

Bibliographical Update Work:



Ethnic Variations in the topography of the root canals

Maria Eugenia Tinelli

✉: eurato3@hotmail.com

Gabriel Ferreira

Natanael Gomez

Karim Llahyah

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Specialization in Endodontic Career (8^o Cohort from 2007 to 2011)
Facultad de Odontología – FOR –
Universidad Nacional de Rosario – UNR –

It is impossible to think of the roots canals morphology without regard to the topographic anatomy of the dental piece, so before beginning any Endodontic Treatment, an Endodontist should be aware of both of them. A preoperative radiograph of the tooth to be treated is considered to be decisive.

It is demonstrated that from the first works up to the most recent studies the root with a unique, conical canal and only one foramen constitutes the exception more than the rule. The researchers have found multiple foramina, additional canals, deltas, connections between canals, C shaped canal, lateral canals, etc. (Gulabivala 2001)

Both sex and ethnicity play an important role in the morphological determination of the canal system. In comparison with white race patients, blacks race ones have a higher number of supernumerary canals in both the first inferior premolar and the second inferior premolar. (Coelho de Carvalho, 2000)

An investigation on Turkish patients which used more than 1000 teeth, described similar morphological results, with the following exceptions: in the 23% of the upper lateral incisors one canal was found, in the 55% of mesiobuccal roots of the second upper molars, and in the 30% of distal roots of second upper molars. (Sert S, 2004)

Another group of authors studied 100 lower front teeth and found 2 new groups of root canals:

- Two separate canals extending from the pulp chamber to the middle portion of the root, where the lingual canal was divided in two, the three canals join together in the apical third to emerge as one.
- A canal that comes out of the pulp chamber was divided in two in the middle third to get joined again to form a canal and then be divided again to come out as three separate canals with different foramina. (Baratto-Filho, 2002)

Another study observed variations in lower molars of **Burmese people** (Southeast Asia) with seven additional root canal configurations:

- Union of three canals in one or two.
- Division two canals in three.
- Joining of two canals to then separate again in two and end up in only one.
- Union of four canals to form two.
- Extension of four canals from the camera to the apex.
- Five tubes that are joined to form four at the apex. (Cohen, Hearnreaves, 2008)

Like the number of root canals, the number of roots may also vary. The **radix entomolaris** is a supernumerary macrostructure located distolingually in the lower molars, mainly first molars, occurring less frequently in second molars. It is located on the lingual as an appendix to the lingual of the molar structure. (Baldasari-Cruz LA, 2002)

When this structure is presented in the mesial root called **radix paramolaris**. This macrostructure is very rare and occurs less frequently than the RE. The prevalence of RP was found to be 0% for the first maxillary molar, 0.5% for the second and 2% for the third molars.

The **RE** has a conical shape and curve like hook path, with a curvature that is directed in a buccolingual direction. In a cross section the canal shape is oval with a circular tendency. These macrostructures are never presented together at the same time. The presence is low and is associated with certain ethnic groups. In African populations a maximum frequency of 3% is found, while in Eurasian and Indian populations the frequency is less than 5%. In populations with Mongoloid traits (such as the Chinese, Eskimo and American Indians) reports have noted that the RE occurs with a frequency that ranges from 5% to more than 30%. Because of its high frequency in these populations, the RE is considered to be a normal morphological variant (eumorphic root morphology). (G. Chen, H Yao, 2009)

In Caucasians (white race) the RE is not very common and, with a maximum frequency of 3.4 to 4.2% (21, 22), is considered to be an unusual or dysmorphic root morphology.

The etiology behind the formation of the RE is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to penetrance of an atavistic gene or polygenetic system (atavism is the reappearance of a trait after several generations of absence).

In eumorphic roots, racial genetic factors results in a phenotypic manifestation. In general, the RE is smaller than the distobuccal and mesial roots and can be separate from, or partially fused with, the other roots. (Calberson Filip L., 2007)

A classification by Carlsen and Alexandersen describes four different types of RE according to the location of the cervical part of the RE: types A, B, C and AC.

