Foraminal debridement: reflections and insight

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ABSTRACT

One of the procedures employed for canal treatment during endodontic therapy, be it performed by manual technique or with rotary instruments, is the foraminal debridement, in which the first tool is used beyond the foraminal opening (0.5 to 1 mm). Some reflections on the clinical implications of these procedures include the real dimension of periodontal ligament thickness and its inflammatory and connective tissue reactive characteristics. These reflections and an insight for future studies are presented here.

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The foraminal patency concept is based on the insertion of an endodontic instrument with small diameter (not greater than #25) in the apical foramen. For some authors, the patency instrument should surpass, on average, 1 mm of the foraminal opening, being in intimate relation with the periodontal ligament.[1,4,5] However, for a sterile instrument with small diameter, this fact does not cause any clinical problems.[5] This protocol leads to some reflections on the clinical implications of these procedures:

1. The periodontal ligament will be completely surpassed by the instrument, given that its thickness varies from 0.2 to 0.4 mm, 0.25 mm on average. "Completely" means that the instrument will surpass the most apical limit of the cementum and will reach the bundle bone beyond the cortical alveolar bone, also known as lamina dura.

2. As it is a highly organized fibrous connective tissue of which half consists of blood vessels, the onset of an acute, inflammatory process, with the concentration of substances (exudate) and cells (infiltrate), especially, neutrophils,[2] is inevitable. In two or three days, if the cells and the substances do not meet a significant amount of bacteria, they will migrate and be reabsorbed, preventing the serous exudate from becoming purulent.[2] This can be named as chronic apical serous pericementitis (periodontitis) physically induced by endodontic instruments and which will develop into repair, once its cause will be removed by canal obturation.

3. If the tooth under treatment is with pulp necrosis and the root canal is contaminated, but with no periapical lesion, a significant increase in the possibility of periodontal ligament contamination is expected, thus, requiring greater need for care.

4. Should the tooth present chronic periodontal lesion — including chronic apical pericementitis, periapical granuloma, root cyst and chronic dentoalveolar abscess — surpassing the instruments beyond 1 mm will not cause damage to the periodontal ligament, since an inflammatory process has started in this region and the ligament structure has been almost completely lost.

But there will be greater risks of causing the process to become more severe by accidentally "pushing" isolated or clustered bacteria to apical tissues previously contaminated, in cases of chronic periapical lesion.[3] Great care should be taken in this sense.

5. If the objective of surpassing these limits is to standardize the cemental canal walls and put them in continuity with the main canal walls, in cases of biopulpotomy, there would be no need for instrumentation beyond the apical foramen, given that the cemental walls are neither contaminated nor reabsorbed.

6. In spite of the fact that pain threshold and discomfort varies from patient to patient, there will inevitably be an initial acute inflammatory process for two or three days in the protocols in which the instrument surpasses the apical foramen limits and passes through the apical periodontal ligament. This may bring discomfort characterized by spontaneous or painful sensibility to mastication. The professional must be prepared to administer analgesic and anti-inflammatory drugs during this period, should the patient complain. Moreover, the professional may even assume that, for better comfort of the patient, he will administer these drugs in all cases in which this protocol is employed.

7. In cases in which inflammatory symptoms persist, the possibility of greater bacterial presence, taken or pushed by the instruments to the apical region, must be considered. The process may develop into abscessation. In cases of greater sensibility, the possibility of an antibiotic therapy must be considered in order to avoid bacterial proliferation in the apical tissues, aborting any possible abscessation focus.

8. If we consider that the inflammation induced in the apical region is inevitable when the instrumentation is adopted beyond the apical foramen, the possibility of having bacteria in the periapical tissues, "taken or pushed" by the instruments to the apical periodontal ligament, increases. Thus, the preventive administration of medication right after endodontic treatment of special patients, such as cardiac, renal and immuno-compromised patients, should be emphasized.

9. Even if the filling material is expected to greatly adapt itself to the walls of the instrumented canal with this protocol, it must be emphasized that there will be no hermetic closure and perfect adaptation in the material-canal interface at the enlarged apical foramen, due to the irregularity of its anatomy (Fig 1) and uniformity of its walls, in terms of space and surface.

10. Inflammation represents a very efficient mechanism of local defense that is able to easily eliminate isolated bacteria. In the first two or three days, the neutrophils, arriving 90 minutes after the physical aggression, phagocyte the bacteria and even though they release enzymes and anti-bacterial substances that are toxic to the tissues, they prevent abscessation or microabscesses

