



Experimental Article

Root canal configurations of the first and second mandibular premolars in the population of north Syria



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Received 24 December 2014; revised 13 February 2015; accepted 20 February 2015; Available online 2 April 2015

المخلص

أهداف البحث: يهدف هذا البحث لتقييم تشريحي وشكلي للأقنية الجذرية للضواحك السفلية الأولى والثانية لدى سكان شمال سوريا.

طرق البحث: تكونت العينة البحثية من ١٦٠ ضاحكة سفلية (٩٥ ضاحكة سفلية أولى و ٦٥ ضاحكة سفلية ثانية) مقلوعة حفظت بمادة الكلورامين - ت بنسبة ١٠٪، وحقنت الأسنان بعد فتح الحجرة اللبية بالحبر الهندي ومن ثم جعلت شفافة لتسهيل دراسة عدد، ونموذج، وأنماط الأقنية الجذرية الموجودة في أسنان العينة البحثية.

النتائج: أظهرت نتائج البحث أن ٨٢،١ ٪ من الضواحك الأولى السفلية كانت بقناة واحدة، بينما احتوت ١٧،٩٠ ٪ من الأسنان على قناتين جذريتين. كما لوحظ أن ٨٣،٠٧ ٪ من الضواحك الثانية السفلية كانت بقناة واحدة، بينما كان ١٥،٣٥ ٪ منها بقناتين. وضاحكة ثانية سفلية واحدة (١،٥٣ ٪) وجد فيها ٣ قنوات.

الاستنتاجات: إن معظم الضواحك السفلية هي أسنان وحيدة القناة مع احتمال وجود قناتين أو أكثر، لذلك يجب على الطبيب المعالج أن يفترض وجود أكثر من قناة جذرية عند علاج هذا النوع من الأسنان.

الكلمات المفتاحية: تشريح؛ شفافية الأسنان؛ تشعبات القناة الجذرية؛ ضاحكة سفلية؛ شكل القناة الجذرية

Abstract

Objective: This study was conducted to assess the canal anatomy and morphology of the first and second mandibular premolars in the population of north Syria.

Methods: One-hundred and sixty permanent fully developed apices of the mandibular premolars (95 first mandibular premolars and 65 second mandibular premolars) were collected and stored in 10% chloramine-T solution. Teeth were stained with India Ink and cleared. The number and the type of root canal were examined in the root of each cleared mandibular premolar.

Results: The results showed that 82.1% of first mandibular premolars had a single canal and 17.9% contained two canals. Eighty three percent of second mandibular premolars had a single canal, 15.3% two canals, and 1.5% three canals.

Conclusion: Most of mandibular premolars have a single canal with the probability of presence of two or more canals. This possibility of the existence of two or more canals in the mandibular premolars should be considered by the dentists while performing endodontic therapy.

Keywords: Anatomy; Cleared tooth; Configuration; Mandibular premolar; Morphology

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Peer review under responsibility of Taibah University.



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Introduction

Knowledge of pulp anatomy is essential for endodontic treatment success, and a lack of sound knowledge of the pulp anatomy can contribute to treatment failure. The morphologies of the roots and canals of the first and second mandibular premolars can be complex and variable. Due to this varied morphology, the endodontic treatment of mandibular premolars is a challenging task.¹ Slowey indicated that the mandibular premolars are difficult teeth to treat endodontically likely because of the variations in canal anatomy.² The distributions of the numbers of roots and canals vary greatly in the literature.³ The root canal morphologies of the mandibular premolars have been reported based on studies of various population groups (Table 1), including Chinese,⁴ Turkish,⁵ American,^{6,7} Mexican,⁸ and African American populations.⁶

Zillich and Dowsen revealed that second or third canals are present in at least 23.1% of first mandibular premolars and in at least 12.1% of second mandibular premolars.⁹

Vertucci found that the mandibular first premolar has one canal in 74.0% of teeth, two canals in 25.5%, and three canals in 0.5% of teeth. The mandibular second premolar has one canal in 97.5% and two canals in 2.5% of teeth.¹⁰

Lu et al. indicated that 54% of mandibular first premolars in a Chinese population exhibited a single canal, 22% contained two canals, and 18% exhibited a C-shaped configuration.⁴

Baisden et al. found that 76% of mandibular first premolars demonstrated Type I canals, and 24% contained Type IV canals, and the shapes of the canals were predominantly oval or round. Interestingly, C-shaped canals have been found to be predominantly associated with Type IV canal systems; this pattern has observed in 14% of roots.¹¹

Jain and Bahugund¹² studied the root canal morphologies of mandibular first premolars in a Gujarati population and concluded that mandibular first premolar teeth predominantly had one root and a Type I canal system (67.39%).