- Type A, B: refer to a distally located cervical part of the Radix Entomolaris with two normal and one normal distal root components, respectively.
- Type C: refers to a mesially located cervical part.
- Type AC: refers to a central location, between the distal and mesial root components. (Gulabivala K, Opananon A, 2002)

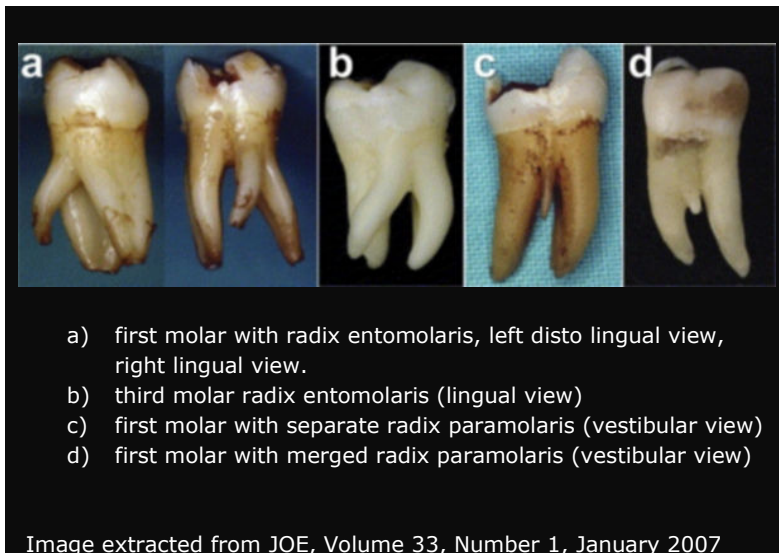
In the Radix Entomolaris root three types of curvatures can be identified:

- Type I: refers to a straight root canal.
- Type II: refers to an initially curved entrance which continues as a straight root canal to the apex.
- Type III: refers to an initial curve in the coronal third of the root canal and a second curve beginning in the middle and continuing to the apical third. (Ghoddusi J, Naghavi N, 2007)

The **RP** has mesiobuccal location and 2 types can be described:

- Type A: where the inlet is mesially located.
- Type B: the inlet is centralized between the mesial and distal root. (Chen SC, Chueh LH, 2007)

An increase in the number of cusps of the tooth does not report an increase in the number of roots, however, an additional root is always associated with an increase in the number of cusps and the increase of an additional canals. (Tu MG, Tsai CC, 2007).



C shaped canals are another anatomical variations that can appear in certain teeth occurring in the 35% of cases, mostly, in the lower second molars of Asian populations but it has also been reported in low erfirst molars, premolars and upper molars.

The C-shaped canals root is considered an anomaly which has a certain anatomical complexity because when the

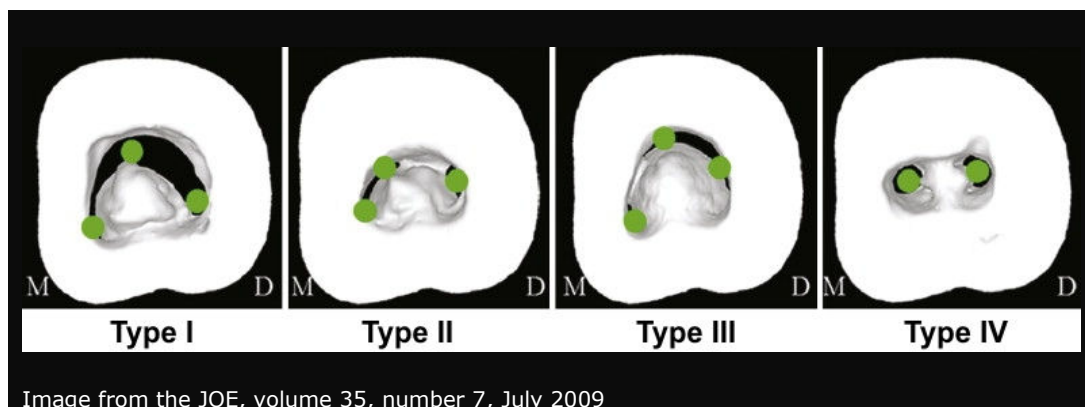
preoperative radiograph is analyzed; it revealed that this molar is similar to a normal molar. However, when performing the access cavity preparation and it is examined from the occlusal surface the different canals can not be differentiated, a C-shaped depression in the floor of the pulp chamber can only be observed. (Fan B, Gao Y, 2008)

