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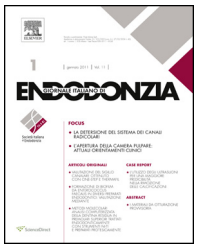

ORIGINAL ARTICLE/ARTICOLO ORIGINALE

Comparative analysis of root canal changes after preparation with three systems using Cone-Beam Computed Tomography

Analisi comparativa alla CBCT delle modificazioni canalari dopo la preparazione con tre diversi sistemi

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KEYWORDS
Cone-Beam Computed Tomography;
Canal curvature;
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Revo-S®;
HEROShaper® and ProTaper®.

Abstract
Introduction: The aim of this study was to investigate the morphological changes in the root canal trajectory on extracted teeth after preparation with Endoflare/Revo-S®, Endoflare/HeroShaper® and ProTaper® using Cone-Beam Computed Tomography (CBCT).
Methods: 39 root canals with similar curvatures were divided into three homogeneous groups (n = 13). Root canals in Group 1 were shaped with Endoflare/Revo-S®; Group 2 with Endoflare/Hero Shaper®, and Group 3 with ProTaper®. All specimens were scanned pre- and postoperatively using the Kodak® 9000C 3D imaging system. Changes in both degree and position of the root canal

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curvature were assessed. Canal transportation was calculated for each slice by comparing the position of the root canal centroid before and after instrumentation. Statistical analysis was carried out by the non-parametric Kruskal–Wallis test ($p < 0.05$), and Mann–Whitney test applying the Bonferroni correction ($p < 0.05$).
Results: The mean of curvature degree decreases significantly ($p < 0.003$) for each group, with no statistical differences between the three groups. Mean canal transportation scores ranged from 52 μm (Revo-S®) to 85 μm (ProTaper®) in the apical third; 51 μm (Revo-S®) to 87 μm (ProTaper®) in the middle third, and 77 μm (HEROShaper®) to 119 μm (ProTaper®) in the cervical third. In the apical and the middle parts, Revo-S® produced statistically less transportation than HEROShaper® (respectively $p = 0.01708$, $p = 0.01328$) and ProTaper® (respectively $p = 0.02402$, $p = 0.0202$).
Conclusion: All instruments produced a small curvature deviation and mild canal transportation. Revo-S® resulted in less transportation in the apical and middle thirds.

PAROLE CHIAVE
Tomografia computerizzata a fascio conico;
Curvature canalare;
Trasporto canalare;
Revo-S®;
HEROShaper® and ProTaper®.

Riassunto
Obiettivi: Lo scopo di questo studio è stato quello di studiare le alterazioni morfologiche della traiettoria canalare su denti estratti dopo la preparazione con Endoflare/Revo-S®, Endoflare/HeroShaper® e ProTaper® utilizzando tomografia computerizzata a fascio conico (CBCT).
Materiali e metodi: Metodi: 39 canali radicolari con curvature simili sono stati suddivisi in tre gruppi omogenei (n = 13). I canali radicolari del gruppo 1 sono state sagomati con Endoflare/Revo-S®, quelli del gruppo 2 con Endoflare/Eroe Shaper® e quelli del Gruppo 3 con ProTaper®. Tutti i campioni sono stati sottoposti a scansione CBCT prima e dopo la preparazione canalare utilizzando il sistema di imaging 3D Kodak® 9000C. Sono stati valutati sia i cambiamenti del grado e della posizione della curvatura canalare che il trasporto del canale, confrontando la posizione del canale radicolare centroide prima e dopo strumentazione. L'analisi statistica è stata effettuata utilizzando il test non parametrico di Kruskal-Wallis ($p < 0,05$) e il test di Mann-Whitney applicando la correzione di Bonferroni ($p < 0,05$).
Risultati: Il grado di curvatura è risultato diminuito significativamente in tutti i gruppi ($p < 0,003$), senza evidenziare però differenze statisticamente significative tra i tre gruppi. I valori di trasporto canalare medio variavano da 52 μm (Revo-S®) a 85 μm (ProTaper®) nel terzo apicale, da 51 μm (Revo-S®) a 87 μm (ProTaper®) nel terzo medio e da 77 μm (HEROShaper®) a 119 μm (ProTaper®) nel terzo cervicale. Nel terzo apicale e medio i Revo-S® hanno determinato statisticamente meno trasporto degli HEROShaper® (rispettivamente p = 0,01708, P = 0,01328) e dei ProTaper® (rispettivamente p = 0,02402, P = 0,0202).
Conclusioni: Tutti gli strumenti hanno prodotto una piccola modificazione della curvatura e un leggero trasporto canalare. Gli strumenti Revo S® ha dimostrato un minor trasporto nei terzi apicale e medio.

Introduction

Canal shaping is a critical aspect of endodontic treatment. It influences the outcome of the subsequent phases of irrigation, root canal filling and therefore, the success of the endodontic treatment. Once the canal is shaped, it should have a uniformly tapered funnel shape, increasing in diameter from the apical foramen to the coronal orifice. This shape enhances the efficiency of the irrigation and allows the placement of an effective tooth filling.[1]

The development of Nickel–Titanium (Ni–Ti) rotary instrumentation has been a great technological advance. These instruments enable root canals to be shaped with fewer procedural errors.[2,3] Procedural errors such as transportation and loss of working length were mainly associated with the use of stainless-steel files, which had insufficient flexibility.[4,5] Ni–Ti rotary instruments also work faster thus reducing operating time.[2]

A number of techniques are currently available to evaluate canal transportation and centring ability of instruments during root canal preparation. Micro-Computed Tomography seems to be a promising tool for root canal anatomy studies but this technique is time-consuming and not indicated for chairside use. Recently, Cone-Beam Computed Tomography (CBCT) has become available for clinicians and many endodontic applications have been identified.[6,7] The aim of this study was to investigate the morphological changes in the root canal trajectory after preparation with Endoflare/Revo-S®, Endoflare/HeroShaper® and ProTaper® using CBCT.

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