽⁸⁾:** Studied amount of apical extruded debris after instrumentation by reciprocating and rotating system in vitro study. This study performed on 80 mandibular central incisors which divided to 4 groups. First 2 groups used reciproc single file and wave one single reciprocating file, other 2 groups used rotating system Mtwo file and protaper rotating file and used Bidistilled as irrigating solution. The results showed that reciprocating system performed more apically extrusion of debris more than rotary system ($p > 0.05$) and between all files used that reciproc single file produced more apical debris than other files. ($p < 0.05$). It was concluded that all instrumentation system produce apical debris but reciprocating single file

produced more debris than rotating system which subsequent lead to more postoperative pain in reciprocating system.

- **Nayak et al., 2014** ⁽⁹⁾: Assessed amount of debris and irrigant that extruded apically which produced more inflammation and subsequent postoperative pain during instrumentation by using 2 reciprocating and one rotary single file NiTi instrumentation system. This study performed on 60 mandibular premolars, divided to 3 groups (G1 reciproc, G2 wave one, G3 one shape), used Bidistilled water as irrigating solution, collected debris by eppendorf tubes, dried the liquid inside the tube and evaluated mean weight of debris by using electronic microbalance. They found that continuous rotary instrumentation produced lower debris than reciprocating file system but there were no statistically difference between 2 reciprocating files ($p > 0.05$). It was concluded that all instrumentation systems cause extrusion of debris apically but extrusion of debris happen less in continuous rotary system than reciprocating system.
- **Marinho et al., 2014** ⁽¹⁰⁾: Compared the effect of reciproc and multfile rotary systems on elimination of bacteria and endotoxins from root canal during preparation. Performed on 40 mandibular single root mandibular premolars affected by *Escherichia coli* divided to 4 groups (G1 reciproc, G2 Mtwo, G3

protaper universal, G4 race). They took bacterial and endotoxin before and after instrumentation by sterile paper point. They found that there was no difference in ability of bacteria and endotoxin removal between reciprocating single file, reciproc and other multife rotary system.

- **Yan et al., 2015⁽⁵⁾**: Investigated the apical and coronal extrusions by using two reciprocating and two rotary instrumentation systems. Eighty extracted human single-rooted anterior teeth were randomly divided to four groups according to instrumentation technique, including two reciprocating single-file systems, Reciproc and WaveOne, and two full-sequence rotary BLX and ProTaper instruments. Debris collected from the coronal by the instruments and apical extrusions were quantified respectively. After drying the collections, the mean weight of debris collected from apical and coronal extrusions was assessed using an electronic balance and analyzed using the Kruskal–Wallis *H* and Mann–Whitney *U* tests. The results showed that all of the systems produced apical extrusion of debris. But, reciprocating single-file systems produced less apical extrusion than full-sequence rotary systems.
- **Nevares et al., 2015⁽¹¹⁾**: Evaluated apical extrusion of debris in canals instrumented with systems used in reciprocating and continuous motion. Sixty mandibular premolars were randomly divided into 3

groups ($n = 20$): the Reciproc (REC), WaveOne (WO), and HyFlex CM (HYF) groups. One Eppendorf tube per tooth was weighed in advance on an analytical balance. The root canals were instrumented according to the manufacturer's instructions, and standardized irrigation with 2.5% sodium hypochlorite was performed to a total volume of 9 mL. After instrumentation, the teeth were removed from the Eppendorf tubes and incubated at 37°C for 15 days to evaporate the liquid. The tubes were weighed again, and the difference between the initial and final weight was calculated to determine the weight of the debris. The data were statistically analysed using the Shapiro-Wilk, Wilcoxon, and Mann-Whitney tests ($\alpha = 5\%$). The results showed that Reciproc produced significantly more debris than WaveOne ($p < 0.05$), and both systems produced a greater apical extrusion of debris than HyFlex.

- **Vivekanandhan et al., 2016⁽¹²⁾**: Investigated the amount of apically extruded debris after preparation of straight root canals in extracted human teeth using three rotary systems (Protaper, Revo-S and WaveOne). Sixty single-rooted human teeth with single root canal and apical foramen were selected and randomly divided into three experimental groups ($n=20$) according to the rotary system used: Group 1 - ProTaper, Group 2 - Revo-S, Group 3 - WaveOne. Apical enlargement was done up to size 40/0.06 for