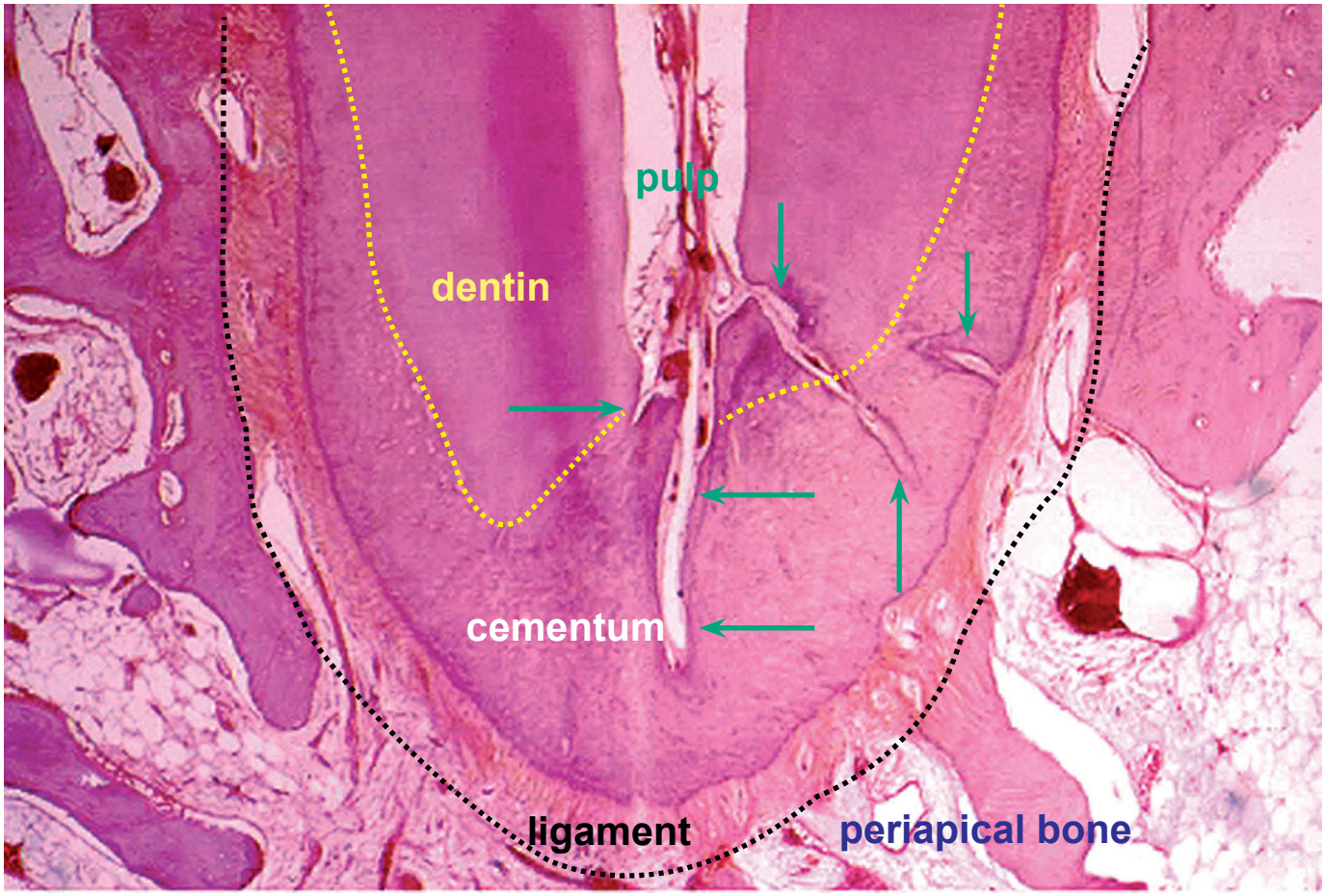

Figure 1. Microscopic morphological aspects of human dental apex and periapical region, emphasizing proportionality between the parts and irregularity of the region, especially the apical delta (arrows) (H.E. Magnification = 10X).

from being formed due to the low number of bacteria. Abscessation and exuberant pus formation occur when there is a great number of bacteria and/or when they are organized in microbial biofilms, the moment in which they assume greater resistance caused by the lack of access of cells, substances of defense, antiseptics and antibiotics.[2]

11. Despite regularizing and cleaning the cemental canal wall, instrumentation beyond the apical foramen does not eliminate the microbial biofilm adhered to the external apex surface, let alone the ones located in the anatomical irregularities, in the apical deltas and/or apical resorption areas.[3] This situation explains the persistence of a small, but significant percentage of endodontic failures when teeth with chronic periapical lesions are treated.

12. The last stage of an inflammation or repair is characterized by the reconstruction of unorganized and destroyed areas only after the local aggressor has been eliminated. The vessels and adjacent periodontal ligament cells proliferate and colonize the area, forming an immature tissue known as granulation tissue which gradually matures into connective tissue, structurally and functionally. The apical structures, such as the cement and ligament, are reestablished, and their bone limits are reinstalled from the granulation tissue, promoting complete periapical bone repair.

13. The concept of infection refers to the contact of microorganisms (bacteria, viruses and fungi) with another living organism. An infection may be characterized by: a) the latency of microorganisms without causing any aggression, or even, b) the induction of aggression and tissue reactions that characterize the diseases. Despite being technically and technologically developed, the endodontic techniques cannot ensure that all microorganisms are eliminated from the apical region after canal obturation. However, a significant reduction in the amount of microorganisms is mandatory, since it will imply in an inflammatory reaction that will eliminate and/or control this apical infection/contamination, without any clinical discomfort to the patient.

Final considerations and insight

The endodontic clinic, including the Imaging sciences, offers several parameters to establish successful and unsuccessful criteria for performed treatments. These criteria must be applied to research carried out with human beings. Researches carried out with humans are directly extrapolative and way more reliable, if the ethical principles are respected and the specificities of each species are considered.

Researches on new treatment protocols that exceed the apical limits to an extent not greater than 1 mm should assess cases in light of the following criteria: Pain and discomfort (type, intensity and duration), painful occlusion (type, intensity and duration), need for therapy with analgesic, anti-inflammatory and antibiotic drugs (time, type, costs and efficiency).

At the same time, these results should be compared by means of the same parameters used in similar cases, but using more classic protocols of endodontic therapy, in which the apical limits of work were restricted to the main and cemental canals, only.

Likewise, in the same cases, but in distinct subgroups, the previous images of the apical region, with and without chronic periapical lesions, could be studied and compared with the progress of apical and periapical repair. Digital, radiographic and tomographic images currently offer high accuracy in analysis.

The following parameters are among those that could be compared and assessed: the limits of obturation, material overflow, apical periodontal space width, lamina dura continuity, reparative bone new formation, apical resorption and structural impairment degree, in addition to the frequency of instrument fracture. The new technologies for analysis have developed significantly and, now, allow the assessment of endodontic therapy advances in humans.

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