Interpretation of ground section of human dentin tissue

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ABSTRACT

Background: Thick ground sections from human teeth showed a considerable amount of details in dentin tissue, the purpose of this study was to prepare ground sections for dentin tissue that were in all aspects helpful in teaching purpose, because of their shortage in our oral histology labs.

Materials and methods: Fifteen permanent and five deciduous human teeth used in this study. Each tooth was ground by hand into two halves, section was 50-75 microns thick was made, which mounted on glass slide, the sections were cut mostly longitudinally, and few sections were transversely ground.

Result: The results are demonstrated throughout the figures, they showed a considerable amount of details in dentin tissue like as: dentinal tubules, primary and secondary curvature, branching of dentinal tubules in crown, root and bifurcation area, radicular tubules, in addition to dentinoenamel junction, mantle dentin, interglobular dentin in crown and root, tomes granular layer, secondary dentin, seclerotic dentin and dead tract.

Conclusion: Ground sections for dentin tissue were gained, the study could be as a background for examination of special clinical cases, and the sections were shown to be beneficial for teaching purpose.

Keywords: Ground section, dentin, tomes granular layer.

INTRODUCTION

Mature dentin, a calcified connective tissue can be studied successively in ground sections because of its high in inorganic contents (70%). It is penetrated by definitely arranged small canals containing proto-plasmic processes belonging to cells which remain outside dentin and in pulp cavity (1). The tubules are found everywhere in normal dentin running parallel to each other and in one direction and form the outer surface of dentin to pulp cavity (2,3).

In dried ground sections of dentin the odontoblastic processes disintegrate and the empty tubules are filled with air appearing black in transmitted light and white in reflected light (4). Again, in dry sections, the structural elements may be lost and spaces result giving the black colored structures in transmitted light, and these are like, Tome's granular layer, interglobular dentin and dead tracts (5). Tome's layer can on only be discerned in thick ground sections as a result of a superimposition phenomenon and the ability to focus within the depth of the sections of root dentin (6-8).

and middle layers of coronal dentin. No interglobular dentin was seen in root except at the cervical part (9,10). Tissue changes in dentin may take several forms like appearing all light in transmitted light (10).

In concern with interglobular dentin, many author's shown in their alizarin stained ground sections that this structure was seen between outer

The aim of the study was to prepare ground sections for dentin tissue in order to be used for teaching the undergraduate dental students because of their shortage in our laboratories.

MATERIALS AND METHOD

Fifteen permanent and five deciduous human teeth gathered from patients of 6-60 years of age, were used in this study. The extracted teeth were preserved in 10% Formalin solution. Each tooth was split by hand into two halves. One section 50-75 microns thick was made from each tooth under water cooled rotating diamond and brushed under running water, dried with air and then mounted on a regular glass slide with resin and held with Canada balsam under a cover slide. The sections were cut mostly longitudinally but only few sections were transversely cut. Every section was identified according to age and type of tooth and finally was examined by four senior dentists under ordinary transmitted light microscopy.

RESULTS

The results are demonstrated throughout the figures 1-19.

Figure 1 shows dentinal tubules in a cross section in dentin, which are cut at right angles to their direction. The many black spots indicate odontoblast processes spaces (0) surrounded by light calcified rings the peritubular dentin (Pd) and
all are scattered in the dentin matrix the intertubular dentin (Id).

The primary curvature or S-curved coarse dentinal tubules in coronal and gingival portions of dentin are presented in figure 2. They start at right angles to dentino-enamel and cement-enamel junctions and end also at right angles to pulpal surface (P). The first convexity of the S-coarse is directed apically, and the other one is directed apically. On the other hand, secondary curvature (Sv) appears having little wavy curves (arrows) throughout the length of dentinal tubules. They are also seen well in figures 5&7.

Figure 4 shows branching of dentinal tubules in crown. Minute lateral branches (small arrows) from one tubule to another in coronal dentin and near DEJ terminal branches (large arrow) occur extensively looking like forks.

Radicular dentinal tubules show only the secondary curvature (Sv) which fan out some what by compound curves at pulpal side (P) and end at DEJ (arrow) in the granular layer of Tome's (T) (figure 5).

Branching of dentinal tubules in root appear parallel to each other. They give off numerous fine branches (arrows) from one tubule to another giving the appearance of rootlets of a plant.

Figure 7. Dentinal tubules in bifurcation area. Primary curvatures are absent, only the secondary curves (Sv) are seen and they start fanning from the pulpal side (P). Figure 8 shows the dentino enamel junction (J) which is a dark scalloped line between enamel and dentin. The figure shows the terminal branching of dentinal tubules near the junction and the enamel spindles (S) that appear as perpendicular short lines penetrating the junction. At incisal region, the dentin tip appears as a cone of crowded tubules with numerous spindles extending into enamel which shows multiple cracking (arrows) (figure 9).

