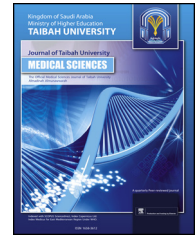




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Original Article

The efficacy of retreatment and new reciprocating systems in removing gutta-percha-based filling material

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المخلص

أهداف الدراسة: للتحقق من فعالية انظمة اعادة معالجة الآلية و الأنظمة الآلية ذات الحركة التبادلية في ازالة حشوات الأقتنية الجذرية ذات الاساس المكون من الكوتابيركا.

طرق و مواد الدراسة: تم تحضير الأقتنية لـ ٩٠ سن سليمة باستخدام نظام البروتيبير الآلي حتى قياس اف٣. حشيت الأقتنية المضرة بالكوتابيركا و سيلر من نوع تيولسيل باستخدام تقنية التكتيف الجانبي. قسمت الأسنان الى ٥ مجموعات حسب انظمة اعادة المعالجة الآلية المستخدمة كالتالي: مجموعة الريسبروك و التي استخدمت فيها مبادر الريسبروك قياس ٢٥. مجموعة الويف ون و التي استخدمت فيها مبادر الويف ون الأساسية. مجموعة أس ون و التي استخدمت فيها مبادر أس ون ذات القياس ٢٥ و الأستقاق بمقدار ٠.٦. مجموعة نظام اعادة المعالجة من نوع البروتيبير. و مجموعة نظام اعادة المعالجة من نوع ام تو. تم تسجيل الوقت اللازم لإزالة المادة الحاشية (دقيقة) وحوادث انكسار المبادر كاختلاط مرافق لاعادة المعالجة ان وجد. بعد اعادة المعالجة، تم شطر كل سن طوليا الى نصفين و صور كل نصف بكاميرا ذات دقة عالية. ادخلت الصور الى برنامج اوتو كاد من اجل قياس كمية المادة الحاشية المتبقية ضمن القناة بعد اعادة المعالجة. ثم خضعت البيانات لتحليل احصائي باستخدام اختبارات ون وي انوفا و كاي سكوير.

النتائج: أظهرت مجموعة ام تو لاعادة المعالجة أعلى متوسط من المادة الحاشية المتبقية بعد اعادة المعالجة (٥١%) و لم يكن هناك فارق احصائي بين المجموعات الأخرى. احتاجت مجموعة البروتيبير أقل وقت لأزالة المادة الحاشية (٥.٨٣ دقيقة). بشكل عام، حدث انكسار الفايالات ١٣ مرة خلال اعادة المعالجة، حيث كانت نسبة الانكسار ضمن مجموعة ام تو هي الأعلى احصائيا (٣٣.٣%)

الاستنتاجات: ضمن محدوديات هذه الدراسة في المختبر، كانت الأنظمة الدوارة ذات الحركة التبادلية فعالة مثل انظمة اعادة المعالجة الآلية في ازالة حشوة الأقتنية الجذرية. أظهر نظام ام تو لاعادة المعالجة اسوء النتائج من حيث قلة الفعالية في ازالة حشوة الأقتنية و من حيث على نسبة انكسار المبادر خلال اعادة المعالجة.

Abstract

Objectives: To investigate the efficacy of retreatment and reciprocating rotary systems in removing gutta-percha filling material from root-canal systems.

Methods: A total of 90 single-canal human teeth were instrumented using a F3 ProTaper file and obturated with gutta-percha and the Tubliseal sealer using the lateral-compaction technique. They were divided into five groups according to the rotary system used to remove the filling material: Reciproc, which used the Reciproc-R25 file; WaveOne, which used the WaveOne-Primary file; S1, which used the S1 (25/.06) file; ProTaper-R, which used the ProTaper-Retreatment system; and Mtwo-R, which used the Mtwo®-Retreatment system. The time required to remove the filling material (min) and the associated instrument separation, if any, were recorded. Teeth were cleaved longitudinally and photographed with a high-resolution camera. Images were imported to the AutoCAD application to measure the remaining filling material and the root-canal space. Data were analysed using the one-way analysis of variance and Chi-squared tests.

Results: The Mtwo-R group showed the highest mean remaining filling material (51%) ($p < 0.001$), with no significant differences among the other groups. The ProTaper group required the least time for filling-

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material removal (4.95 min), with significant differences compared to the other groups ($p < 0.05$), except the WaveOne group (5.83 min; $p = 1.000$). Overall, 13 instruments (15.9%) were used for filling-material removal, with a significantly greater proportion in the Mtwo-R group (33.3%) compared to the other groups ($p = 0.009$).

