Editorial

Root canal morphology and effects on root canal preparation

The preparation of the root canal system is the most important phase of endodontic treatment, and undesirable tissue reactions are observed when instrumentation is not limited to the canal system.[1] There is no consistent agreement as to the endpoint of canal instrumentation defining the working length. Most studies suggest that chemo-mechanical instrumentation should end at the apical constriction (AC) located at 0.5–1.5 mm from the major apical foramen.[2,3] Anatomically, the AC is located either in dentin or at the cementodentinal junction (CDJ) level and less frequently in the cementum.[4]

An adequate knowledge of root canal morphology is a key requirement for successful root canal treatment. Numerous anatomical characteristics, such as the number of canals, cross section, root canal curvatures, shape, and position of apical foramina, should be investigated by the clinician to avoid unpredicted events during root canal preparation.[2] A wide range of anatomic and morphological variations can be encountered in the root canal systems. Conventional and digital periapical radiographs are commonly used methods to evaluate root canal morphology. They provide more accurate information if they are taken in both buccolingual and mesiodistal directions. The dental operating microscope represents an additional tool for evaluating canal anatomy.[2]

Several classifications of root canal morphology are available.[2,3,5] The most commonly used classification is that of Vertucci,[5] which divides the root canal systems into eight categories according to the number of canals and their different types, the ramifications of the main root canals, the location of apical foramina and transverse anastomoses, and the frequency of apical deltas. Highly variable anatomy is frequently observed in molars. The first and second maxillary molars have been reported to have three roots in 97.2% and 79%, respectively, and 6% have four roots.[6] Palatal and distobuccal roots contain one root canal in 100% of the cases (Vertucci's Type 1 configuration). The mesiobuccal root has one (29.4%; Type 1) or two canals (70.6%; Types 2, 3, or 4).[5] In the mandibular molars, the frequency of two roots is 94% in the first molars and 83% in the second molars. The mesial root shows a greater variability with most commonly two canals.[6]

The root canal begins as a funnel-shaped canal, with the orifices generally present at or slightly apical to the cervical line, and ends at the apical foramen, which opens at the root surface between 0 and 3 mm from the center of the root apex.[2] The position of the major apical foramen on the root tip is highly variable. Nearly, all root canals are curved particularly in a buccolingual direction.[2] Angled views are necessary to determine the presence, direction, and severity of these curvatures which may not be evident on buccolingual radiographs.[2]

Root canal anatomy is susceptible to changes over the years due to the deposition of secondary dentine which starts to form once the tooth erupts and is in occlusion.[7] In addition, the anatomy of molars appears to be genetically determined by ethnic differences, origins, age, and gender.[6] Young patients tend to have large single canals and pulp chambers while older patients tend to have narrower root canals.[7] A root canal has two main sections, a longer conical section in the coronal region consisting of dentine and a shorter funnel-shaped section consisting of cementum located in the apical portion.[4] The shape of this apical portion is considered to be an inverted cone with its base located at the major apical foramen. The tip of the inverted cone is the minor foramen that is often thought to coincide with the AC regarded as being at or near the CDJ.[8] In other words, the most apical portion of the root canal system narrows from the opening of the major foramen, which is within cementum, to a constriction (minor foramen) before widening out in the main canal to produce an hourglass shape.[9] The AC is in theory the narrowest part of the canal where the pulp ends and where the periodontium begins.

The anatomical apex differs from the radiographic apex in that the first is identified morphologically as being the end of the root while the other is identified radiographically and does not always coincide with the anatomical apex of the tooth.[9]

Salwa Yammine
Department of Restorative/Esthetic Dentistry and Endodontics, Faculty of Dental Medicine, Lebanese University, Campus Rafic Hariri, Hadath, Beirut, Lebanon.
E-mail: salwa.yammine@hotmail.com; syammine@ul.edu.lb

Submitted: 27-Feb-2022, **Accepted in Revised Form:** 26-Mar-2022, **Published:** 27-Jun-2022

REFERENCES

1. Dhingra A, Kochar R, Banerjee S, Srivastava P. Comparative evaluation of the canal curvature modifications after instrumentation with One Shape rotary and Wave One reciprocating files. J Conserv Dent 2014;17:138-41.
2. Vertucci FJ. Root canal morphology and its relationship to endodontic procedures. Endod Topics 2005;10:3-29.
3. Ahmed HM, Versiani MA, De-Deus G, Dummer PM. A new system for classifying root and root canal morphology. Int Endod J 2017;50:761-70.
4. Kuttler Y. Microscopic investigation of root apexes. J Am Dent Assoc 1955;50:544-52.
5. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol 1984;58:589-99.
6. Pérez-Heredia M, Ferrer-Luque CM, Bravo M, Castelo-Baz P, Ruíz-Piñón M, Baca P. Cone-beam computed tomographic study of root anatomy and canal configuration of molars in a spanish population. J Endod 2017;43:1511-6.
7. Martins JN, Ordinola-Zapata R, Marques D, Francisco H, Caramês J. Differences in root canal system configuration in human permanent teeth within different age groups. Int Endod J 2018;51:931-41.
8. Kuttler Y. A precision and biologic root canal filling technic. J Am Dent Assoc 1958;56:38-50.
9. Nekoofar MH, Ghandi MM, Hayes SJ, Dummer PM. The fundamental operating principles of electronic root canal length measurement devices. Int Endod J 2006;39:595-609.

Access this article online	
Website: www.sidj.org	**Quick Response Code**
DOI: 10.4103/sidj.sidj_5_22	

How to cite this article: Yammine S. Root canal morphology and effects on root canal preparation. Saint Int Dent J 2022;6:2-3.