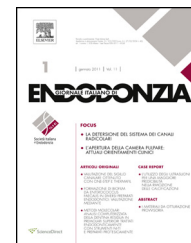




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ORIGINAL ARTICLE/ARTICOLO ORIGINALE

The influence of antibiotics on the physical properties of endodontic cements

Influenza dell'utilizzo di soluzioni antibiotiche sulle proprietà meccaniche di cementi endodontici

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KEYWORDS

Antibiotic;
Chlorexidine;
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Push-out strength;
MTA.

Abstract

Aim: To evaluate the influence of Metronidazole, Minocycline and Ciprofloxacin as a mixture or individually and of chlorhexidine on the push-out bond strength and surface microhardness of calcium silicate cements of differing particle size.

Methodology: 120 extracted adult human premolars were decoronated and 2 mm dentin slices were prepared. Specimens were divided equally into the following groups: normal saline and CHX, Metronidazole, Minocycline, Ciprofloxacin, and combination of Metronidazole, Minocycline and Ciprofloxacin. The specimens were irrigated with solutions and filled with endodontic cements. In the second part, the endodontic cements were mixed, placed in plastic tubes

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PAROLE CHIAVE

Antibiotici;
Clorossidina;
Microdurezza;
Resistenza alla
dislocazione;
MTA.

and then irrigated for 1 or 5 min. Push-out and surface microhardness values were calculated and data were analyzed with three way ANOVA followed by Tukey's post-hoc test.

Results: The normal saline and ciprofloxacin groups showed significantly higher and lower, respectively, push-out bond strength among the experimental groups ($p < 0.001$ for all groups). Nano type cement showed higher push-out bond strength and microhardness than regular one at both time intervals. The mixture of antibiotics had significant effects on the push out and microhardness of calcium silicate cement.

Conclusions: Nano particle MTA resisted more than the conventional MTA to the effect of the irrigating solution and antibiotics in both hardness and push-out strength. Furthermore, the results of microhardness were consistent with the push-out strength in most cases. The microhardness test may be employed as a complimentary test to evaluate push-out strength of dental cements.

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Riassunto

Obiettivo: valutare l'influenza dell'uso di metronidazolo, minociclina e Ciprofloxacina come miscela di antibiotici o singolarmente e della clorossidina sulla forza di legame e la microdurezza superficiale di cementi di silicato di calcio di diversa granulometria.

Metodologia: 120 premolari umani adulti estratti sono stati decoronati e sono state preparate fette di dentina di 2 mm. I campioni sono stati divisi in parti uguali nei seguenti gruppi a seconda della soluzione irrigante utilizzata: soluzione fisiologica e CHX, metronidazolo, minociclina, ciprofloxacina, e una combinazione di Metronidazolo, minociclina e ciprofloxacina. I campioni sono stati irrigati con una di queste soluzioni e riempiti di cemento endodontico e poi sottoposti a test di push-out. Nella seconda parte, i cementi endodontici sono stati mescolati, messi in provette di plastica e poi posti in contatto per 1 o 5 min con le diverse soluzioni prima di essere testati per microdurezza superficiale. I valori push-out e microdurezza superficiale sono stati calcolati e i dati sono stati analizzati con test ANOVA a tre vie seguito dal test post hoc di Tukey.

Risultati: I gruppi trattati con soluzione saline e con la ciprofloxacina hanno mostrato rispettivamente una forza di legame significativamente più alta e più bassa tra i gruppi sperimentali ($p < 0.001$). Il cemento di tipo nano ha mostrato una maggiore forza di legame al test push-out e una maggiore microdurezza superficiale rispetto al cemento regolare nei due intervalli di tempo. La miscela di antibiotici ha avuto effetti significativi sulla resistenza alla dislocazione e sulla microdurezza superficiale del cemento al silicato di calcio.

Conclusioni: Un MTA a nanoparticelle ha resistito maggiormente all'effetto negativo delle soluzioni irriganti e antibiotiche rispetto al MTA convenzionale sia per quanto riguarda la durezza superficiale che la resistenza al push-out. Inoltre, i risultati di microdurezza superficiale sono risultati correlati alla forza di legame nella maggior parte dei casi. Il test microdurezza può essere impiegato come test complementare per valutare la forza al push-out dei cementi endodontici.

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Introduction

Since the introduction of Mineral Trioxide Aggregate (MTA) to the field of dentistry¹ several variables, such as the powder-to-water ratio,² mixing technique,³ humidity and setting time⁴, storage temperature⁵, and the pH value of applied area⁶⁻⁸ have been shown to have an impact on different properties of MTA. Likewise, post-setting factors such as thermal fluctuation after cement application can have significant impact on the structural and physical properties of this material.⁹ In addition to environmental variables, there are different materials that are used in root canal procedures which can produce similar alterations¹⁰ and may affect biologically root canal treatment and regeneration.^{11,12}

Chlorhexidine (CHX) is a cationic based antiseptic that is active against a wide range of microorganisms including

aerobic and anaerobic gram-positive and negative bacteria, viruses, molds and yeasts.^{13,14} The mutual effect of CHX and MTA cement has been questioned from antibacterial and cytotoxicity characteristics.¹⁰ When 0.12% CHX was mixed with MTA cement, the antibacterial properties of CHX can be beneficial for MTA; however, MTA can increase the cytotoxicity of CHX as a result.¹⁰

Antimicrobial agents are frequently employed within root canals in form of liquids, pastes or solids. Investigations have confirmed the use of combination of Metronidazole, Minocycline and Ciprofloxacin for sterilization of root canal systems and are now acceptable in clinical practice.¹⁴⁻¹⁶ An *in vitro* study¹⁵ testing the antibacterial efficacy of these drugs alone and in combination indicated that these drugs individually could not completely eliminate bacterial contamination, however the mixture of these antibiotic was able to consistently sterilize all samples. Published studies

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