Conclusions: Within the limitations of this in vitro study, reciprocating rotary systems were as effective as retreatment rotary systems in removing root-canal filling material. The Mtwo-R system showed the poorest performance with respect to removal effectiveness and instrument separation.

Keywords: Mtwo-R; Reciproc; Removal; Retreatment; S1; WaveOne

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Introduction

There has been an increased emphasis on preservation of teeth, including those with failed root-canal treatments (RCTs). Nonsurgical RCT is usually preferred for such cases, especially since the survival rate of teeth receiving nonsurgical root-canal retreatment is similar to that associated with primary treatments.¹ The main objective of nonsurgical RCT is to completely remove the root-canal filling materials (RCFMs) to allow effective disinfection and shaping of the root-canal system. This is essential for successful RCT.²

Several tools have been employed for removal of RCFMs from the root-canal system, including chemical solvents,³ hand instruments,⁴ NiTi rotary instruments,⁵ Gates–Glidden drills,⁶ heat-transferring instruments and ultrasonics,⁴ and laser irradiation.⁷ Traditionally, RCFMs were removed using hand-files with/without solvents.⁴ However, this procedure can be tedious and time-consuming, especially if the RCFM is well-compacted.⁸ Moreover, solvents may damage the periapical tissues when extruded and their toxicity cannot be overlooked,³ jeopardising the prognosis of the RCT. Retreatment rotary instruments, which rotate in continuous motion and are especially designed for retreatment, are practical options in such scenarios^{9,10} and may decrease patient and operator fatigue. However, their superior efficacy over hand instruments has been a matter of debate, with some studies showing that retreatment rotary instruments are not better than hand instruments.¹¹ Furthermore, to this date, there is no rotary or hand file that can completely remove the entire RCFM, regardless of the technique used,¹⁰ especially from the apical third of the root canal.¹² Therefore, research is warranted to identify rapid, safe, and efficient method(s). The WaveOne (Dentsply Maillefer, Ballaigues, Switzerland) and Reciproc (VDW, Munich, Germany) are new single-file rotary systems that are designed for cleaning and shaping root-canal systems

using reciprocating motion. They have shown better mechanical behaviour in comparison with conventional rotary files.¹³ However, conflicting results were reported regarding their effectiveness in root-canal retreatment.^{5,9} The S1 (Sendoline AB, Täby, Sweden) system is a new reciprocating single-file system that was recently introduced in the market and is designed for cleaning and shaping. Unlike the WaveOne and Reciproc systems, this system has not received any research attention, neither for cleaning and shaping nor for retreatment. Therefore, there is a need to investigate its potential in root-canal retreatment.

The aim of this in vitro study was to investigate the effectiveness of two retreatment rotary systems rotating in continuous motion and three systems rotating in reciprocating motion in removing a gutta-percha-based filling material from the root-canal system.

Materials and Methods

Root-canal treatment

Single-canal sound human teeth with curvatures less than 10° , which were determined by the Schneider technique,¹⁴ were obtained from a pool of extracted teeth at XXXX; the teeth were extracted due to periodontal diseases or orthodontic considerations, but not specifically for the purpose of this study. Teeth with immature apices, previous treatments, or cracks or restorations were excluded. This resulted in a 90-teeth sample, with the sample size of each group within the range of those in previous studies adopting the same methodology. After standard access cavity preparation, the working lengths for cleaning and shaping as well as retreatment procedures were established and recorded. ProTaper-Universal rotary files (Dentsply, Maillefer, Switzerland) were used to clean and shape root canals to size F3. The irrigation protocol employed 2.5% sodium hypochlorite (NaOCl) between each file, followed by treatment with a 17% EDTA solution for one minute, and a final rinse with 2.5% NaOCl. The root canals were obturated with a gutta-percha core and Tubli-seal sealer (SybronEndo, Orange, CA) using the lateral-compaction technique. Mesiodistal and buccolingual radiographs were obtained to check the quality of the root-canal filling. After insertion of temporary restorations, the teeth were stored at 37°C with 100% humidity for one month to allow setting of the sealer.

Root-canal-filling removal

Teeth were randomly divided into five groups (18 teeth in each group) using the random number table method. There were no significant intergroup differences in the means of teeth dimensions (teeth lengths and minimum and maximum root widths). The groups were as follows:

Reciproc group

The Reciproc-R25 file (VDW, Munich, Germany) was used with the VDW Silver motor in an in–out pecking motion using the preset ‘Reciproc All’ parameters. The process was repeated until the file reached the working length.

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