Prevalencia ovalnih kanala korena u apeksnoj i srednjoj trećini donjih molara i premolara

The prevalence of oval root canals in the apical and middle third of mandibular molars and premolars

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SUMMARY

Introduction. Oval root canals are predominant in all groups of human teeth.

In such canals it is a challenge to fulfill the necessary preconditions for a successful outcome of root canal therapy – complete cleaning, shaping, and obturation.

Aim. The aim of this study was to investigate the shape and diameter of root canals in the apical and middle third of human mandibular molars and premolars, to determine the prevalence and extent of long oval canals.

Materials and methods. The study was carried out on 80 extracted human teeth, 40 molars and 40 premolars. The teeth were placed in a specially designed muffle mould and embedded in transparent acrylic resin. After the polymerisation of the acrylic resin, the teeth were taken out of the mould and sectioned at levels 3 and 6 mm from the apex. The cross-sections were photographed under 30X magnification using a digital camera. The long and short canal diameter were measured on the images and their ratio calculated.

Results. In the apical third 32% of the premolars and 33% of the molars had oval root canal morphology. In the middle third 36% of premolars and 41% of molars.

Conclusion. Root canals of mandibular molars and premolars are often oval in their cross-section. They seem to be more frequent oval in their cross-section than previous studies have shown.

Keywords: root canal, dental anatomy
Brojni su faktori koji mogu uticati na kvalitet i ishod endodontskog lečenja zuba. Medju onima na koje terapeuti nema nikakvog uticaja je unutrašnja morfologija kanala korena zuba. Uobičajenim dijagnostičkim metodama, koji su na raspolaganju kliničaru, uglavnom se dobijaju ograničene informacije o obliku kanalnog sistema tretiranog zuba. Zbog toga su od ključne važnosti podaci o anatomijskoj pojedinačnosti zuba. 1.4 Poprečni preski kanala korena zuba često pokazuju varijacije koje se mogu pojednostavljeno prikazati u vidu približno okruglog, približno ovalnog i nepravilnog oblika kanala. Problemi u obradi, čišćenju i oblikovanju ovalnih kanala korena su dugi niz godina predmet brojnih istraživanja. 2.6

U više eksperimentalnih studija proveravan je kvalitet preparacije ovalnih kanala korena upravo na čim bu premoštanima i distalnim korenom u donjoj mole. Međutim, osnovni problem u endodontskom lečenju zuba je upravo nemogućnost tačne identifikacije oblika kanala korena. U nekim studijama se ovaj problem morfologija kanala praktično podrazumevala i verifikovana je samo inspekcijom otvora kanala.7 Za očekivati je da neki od ispitivanih zuba i nisu ispunjavali kriterijum ovajnosti u celoj svojoj dužini. Drugi autori su rendgenografijom zuba iz dva pravca određivali njegovu unutrašnju morfologiju i tako ih uključivali u studiju.8-9 Korrelacija između stepena izraženosti ovale morfol. kanala korena i efikasnosti preparacije nije zapažena ni u jednom ispitivanju. Ovakav stav se može smatrati mehanističkim pristupom bez punog uvažavanja specifičnosti anatomskih karakteristika. Wu i saradnici su 2000.g ispitivali prevalenciju i izraženost izduženih ovalnih kanala korena u svim grupama zuba.1 Oni u radu ukazuju na moguć značaj stepena izduženosti poprečnih preski kanala na kvalitet i mogućnosti preparacije i optereti kanala.

Numerous factors can influence the quality and outcome of endodontic therapy. Among those that cannot be controlled by the therapist is the inner morphology of the root canal system. Usual diagnostic methods provide only limited information about the shape of the treated root canal system. Therefore, previously established information regarding the anatomy of each group of teeth is of utmost value, including basic as well as much more detailed characteristics of root canals.1 4 There are many variations in shape of the root canal cross-section. They can be simplified as near round, near oval and irregular shape. Difficulties in shaping oval root canals have been noted in practice and are subject to scientific investigations for many years. 5, 6

Several experimental studies assessed the quality of preparation of oval root canals using lower premolars and distal roots of lower molars. In some of the studies the oval root canal morphology of these teeth was taken for granted and was verified only by inspection of the canal opening.7 It can be expected that some of the root canals did not meet the criteria to be assessed as oval, at least not in all their length. Other authors used two directional radiographic images to assess inner canal morphology and decide which teeth to include in the experiment.8-9 Correlation between the extent of oval shape and efficiency of the preparation was not given in any investigation. Wu et al. (2000) investigated the prevalence and extent of long oval canals in all groups of teeth.3 In the same paper they pointed out that there was a possible correlation between the extent of the oval root canal shape and the chance for complete preparation and obturation.

