Cumhuriyet Dental Journal: 2019; 22(4)
e-ISSN 2146-2852
Doi:10.7126/cumudj.646189

Case report

MICRO-CT EVALUATION OF TAURODONTISM IN A DECIDUOUS MOLAR AND A PERMANENT MOLAR: CASE REPORT

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ABSTRACT

Taurodontism is a morphological anomaly of teeth characterized with large pulp chambers and apically displaced pulpal floor. The aim of this case report was to make a comparative evaluation by panoramic radiographies and 3D examinations to locate pulp chamber and root canal morphology of a primary mandibular first molar and the adaptation of root canal filling material of a permanent mandibular first molar, both diagnosed with taurodontism. In Case-1, a mandibular primary first molar was extracted due to physiological root resorption seen in the panoramic radiograph. The micro-CT (Bruker, SkyScan 1174, Belgium) examined the distance of the tooth a (distance between the lowest and the top point of the pulp chamber) and b (distance between the lowest point of the pulp chamber and the apical). The tooth was classified as mesotaurodont by the value of 52.91 obtained with the formula a/b x 100. In Case-2, the tooth was extracted because of the large periapical radiolucency observed in the radiography taken from the tooth which was admitted for pain and percussion tenderness. The calculation for subgroup could not be performed due to loss of the "a" value because of the cavity preparation. Although the root canal filling on the radiograph was found to be sufficient and long enough, an empty extra canal and insufficient wall adaptation of root canal filling were detected by micro-CT. Despite the fact that taurodontism can be diagnosed by 2D measurements, it is obvious that a 3-dimensional examination is necessary to obtain decisive data about the root canal cavity morphology especially for endodontic treatment and also to define prevalence and subgroups of anomalies. Although micro-CT is seen as a method that provides more detailed images, it is thought that it should be developed and supported with clinical studies in order to be valid and easy to use in clinical practice.

Key words: Taurodontism, microcomputed tomography, primary tooth, permanent tooth.

Received : 13.11.2019
Accepted : 05.12.2019

How to Cite: Yüksel BN, Orhan K, Tulga Öz F. Micro-Ct Evaluation of Taurodontism in a Deciduous Molar and a Permanent Molar: Case Report. Cumhuriyet Dent J 2019;22:4;
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INTRODUCTION

Taurodontism has been accepted as a shape alteration defined as the enlargement of the pulp chamber and the apical displacement of the pulpal floor and the bifurcation/trifurcation of the roots.[1]

It is stated that conditions such as calcification delay at pulp chamber floor, odontoblastic deficiency, failure of the invagination level of the Hertwig's epithelial root sheath could be related for the pathogenesis.[2]

In studies conducted in different countries prevalence varies from 0.4%-46.4% for permanent teeth.[3-6] Prevalence studies for primary dentition are limited and frequency was stated as 2.4% for the Turkish population.[7]

Diagnosis have been done with periapical or panoramic radiographs only by visual observations.[8,9] With the evolution of technical equipment, certain dimensions could be done with digital radiographies to locate the points of cementoenamel junction, furcation boundaries and the upper and lower points of pulpal chamber.[5,10] Following years, diagnostic studies were performed to define the subgroups of taurodontism by the calculation of the ratio of the lengths of the crown plus body (CB) to the root.[5,11,12] It was observed that taurodontism occurs by varying degrees that may be classified in increasing order of severity as hypotaurodontism, mesotaurodontism, and hypertaurodontism. As the results of these studies, metric criteria were determined to diagnose the subgroups.

Taurodontism were diagnosed frequently by radiographic techniques.[8-10] Micro-computerized tomography methods (micro-CT) that allows 3-dimensional measurements and images have been began to be used in pediatric dentistry.[13,14]

In this case presentation, comparative evaluation by panoramic radiographies and micro-CT methods was used to locate pulp chamber, root canals and morphologies of a primary mandibular first molar and a permanent mandibular first molar diagnosed with taurodontism.