Zaatar et al. found that 95.3% of mandibular second premolars have one canal, and 4.7% have two canals.¹³ In France, Geider et al. observed that 86.6% of mandibular second premolars have one canal, and 13.4% have two canals.¹⁴ In Turkey, Sert and Bayirli revealed that 71% of mandibular second premolars have one canal, and 29% have two canals.⁵

The methods that are commonly used to study root canal anatomy include radiography⁸, clearing techniques,¹⁵ direct observation with a microscope,¹⁶ 3D reconstruction,¹⁷ and macroscopic sectioning.^{4,11} Conventional radiography has the problem of superimposition¹⁸; moreover, this technique

results in a two-dimensional representation of a three-dimensional object. The difficulties encountered with other methods (e.g., cross or longitudinal sections) include disturbance of the pulp space and its surrounding structures during the preparation of the teeth.¹⁹

Advancements in the field of radiology have drawn upon the use of computed tomography (CT) to image imaging teeth. Eder et al. reported that CT is a viable tool for the evaluation of unclear root canal configurations.²⁰ Spiral computed tomography (SCT) is also a more useful technique for assessing unusual root canal morphologies compared with routine intraoral periapical radiography.^{21,22} A cone-beam computed tomography has also been used to study root canal morphologies because this non-destructive technique provides three-dimensional pictures²³; however, this technique is expensive and requires complex devices²⁴

Until 1982, the clearing procedure was used for anatomical studies of the pulp cavity.²⁵ In 1983, Tagger et al. put forward an improved method that utilizes methyl salicylate as the clearing agent for three-dimensional studies of apical leakage.²⁶ The benefits of this clearing technique for creating transparent root canals include the following: it enables three-dimensional assessments²⁷; it maintains the original form of the root canal, including minute details²⁸; failure in the preparation of the specimen is rare; and the specimen can be preserved for a long time.

The purpose of this study was to investigate the canal configurations of the first and second mandibular premolars of the population of north Syria.

Materials and Methods

This study was approved by the Research Ethics Committee of the College of Medical Science, University of Science and Technology, Yemen.

Totals of 95 extracted mandibular first premolars and 65 mandibular second premolars were collected from various dental clinics within north Syria. All of the teeth belong to people from northern Syria. The teeth included in this study had intact clinical crowns and fully developed apices. Data regarding the age and sex of the donors and the reasons for extraction were not recorded. Any adherent soft tissues, bone fragments or calculus were removed via scaling and polishing. The number of roots was recorded in this stage (Figure 1). Access cavities were prepared with a high-speed handpiece and diamond fissure burs (Komet, Gebr. Brasseler GmbH & Co. KG Germany). After locating the orifices, the pulp tissue was dissolved by immersing the teeth in 5.25% sodium hypochlorite (Clorox, Dammam, Saudi Arabia) for

Table 1: Some studies show number of canals in the mandibular first and second premolar according to population groups.

Study	Teeth in study	Geographic area	1 canal	Results% 2 canals	3 canals
Vertucci1978 ¹⁰	First premolar second premolar	USA	74	25.5	0.5
Lu et al2006 ⁴	First premolar	China	54	22	0
Baisden et al1992 ¹¹	First premolar	USA	76	24	0
Jain and Bahugund2011 ¹²	First premolar	Gujarati population	67.39	32.61	0
Zaatar et al1997 ¹³	Second premolar	Kuwait	95.3	4.7	0
Geider et al1989 ¹⁴	Second premolar	France	86.6	13.4	0
Sert and Bayirli2004 ⁵	Second premolar	Turkey	71	29	0

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