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Araştırma/ Research Article

EFFECT OF LENTULO SPIRAL USAGE AT DIFFERENT SPEEDS ON APICAL EXTRUSION OF CALCIUM HYDROXIDE[≠]

FARKLI HIZLARDA LENTÜLO SPİRAL KULLANIMININ KALSİYUM HİDROKSİTİN APİKAL EKSTRÜZYONU ÜZERİNE ETKİSİ[≠]

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ABSTRACT

Aim: The aim of this study was to evaluate the apical extrusion of calcium hydroxide [$Ca(OH)_2$] paste, which placed into the root canal with lentulo usage at different speeds and a hand file.

Material and Methods: 40 maxillary central incisors were used. Root canals were enlarged up to 40.06 Revo-S size. At each instrument change, root canal was irrigated with 2.5 mL of 5.25% NaOCl. Final irrigation was performed with 5 mL of 17% EDTA, 5 mL of 5.25% NaOCl, and 5 mL of saline; then, dried with paper-points. Each teeth were placed in the plastic tubes, and the tubes were covered with aluminium foil. $Ca(OH)_2$ powder and distilled water were mixed at a ratio of 1:1.5. Specimens were divided into 4 groups according to $Ca(OH)_2$ placement method (n=10): **G1:** #30 Lentulo spiral at 20000 rpm, **G2:** #30 Lentulo spiral at 10000 rpm, **G3:** #30 Lentulo spiral at 5000 rpm, **G4:** #40 K-Flexofile. Lentulo was used 2 mm short of the working length, and K-Flexofile at the working length. The apices of the specimens were inspected with a dental loop, and situation was scored. Data were subjected to statistical analysis using Chi-square test (α=0.05).

Results: Minimum extrusion was seen in Group 3 and 4, and maximum was in Group 1. However, there was no significant difference among the groups ($P > 0.05$).

Conclusions: Lentulo should be used with lower speeds in clinical practice to prevent extrusion. $Ca(OH)_2$ placement with K-Flexofile and lentulo spiral at 5000 rpm can be considered safe.

Keywords: Apical extrusion, calcium hydroxide, lentulo spiral.

ÖZ

Amaç: Bu çalışmanın amacı, bir el eğesi ve farklı hızlarda lentülo kullanımı ile kanala yerleştirilen kalsiyum hidroksit [$Ca(OH)_2$] patının apikal ekstrüzyonunun değerlendirilmesiydi.

Gereç ve Yöntem: 40 adet maksiller santral keserler kullanıldı. Kök kanalları 40.06 Revo-S boyutuna kadar genişletildi. Her enstrüman değişiminde kök kanalı 2.5 mL %5.25'lik NaOCl ile irrige edildi. Final irrigasyonu 5 mL %17'lik EDTA, 5 mL %5.25'lik NaOCl ve 5 mL serum fizyolojik ile yapıldı; ardından kağıt konlar ile kurutuldu. Her bir diş plastik tüplere yerleştirildi ve tüpler alüminyum folyo ile sarıldı. $Ca(OH)_2$ ve distile su 1:1.5 oranında karıştırıldı. $Ca(OH)_2$ yerleştirme yöntemine göre dişler 4 gruba ayrıldı (n=10): Birinci, ikinci ve üçüncü gruplar 30 numara Lentülo ile sırasıyla 20000,10000 ve 5000 tur/dk da çalışılarak dolduruldu. Dördüncü grupta ise #40 K-Flexofile kullanıldı. Lentülo çalışma boyundan 2 mm kısa, Flexofile ise çalışma boyunda kullanıldı. Örneklerin apeksleri dental loop ile gözlendi ve durum skorlandı. Ki-kare testi kullanılarak veriler istatistiksel analize tabi tutuldu (α=0.05).

Bulgular: Minimum ekstrüzyon Grup 3 ve 4'te, maksimum taşma Grup 1'de gözlendi. Ancak, Gruplar arasında anlamlı farklılık yoktu ($P > 0.05$).