CASE REPORTS

Case 1

A mandibular first primary molar in 10 years-old patient have been diagnosed with deep dentine caries and physiological root resorption. After written informed consent was taken, tooth was extracted due to 2/3 of root growth of the underlying germ was complete and symmetrical first premolar was erupted (Figure 1).

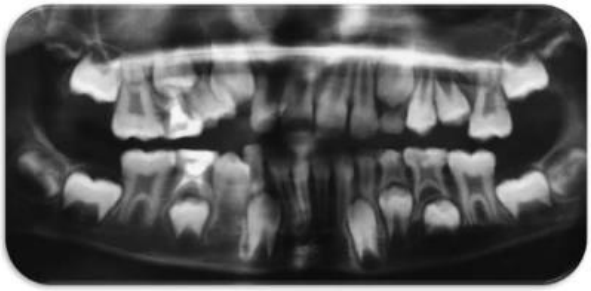

Figure 1: Panoramic radiograph of Case 1.

Radiographic signs of all permanent first molars and left second primary molar have revealed large pulpal chambers which also confirmed the definition for taurodontism. Dental history was not relevant with any medical history. Parents and siblings were also examined radiographically and no signs of taurodontism were detected. Tooth were examined with a micro-CT (Bruker, SkyScan 1174, Belgium) and measurements have been done for the reference points a (distance from the lowest point of pulp chamber roof to the highest point of the floor) and b (distance from the highest point of pulp chamber roof to the apex) (Figure 2a, 2b, 2c, 2d).

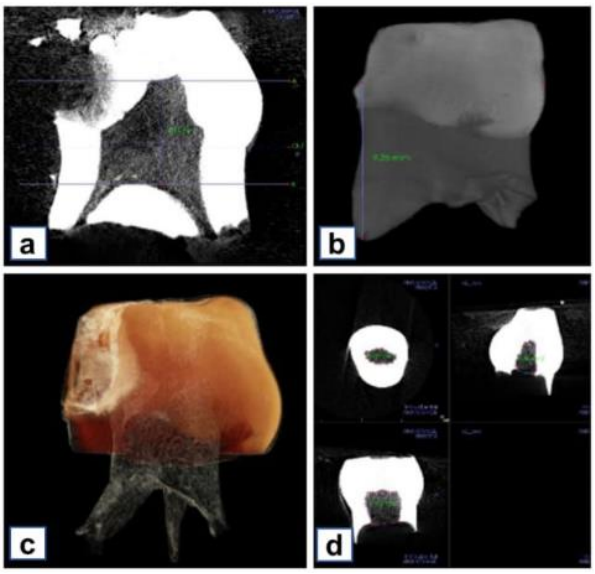

Figure 2a, 2b, 2c, 2d: Images and measurements of Case 1 by micro-CT

According to calculation by a/b x 100 acquired values as 0-24.9, 25-49.9, 50-74.9, 75-100; teeth were defined respectively as "cynodont (usual), hypotaurodont, mesotaurodont and hypertaurodont". Shifman and Chananel (1978) criteria were used for assessment.[9] The value of was calculated as 52,91 for the left mandibular primary molar and classified as mesotaurodont.

Case 2

A 13 years-old patient applied with a chief complaint of pain and tenderness to percussion in the right mandibular region. Radiographic examination revealed a periapical radiolucency and a root canal treatment for permanent mandibular right molar (Figure 3a, 3b).