**Material and Method**

Eighty extracted adult human teeth, which had been stored in 5% formalin solution, were randomly selected for this investigation. The teeth with present external or detectable internal root resorptions were excluded from the experiment. Root canal morphology was evaluated using a modification of the Brannstrom technique. The extracted teeth were mounted in a specially designed muffle mould and embedded in transparent acrylic resin.
Kalup se sastoji od baze i četiri strane koje se šrafiraju pričvršćuju na bazu čineći na taj način kocku koja je s jedne strane otvorena. Na stranicama kalupa osemitim unutrašnjosti kocke su na istim nivouima urezani zlebovi širine 1mm.

Po vezivanju akrilata zubi su sećeni na dva nivoa, na tri i šesti milimetar od vrha korena pod pravim uglom u odnosu na uzdužnu osnovu korena mikrotomom Leica SP1600 (Leica microsystems GmbH, Wetzlar, Germany). Svaki od poprečnih preseka fotografisan je digitalnim fotogramom (Olympus B-500, Olympus corporation, Tokyo, Japan) uz pomoć mikroskopa na uveličanju od 30x. Na fotografijama je vršeno procenjivanje oblika poprečnog preseka korenskog kanala i određivanje njegovih prečnika. Na fotografijama donjih molara vršena je analiza samo distalnog korena. Određivana je linija najdužeg dugog prečnika kanala (P1) i najdužeg kraćeg prečnika (P2) koje su bile uopšte jedna drugu. Linije su određene usaglašavanjem dva ispitivača. Dužine linija prečnika merene su na digitalnim fotografijama u pikselima i izračunat je njihov odnos. Odnos dužeg prečnika kanala korena P1 (koji se obično proteže u vestibulo-oralnom pravcu) i kraćeg prečnika P2 (koji se obično pruža u mesiodistalnom pravcu), je određivao indeks ovalnosti kanala P1/P2=IO. Ta numerička vrednost pokazuje do koje mere je poprečni presek kanala ovalni ili splošten oblika.

The mould consisted of a base plate and four sides which are screwed on to the base plate thus forming a cube open on one side. Sides of the mould had 1mm deep grooves facing the inner side of the cube. After the setting of the resin, teeth were sectioned at levels 3 and 6mm from the apex at a straight angle on the root axis using Leica SP1600 microtome saw (Leica microsystems GmbH, Wetzlar, Germany). Each cross-section was photographed using a digital camera (Olympus B-500, Olympus corporation, Tokyo, Japan) and a microscope under 30X magnification. Evaluation of the shape of root canal cross-sections was done on the photographs as well as the measurement of the root canal diameters. On the photographs of the lower molars only the distal root was analysed. The lines of the longest long canal diameter (P1) and the longest short canal diameter (P2), at right angles at each other, were determined and agreed on by two investigators. Length of the diameter lines was measured on the digital photographs in pixels and their ratio was calculated. The ratio between the length of the longer root canal diameter (P1, usually in the vestibulo-oral projection), and the shortest root canal diameter (usually in the mesio-distal projection), gave the IO index. That number indicated the extent to which the canal was oval or flattened.
Rezultati

Na 36% premolara je u srednjoj trećini korena identificirana ovalna morfologija kanala. Od toga je u pet slučajeva, ili 12.5%, bio prisutan izražen ovalni izgled kanala. U dva slučaja splošten oblik sa IO 4. U apskenoj trećini ovalna morfologija imalo je 22% premolara od čega je u 3 slučaja bilo sa izraženijim IO indeksom od 3-4.