Cameral Anatomy of a C shaped canal corresponded to the root morphology of the same. Canals can be independent, fused, with an own foramen or with an attached to the main canal one. (DeMoor RJG, 2002)

It has been studied that the morphology of the teeth changes over the years. With age, the deposition of secondary dentin results in the formation of structures that will, surely origin the differentiation of the root canal system resulting in the development of separate or cross-linked canals.

The differentiation of a simple canal into a complex one usually occurs in roots that are compressed or presented external furrows development. Another setting in C shaped molars root canals can be represented by the buccal or lingual fusion of the root in the mesial or distal areas.

It is important to avoid an over-instrumentation of these canals as there is a minimal amount of dentin between the outer surface of the root and the canal system in these teeth. In histological studies it was observed less than 1 mm of dentine separating the canal from the outer surface of the root. (Bing Fan, Yi Min, 2009)



There are 4 types taking into account the pulp chamber floor:

- **Type I:** a horn-like as a floor with a C-shaped continuum hole.
- **Type II:** a mesial and buccal canal separated from the distal dentin by a strip-shaped groove dentin that emerges from the chamber floor to join the vestibular wall. The distal duct can be round, oval or flat.
- **Type III:** a mesiolingual canal separate from the vestibular and distal by a strip-shaped groove dentin that emerges from the chamber floor to join the mesial wall. The mesiolingual canal can be round, oval or flat. The type II and III belong to the so-called semicolon shaped canals.
- **Type IV:** It is a variant that present no C form. A distal canal and a mesial oval canal or two round mesial canals may be present.

Type II is the one that most frequently occurs, followed by type III, type I and finally, by type IV. (Fan W, Fan B, 2007)

Además otra variante que pueden presentar los molares en general, tanto superiores como inferiores es la presencia de istmos.

Another variant that molars in general, both upper and lower, may present, is the presence of isthmus.

An **isthmus** is defined as a string or narrow ribbon of communication between two root canals that contains pulp tissue or necrotic. This must be well removed to prevent Endodontic failure because the buccolingual or palate orientation of this isthmus is not seen in X-rays.

This variant tends to occur frequently in maxillary first molars of China's population, which is why a study was conducted in which molars from this population were collected and divided into 3 groups according to age:

- ⇒ Group A: 20 to 39 years old.
- ⇒ Group B: from 40 to 59 years old.
- ⇒ Group C: over 60 years old. (Von Arx T, 2005)

The micro-computed tomography was the method used for this study as the isolation of the dental piece makes the formation of a type of smear layer which obliterated the isthmus making them difficult to analyze.

Because the internal anatomy of the canals is modified by the age because dentin deposition, it was found that group A had a 50% of isthmus, 41% group B and group C 24 %. (Manocci F, Peru M, 2005)

Previous studies have shown the presence of isthmus especially in mesial apical roots of first molars from 3 to 6 apical mm.

An isthmus can be complete or partial:

- ⇒ **Complete:** there is continuity of communication between two passages through the isthmus.
- ⇒ **Partial:** narrow passageway projection to another, but without fusion.

The main morphological characteristic of a isthmus is the presence of a fin or burr, while others have web structure or a simple string. (Texeira FB, 2003)

Conclusions

Nothing in life is random; there are predetermined things for every human being as well as the pathognomonic characteristics of each ethnic race. Man does not only experience emotional changes, but physical. Each individual is unique and unrepeatably the same as every Endodontic that is made. It is important to know these anatomical and topographical variations of the canals in order to enjoy these daily challenges we face in life.

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