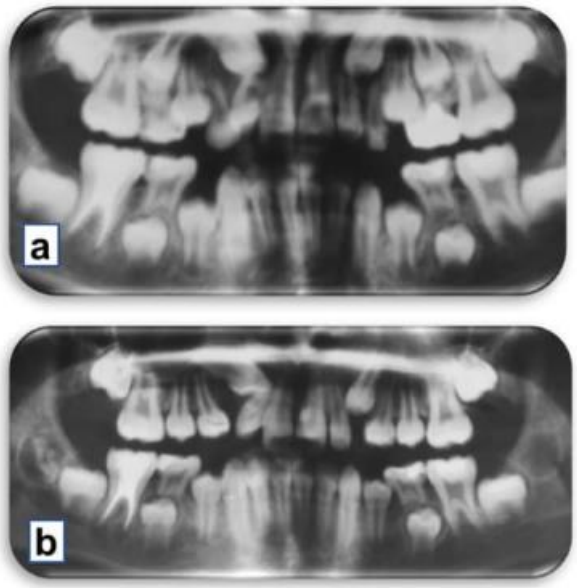

Figure 3a-3b: Panoramic radiographs of Case 2 taken 1 year interval.

Parent of the patient told that root canal treatment was a retreatment intervention which was done a year earlier. All permanent first molars and primary mandibular molars was also diagnosed as taurodont. Extraction of tooth was indicated after written informed consent was taken. Tooth were examined with a micro-CT and images were taken.

Despite of the length and the wall adaptation of the root canal treatment could be defined as satisfactory by radiographic observation and the coronal restoration was stated as adequate by visual inspection, an extra canal could be seen as obtained from the sectional images (Figure 4a, 4b, 4c).

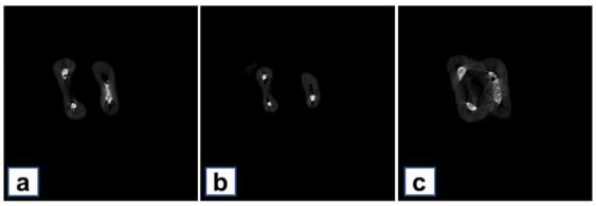

Figure 4a, 4b, 4c: Images of the sections that presents poor dentinal wall adaptation of root canal filling for Case 2.

Besides these, especially distal root canal of the tooth could be identified quite elliptical, combination of the gutta percha and the sealer located in the center of the canal space as circular and gaps were detected between the root canal walls and the filling material. Measurements and calculations could not be done because of the preparation and treatment processes. However, morphology of taurodontism could obviously be seen by radiographically.

DISCUSSION

For making a diagnose and a classification for taurodontism it was reported that certain and constant external attributes (crown, body and root) had to be assessed combined with internal variables.[15] It was reported that external points could be failed because prismatic roots with separate root canals could not be distinguished with the taurodont teeth which may have separate or adjacent root canals. Additionally, space of the pulp chamber which could be counted as internal variable may alter due to calcifications related to environmental changes such as age, caries and also root canals need to be assessed internally. Therefore, biometric measurements will be needed to be made from points that are not affected by environmental factors and that do not change in the developmental process.[2] Subgroups were also defined by studies which have been carried out with numerical values as a result of the biometrical measurements.[5,11,12] In Case 1, the Shifman and Chananel criteria were used for calculation method to define the subgroup and tooth was classified as mesotaurodont. It was not possible to make a measurement for Case 2 due to preparation and instrumentation process.

Pulp chamber took up a large volume especially for primary teeth even in normal morphology.[14,15] When cavity preparation is planned for any type of restoration, it is desirable

to prevent perforation. In situations where perforation occurs, it is important to locate the pulp chamber and canal orifices to make a better treatment planning. It has been reported that pulp chamber of a taurodont teeth is large compared to cynodont teeth therefore the possibility of perforation was increased.[10] In Case 1, the images supported the superficial and voluminous position of pulpal chamber.

Knowledge of internal root canal anatomy for taurodont teeth could be useful to make a plan including instrumentation techniques and restoration materials.[16,17] For Case 2, the presence of an extra root canal, the difference of the shape of canal anatomy and the failure of the retreatment process displays this necessity.