Sonuç: Klinik pratikte ekstrüzyondan korunmak için lentülo daha düşük hızlarda kullanılmalıdır. K-Flexofile ve 5000 rpm'de lentulo spiral ile $Ca(OH)_2$ yerleştirilmesi güvenli olarak kabul edilebilir.

Anahtar Kelimeler: Apikal ekstrüzyon, kalsiyum hidroksid, lentülo

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INTRODUCTION

The thorough removal of microorganisms by instrumentation alone is not possible during root canal treatment.[1,2] Therefore, irrigation and chemical disinfection is a mandatory requirement to kill and remove microorganisms and their by-products.[3] Calcium hydroxide [$Ca(OH)_2$] is the most commonly used intracanal dressing because of its physical and chemical features.[3,4] Some of these features are; high pH, antibacterial activity, induction of the hard tissue formation, and control of radicular resorptions.[3,5,6] Saline solution or sterile water are the most widely used vehicles for $Ca(OH)_2$ among the many other options, and they facilitates the delivery of $Ca(OH)_2$ and release of hydroxyl ions in root canals.[3]

Although it has been considered as a safe agent, some negative side effects related to $Ca(OH)_2$ were reported. They include continuing inflammatory response and osteonecrosis in repaired perforations, cytotoxicity on cell cultures, the neurotoxic potential of root canal sealers, damaged epithelium with or without a cellular atypia and cellular damage following early $Ca(OH)_2$ placement of avulsed teeth.[7,8] Some authors have reported deleterious effects if the material is extruded under a high pressure during endodontic treatment.[7,9,10] $Ca(OH)_2$ paste can result in necrosis and degenerative changes in animal models by intense inflammatory responses.[11] Its pH is around 12; it has a very low solubility at body temperature and will remain in the tissue for considerable time, and therefore it can not be considered biocompatible.[9,10]

It has been suggested that the root canal should be intensely and fully filled with $Ca(OH)_2$ paste,[6,13] because its effectiveness is mainly depending on the interaction between the residual microorganisms and the paste.[12] The placement of $Ca(OH)_2$ is performed with some endodontic instruments and materials, such as McSpadden compactors, lentulo spirals, K-files, amalgam carriers, reamers, ultrasonic and sonic files, absorbent paper points, gutta-percha cones, ML syringe (SS White), and 27-G long needles.[5]

The effect of different lentulo spiral speeds on $Ca(OH)_2$ extrusion from the apex has not yet been studied. The aim of this study was to compare the apical extrusion of calcium hydroxide paste, which placed into the root canal, with lentulo spirals that rotated different speeds and a hand file.

MATERIAL AND METHODS

Forty extracted human maxillary central incisors with straight roots, similar lengths, and fully developed apices were selected for the study. Before the collection of teeth, the approval of local ethics committee of Erciyes University, Kayseri, Turkey was acquired (Decision number: 2015/305). Access cavities were opened with diamond coated burs under water cooling. Working lengths were determined by visualizing a #15 K-file (Maillefer Instruments, Ballaigues, Switzerland) through the apical foramen and subtracting 1 mm. Root canals were enlarged up to 40.06 Revo-S (Micro-Mega, Besancon, France) instrument within the working lengths in a crown-down manner. At each instrument change, the root canal was irrigated with 2.5-mL of 5.25% NaOCl. After the preparations, a #10 K-file was used to check patency of the apical foramens. Final irrigation was performed with 5-mL of 17% EDTA solution for 30 seconds, 5-mL flush of 5.25% NaOCl, and 5-mL of saline solution. Then, the root canals were dried with absorbent paper cones. Each tooth was placed in the plastic tubes; and the tubes were covered with aluminium foil to mask the filling procedure (Fig. 1). $Ca(OH)_2$ powder (Merck, Darmstadt, Germany) and distilled water at a powder to liquid ratio of 1 : 1.5 were mixed until a creamy consistency. The specimens were randomly divided into 4 experimental groups according to $Ca(OH)_2$ placement method (n = 10):

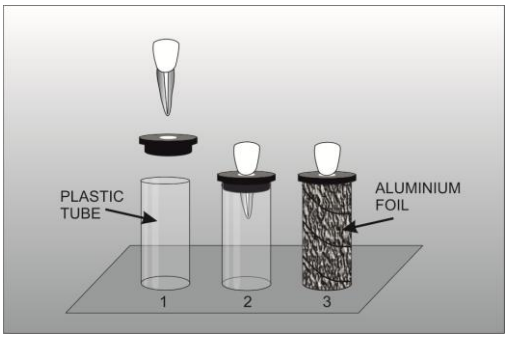

Figure 1. Samples were placed in the plastic tubes which were covered with aluminium foil to mask the filling procedure.