Kod 41% molara je bila prisutna ovalna morfologija kanala korena u srednjoj trećini. U šest slučajeva donjih molara (15%) morfologija je bila izražena ovalna, a dva kanala su kvalifikovani kao splošten oblik. U apskenoj trećini 35% molara je bilo ovalnog oblika, tri sa IO 3-4, a nijedan nije bio sploštenog oblika.

The canal was identified as oval if IO$\geq$2, i.e. the longer root canal diameter was at least two times longer than the short. The canals with IO$\geq$4 were qualified as extremely oval or flattened. According to the IO values at sectioned levels the teeth were grouped as to the extent of their flatness.

Results

36% of premolars had oval cross-sections in the middle third of the root. In five cases, or 12.5%, the canals were more oval, two of which were flattened with IO$\geq$4. In the apical third, 22% of the premolars had oval morphology, with only 3 cases of pronounced oval morphology with IO 3-4. 41% of the molars had oval morphology in the middle third. In six cases, or 15%, their shape was more oval and two canals were qualified as flattened. In the apical third, 35% of the molars had oval shape of their root canals, three with IO 3-4 and none flattened.

Graph 1. Prevalence of oval root canals in the apical third in premolars.

Graph 2. Prevalence of oval root canals in the middle third in premolars.
Diskusija

When choosing the model for this experiment we opted for our own modification of the Bramante model. Such model was used many times over the years by various authors and became a sort of a standard due to its reliability and simplicity. Besides, that model gives us the opportunity to pursue further investigations on the same platform. The elimination of teeth with present external or internal root resorptions reflects the fact that natural inner and outer anatomy of the teeth has been changed by the pathological process. Since the teeth used in the experiment were already extracted due to various otherwise untreated conditions, the number of such teeth was relatively high, four altogether.

Groups of teeth chosen for this investigation were, along with lower incisors, most commonly used in previous studies investigating the quality of preparation and disinfection of oval root canals. Even so there are no studies that would investigate the morphology of these teeth on larger scale and define the percentage and extent of flattened root canals. Wu et al. investigated the cross-sections of the apical 5mm of root canals in all teeth.
nu morphology in 25% of the cases on the distal canals of lower molars and observed that the percentage practically did not change as the canal approached the apex. In premolars, such morphology was identified in 27% of teeth and decreased to 13% 1 mm from the apex. The same authors noticed significant morphological differences between moderate oval canals with IO 2-4 and extremely oval with IO≥4, which they called flattened. Such canals were identified in lower incisors, mesial roots of lower molars, upper premolars and mesial roots of upper molars. In the present study, we found flattened canal shape in the middle third of premolars and molars in 5% of teeth which may indicate greater prevalence of that shape. Flattened root canals with their long recesses present a great challenge for complete instrumentation, elimination of the organic debris and obturation. Bearing in mind that such canals are often narrow and curved, the problem of their preparation becomes even more complex.

Contemporary rotary Ni-Ti techniques have proven to be inefficient in preparing the entire circumference of the canals and opening up the narrow recesses. The explanation was sought in the superelasticity of the material that did not allow the controlled pressure to be applied on canal walls and exclusively rotating instrument motion. On the other hand, stainless steel endodontic instruments used in the lifting motion along the vestibulo-oral recesses did not prove to be efficient either. Extreme enlargement of the apical third of the root bares the risk of perforating the canal walls and destroying the apical constriction, and still does not yield significantly better results.

Most authors agree that the emphasis in endodontic treatment of teeth with flattened root canal morphology should be on the irrigation. Irrigating solution should enhance dissolving of the organic debris and its evacuation, contributing to the disinfection of the canal and possibility of hemetric obturation. All the authors agree that the irrigant of choice is sodium hypochlorite. Increase in its concentration, temperature and volume used is recommended. As the ultimate method, there is ultrasonic irrigation whether the preparation had been performed with ultrasonic techniques or not.

**Conclusion**

Root canals of lower premolars and distal roots of lower molars are often oval in cross-section. Extremely oval, flattened morphology was not detected in the apical third of the analyzed root canals. Relatively frequent presence of such morphological shape of root canals in lower molars and premolars is an important finding that can influence the choice of cleaning and shaping technique.
Literatura / References


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