Diagnosis is usually done by routine radiographs observations.[8-10] It is known that 2D examinations done in the diagnosis stage occasionally may not be useful in the treatment stage. By using micro-CT methods which recently enables 3 dimensional evaluations, detailed sectional measurements and examinations can be made *in vitro*. In both of the cases presented in this case report, micro-CT enabled to make detailed measurements and to obtain data on sectional images. From this point of view, it is clearly seen that sectional examination methods which are applicable *in vivo* should be used by clinicians where clinical conditions are necessary.

CONCLUSIONS

Diagnosis of taurodontism helps diagnose pathological conditions such as systemic diseases and syndromes accompanying this anomaly, as well as facilitating clinical and operative clarification of diagnosis and treatment. Moreover because of its possible family trait this evaluation can be used for forensic purpose. Even though taurodontism can be diagnosed by 2D measurements on radiographic images, it is obvious that 3 dimensional examinations and volumetric measurements are necessary. Though micro-CT is considered as a method to help diagnosis and treatment with more detailed images in this sense, it is thought that 3D measurement methods should be developed for clinical application. It was seen that it should be supported by clinical trials.

ACKNOWLEDGEMENTS

None

CONFLICT OF INTEREST

The authors deny any conflicts of interest related to this study.

Taurodont Bir Süt ve Daimi Molar Dişin Mikro-CT ile İncelenmesi: Olgu Sunumu

ÖZ

Taurodontizm pulpa odası tabanının apikale doğru yer değiştirmiş olması ile karakterize morfolojik bir dental anomalidir. Bu olgu bildirisinde radyografik olarak taurodontizm tanısı konulan ve çekim endikasyonu olan süt 1.azı ve daimi 1.büyük azı dişinin pulpa odası ve kök kanallarının mikro-CT ile değerlendirilmesinin sunumu amaçlanmıştır. Olgu 1'de, radyografik muayenesinde fizyolojik kök rezorbsiyonu olduğu görülen sol alt süt birinci azı dişin çekimi uygun görülmüştür. Mikro-CT (Bruker, SkyScan 1174, Belgium) ile incelenen dişin a (pulpa odası tavanının en alt noktası ve tabanının en üst noktası arasındaki mesafe) ve b (pulpa odası tavanının en alt noktası ile apikal arasındaki mesafe) mesafeleri hesaplanmıştır. Olgu 1'deki dişte a/b x 100 formülüyle elde edilen 52,91 sayısal verisine göre süt azı dişi mesotaurodont olarak sınıflandırılmıştır. Olgu 2'de alt sağ daimi birinci büyük azı dişinde ağrı ve perküsyonda hassasiyet nedeniyle başvuran hastadan alınan radyografide geniş periapikal radyolusensi gözlendiği için dişin çekimi uygun görülmüş ve mikro-CT (Bruker, SkyScan 1174, Belgium) ile kök kanal morfolojisi incelenmiştir. Dişin kavite preperasyonu sonucunda a değeri kaybedildiği için hesaplama yapılamamıştır. Alınan radyografide kanal dolgusunun kök boyu itibariyle yeterli ve olması gereken uzunlukta olduğu belirlenmesine karşın mikro-CT'den elde edilen kesitsel görüntülerde ise kanal dolumu yapılmamış ekstra bir kanal boşluğu ve özellikle distal kanalın kesitinin oldukça eliptik olduğu tespit edilmiştir. 2 boyutlu radyografilerle taurodontizm tanısı konulabilmesine rağmen özellikle endodontik tedavi endikasyonu olan dişlerde kök kanal boşluğu morfolojilerinin 3 boyutlu olarak incelenmesi gerekliliği görülmektedir. Mikro-CT daha detaylı görüntüler sağlayan bir yöntem olarak görülmekle birlikte klinik kullanımda geçerliliği ve uygulama kolaylığı olacak şekilde geliştirilmesi ve klinik çalışmalarla desteklenmesi gerektiği

düşünülmektedir. ***Anahtar Kelimeler:*** *Taurodontizm, mikrobilgisayarlı tomografi, süt dişi, kalıcı diş.*

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