Group 1: a #30 Lentulo spiral (Dentsply, Maillefer,

Ballaigues, Switzerland) at a speed of 20000 rpm,
Group 2: a #30 Lentulo spiral at a speed of 10000 rpm,
Group 3: a #30 Lentulo spiral at a speed of 5000 rpm,
Group 4: a #40 K-Flexofile (MAF size) (Maillefer Instruments, Ballaigues, Switzerland).

Lentulo spiral which was coated with $Ca(OH)_2$ paste inserted up to 2 mm short of the working length for filling of the root canals. Lentulo, was used in a clockwise rotation with a low speed hand-piece (KaVo, Biberach-Riss, Germany) which was connected to dental unit (R7, Anthos, Imola, Italy) that allows adjusting the speed of rotation values. K-Flexofile was used with a counterclockwise rotation entire working length (Fig. 2). These procedures were done until the dressing material was visible at the canal orifice. To provide standardization, all procedures were carried out by the same operator.

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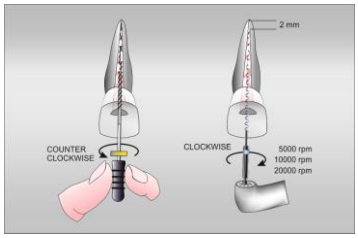

Figure 2. Working actions of lentulo spiral and K-Flexofile instruments while placing calcium hydroxide paste.

The apices of the specimens were inspected with a dental loop (HEINE Optotechnik, Herrsching, Germany) with magnification of 4x. A scoring system was defined to assess the quantity of extruded $Ca(OH)_2$ paste from the apex. The scores used were as followings: **Score 0:** absence of visible $Ca(OH)_2$ in the apex; **Score 1:** visible $Ca(OH)_2$ in the apex, but there was no extrusion; **Score 2:** there was extruded $Ca(OH)_2$ (Fig. 3). The evaluation of scores were done as following; The scores 0 and 1 were accepted as "not extruded" and score 2 was accepted as "extruded". Data were subjected to statistical interpretation using Chi-square test by a statistics software (SPSS for Windows 20.0, SPSS Inc., Chicago, IL, USA) ($\alpha = 0.05$).

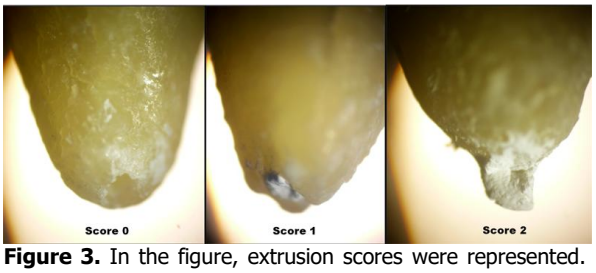

Figure 3. In the figure, extrusion scores were represented. Score 0: absence of visible $Ca(OH)_2$ in the apex; Score 1: visible $Ca(OH)_2$ in the apex, but there was no extrusion; Score 2: there was extruded $Ca(OH)_2$.

RESULTS

There was no significant difference among the groups in terms of $Ca(OH)_2$ extrusion ($P > 0.05$). Minimum extrusion was seen in Group 3 and 4, and maximum was in Group 1. Score distributions are shown in Table 1. There was no visible dressing material at the bottom of the tubes.

