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## Proposal for a simple and effective diagrammatic representation of root canal configuration for better communication amongst oral radiologists and clinicians



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Craniofacial Research

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#### ARTICLE INFO

Article history: Received 8 July 2015 Accepted 21 September 2015 Available online 16 October 2015

Madhya Pradesh 452001, India

Keywords: Classification Communication Root canal Cone-Beam Computed Tomography Three-dimensional imaging

#### ABSTRACT

*Objectives*: Root canal anatomy has been proved to be a complex canal configuration system. The negotiation and cleaning of this system is essential for successful root canal treatment. The present root canal classification systems are unable to transfer the clinically relevant information about the canal system from the oral radiologist to the treating clinician. Thus, a simple and effective diagrammatic representation of the canal system, depicting the major canals, important changes during their course along with other relevant information has been presented.

*Methods*: The proposed representation consists of five horizontal lines dividing the tooth into four segments from the point of reference to apical foramen. Each line has been designated with different line style. The diagrammatic images, one anterior and one posterior multi-rooted tooth, are given for easy understanding of the orientation of image. The whole image can be saved in portable network graphics format and can be imported to any word processing document. The image can be printed in the reporting sheet.

*Result*: Applying the same proposal, some of the diagrammatic representations have been showed.

*Conclusion:* This proposal for diagrammatic representation of root canal configuration can be helpful in getting an approximate distribution of the canals in a relatively simple manner. This scheme also provides valuable clinical information about the root canal system, which the other classifications fail to represent.

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#### 1. Introduction

Knowledge of the root canal anatomy plays an important part for the successful treatment of the tooth and the patient as whole. The presence of an untreated missed main canal, lateral canal or even an isthmus may be a reason for failure. It is extremely important for the clinician to treat the entire root canal system. A number of classifications have been given by various authors<sup>1–3</sup> to represent the root canal system. Amongst these, Weine's Root canal classification is one of the easiest and simplest one, which classifies the root canal system of a root into four types: Type 1 – one canal from pulp chamber to apex; Type 2 – two canals from pulp chamber but merging short of apex; Type 3 – two canals from pulp chamber to apex; and Type 4 – one canal from pulp chamber but dividing into two before apex.

Refinements in tooth clearing procedures have led to better understanding of root canal anatomy. Further with the availability of newer techniques like micro-Computed Tomography and Cone-Beam Computed Tomography (CBCT), an accurate and rapid representation of root canal anatomy of the concerned tooth is possible. These advanced diagnostic techniques are able to recognize various variations as isthmuses, second mesiobuccal in maxillary molars,<sup>4,5</sup> middle mesial in mandibular molars,<sup>6,7</sup> etc. in the root canal morphology which were earlier concealed due to the limitations of our radiographic techniques. Although three-dimensional imaging represents advancement in the field of root canal treatment, it is still not favored as a routine first line imaging modality due to its radiation concerns, and its use is limited to cases suspected of having complex canal systems, or endodontic failures and mishaps.

The currently available classifications of the root canals are not able to depict the complexities of the canal system, which is essential during treatment. Although classifications<sup>8,9</sup> have been proposed to accommodate the various intricacies of the canal morphology, these are difficult to remember and are with limited practical application.

Even when we are able to classify the imagined root canal system, transfer of required information to the treating clinician is limited and one is not able to communicate the approximate location of the changes using the present classification systems. Additionally, these classifications fail to represent the level or position of division or fusion of the canals. The facts gained by the radiologist during imaging should be reported in a manner keeping in mind that the ultimate usage of that information is documentation of the findings and treatment of the patient. This also emphasizes the importance of proper communication between radiologist and treating clinician. Knowing the root canal anatomy beforehand in turn will save the patient's chair side time and add to the clinician's confidence level resulting in improved quality of treatment.

Thus, there is a need for a representation, which reflects the major canals, isthmuses, and connections; and is simple to understand, draw, and communicate, to allow better communication between radiologist and treating clinician. This clinically oriented diagrammatic representation of the root canal anatomy presents the configuration of the root canal system in a simple comprehensible manner. Aim and objectives of a simple diagrammatic root canal representation are as follows:

- 1. Should be simple to understand, draw, and communicate.
- 2. Represent the number of the canals.
- 3. Depict the location of the canals.
- 4. Represent the length of the canals.
- Show the presence and location of the isthmuses and other ramifications.
- 6. Show confluences and bifurcations of the canals.
- 7. Able to include all the major root canal classification systems.
- 8. Able to represent most of the canal configuration.

#### 2. Materials and method

The proposed representation (Fig. 1) consists of five horizontal lines, which divide the tooth into four segments. Coronoapically, the first line, which is a dashed line and has "Ref." written at one end, signifies the point of reference from where the length of root canal is measured. The second one, a solid line marked as "Orf." at one end, depicts the orifice level or cemento-enamel junction (in case of single canal and taurodont teeth). The lowermost line, which is a solid one, represents the apical foramen of the root canal. The third and fourth lines (dotted lines) are the ones which divide the root canal into coronal, middle, and apical thirds; these regions are designated as C, M, and A, respectively. The diagrammatic images of teeth (one anterior/posterior single rooted and one posterior multi-rooted) are given for easy understanding of the orientation of image. The whole image has a transparent background and is saved in portable network graphics (PNG) format. The image can be rotated by 180° to correspond to either mandibular or maxillary teeth. It can be imported to any word processing document and a print of the image can be obtained in the reporting sheet.

## 2.1. Rules for drawing diagrammatic root canals representations

Freehand vertical lines should be drawn from top dashed line to the bottom solid line to represent the major root canals present in the tooth.

The lines representing the respective canals should be labeled at the start of the vertical lines.

The length of the individual canal from the point of reference to the apical foramen can be written (in millimeters), depending on the situation, either adjacent to the origin of its



Fig. 1 - The proposed diagrammatic representation image.

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