DISCUSSION

For the the $Ca(OH)_2$ placement into the root canals, many different techniques have been recommended in various studies.[14-19] Anthony and Senia[14] and Lopes *et al.*[17] advocated the usage of a lentulo spiral. Sigurdsson *et al.*[18] were reported that the most effective way to delivery of $Ca(OH)_2$ into the root canal is lentulo spiral. Dumsha and Gutmann[16] stated that the clinician should be able to analyze the situation and choose the most suitable method.

A lentulo is a spiral formed instrument that is often used to send dressing pastes into the canals with a clockwise rotation. There is no certain knowledge in the literature about its size and length that should be used; however, it can be said that it has a push forward effect on the material due to clockwise rotation. Torres *et al.*[20] suggested to select a lentulo spiral that is easily placed to the working length without binding the canal walls. Estrela *et al.*[5] and Deonizio *et al.*[21], in their studies, used lentulo spiral at 3 mm short from the working length. Torres *et al.*[20] and Simcock and Hicks[22] used lentulo spiral at working length. In this study, a #30 Lentulo instrument was used at 2 mm short of the working length to simulate clinical conditions and to avoid overflow tendency of the dressing material from the apex.

$Ca(OH)_2$ delivery into the root canal by using lentulo spiral is a frequent procedure in clinical practice. Not using the lentulo spiral at proper speeds may result in $Ca(OH)_2$ extrusion from the root canal to the apical tissues, and the overflowed $Ca(OH)_2$ may cause some negative effects[7,8] on the surrounding tissues. There are no studies about the proper usage speeds of lentulo spiral for the safety in the literature. Therefore, this study was designed and aimed to close this gap in the literature.

In several previous studies, investigators preferred various lentulo speeds in the methodologies. Deveaux *et al.*[23] preferred the speed of 500 rpm; whereas, Rahde *et al.*[24] and Caliskan *et al.*[25] only entitled as low and moderate speeds, without particularizing it. Deonizio *et al.*[21] used 5000 rpm, 10000 rpm and 15000 rpm in their experimental groups which are quite realistic speeds for clinical use. Therefore, in the present study, lentulo spiral was used at different speeds as 20000 rpm, 10000 rpm and 5000 rpm. These speeds were established according to the maximum speeds feasible in dental contra-angle handpiece (approximately 20000 rpm) as Deonizio *et al.*[21] mentioned. According to the results of this studythere was no significant difference among the groups ($P > 0.05$). However, 5000 rpm lentulo and hand file groups showed less "score 2" frequency from the other groups. It seems that, the increase in lentulo spiral speed also increases the frequency of $Ca(OH)_2$ extrusion.

In the last group, a #40 size K-Flexofile instrument was selected, which is still a frequently used technique in clinical practice. Staehle *et al.*[26] and Simcock *et al.*[22] reported that the hand instruments are less effective than lentulo instruments in terms of the ability to fill root canals with $Ca(OH)_2$ paste densely. However, there is no information in the literature about the $Ca(OH)_2$ extrusion while placing it into the root canal with hand file. In this study, K-Flexofile did not extrude the $Ca(OH)_2$ paste, even so it was used at determined canal working length. This might be related to the manuel action and counterclockwise rotation of the hand instrument; because this working style serves to apply $Ca(OH)_2$ paste to the canal walls rather than to drive forward.

There were some limitations in this *in vitro* study. One of them was absence of physical back pressure provided by periapical tissues in healthy teeth and periodontium. However, clinicians do not always encounter the healthy teeth in clinics. Therefore, the methodology of the present study represents various clinical situations. The other limitation was the use of lentulo spiral in a constant distance from the apex. Not only the lentulo speeds have an effect on extrusion, but also the length that was studied with lentulo might have an effect on extrusion, as well. Besides, different canal and apex morphologies also might have an effect on the extrusion of $Ca(OH)_2$.

CONCLUSIONS

According to the findings of this study, lentulo spiral should be used with a lower speed in clinical practice to prevent extrusion. $Ca(OH)_2$ placement with K-Flexofile (at working length) and lentulo spiral at 5000 rpm (at 2 mm short of the working length) can be considered safe according to the findings of this study. Further investigations are needed for different parameters that may have an effect on the extrusion of $Ca(OH)_2$ placement into the root canals.

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