Mantle dentin (M) is a unique homogenous light band (M) next to DEJ (J) and parallel to enamel (E) presents an area of better calcification and freedom of hypocalcified spaces (Figure 10). Next to mantle dentine (M) a layer occurs regularly in crowns of permanent teeth containing true dark spaces, it is the interglobular dentin (Figure 11).

Figures 12 & 13 show the interglobular dentin (Ig) in crown. Black irregular globule or triangle or may appear as widely scattered patches of uncalcified dentin matrix. The dentinal tubules are continuous and not interrupted.

Interglobular dentin (Ig) in the root appear as concave facets confined only to the cervical portion of root a short distance form a cellular cementum (Ac). Again dentinal tubules are not interrupted by this layer (Figure 14).

Tome's granular layer (T) appears as a dark colored continuous layer that is in parallel alignment with resting lines (RI) of a cellular cementum (Ac) and the cementodentinal junction as well. The dentinal tubules look ending in this layer (Figure 15). A higher magnification of figure 15 shows irregular black minute points as granules adjacent to cementum (C) (Figure 16).

Secondary dentin (Sd) appears as a continuous bright colored layer with minor irregularities making the roof of pulp space (P). The section also presents two parallel lines running at right angles to the dentinal tubules that extend from pulp space to DEJ (J) giving the characteristic appearance of contour lines of Owen's (Figure 17). The section presents the apical canal (Ap) that is partially lined by calcified dentin, which looks brighter than the adjacent dentin and partially by cellular cementum (Cc) which is not well defined (Figure 18).

Figure 19 shows the dead tract (Dt) which are a group of dentinal tubules appearing bright in color extending against the tip of a cervical carious lesion in enamel (Ec).

DISCUSSION

The evaluation of histological features of dentin tissue in the foregoing figures did not lead to the identification of any structure that had not been previously shown. We, generally agree with the previously described studies (1,2,4,7,9,10) that dentin structural elements were common to sections in the sample used, and all were within the classical descriptions of this tissue. However, incremental lines were not obvious in our sections, being related to the thickness of the sections. Therefore examination of thinner section was suggested.

Appearance of cracks and artifacts in preparation of ground sections is worthy; therefore teeth must never be allowed to dry out.

Finally, the examiner had given a degree of accuracy and correctness about the details of dentin tissue.

REFERENCES

Figure 1: Crosssection in root of perm. molar. Dentinal tubules, odontoblastic process (O), peritubular dentin (Pd), intertubular dentin (Id).
Figure 2: Longitudinal section of perm. molar. Primary curvature, enamel, dentin, cementum and pulp space.
Figure 3: Higher magnification of figure 2.
Figure 4: Longitudinal section of permanent premolar. Dentinal tubules, lateral branches (small arrow), terminal branching (large arrow).

Figure 5: L.S. in root of deciduous molar. Dentinal tubules. Secondary curvature (Sv) pulp space (P) Tome’s granular layer (T) cellular cementum (Cc) DCJ (arrow).
Figure 6: L.S. in root of deciduous molar. Lateral branching of dentinal tubules (arrows)
Figure 7: L.S. in bifurcation area of deciduous molar. Secondary curvature (sv), pulp space (p).
Figure 8: L.S. in crown of permanent molar. DEJ (J), enamel spindle (s)

Figure 9: L.S. in perm. incisor cut labio lingually. En. spindle (s), cracks (arrows).
Figure 10: L.S. in permanent canine. Mantle dentin (M), DEJ (J).
Figure 11: C.S. in premolar. Mantle dentin (M), interglobular dentin (Ig).
Figure 12: C.S. in crown of premolar. Interglobular dentin (Ig) as a globule.

Figure 13: C.S. in crown of permanent molar. Interglobular dentin (Ig) as scattered patches.
Figure 14: L.S. in root of permanent incisor. Interglobular dentin (Ig), acellular cementum (Ac), artifact (A).
Figure 15: C.S. in root of perm. incisor. Tome’s gran. layer (T), acellular cementum (AC), Resting lines (Ri), bubbles of canda balsam (B).
Figure 16: Tome’s granular layer (T), Cementum ©.

Figure 17: LS in crown of deciduous molar. Secondary dentin (Sd), pulp space (P), incremental lines of Owners (arrows).
Figure 18: LS in apex of premolar. Sclerotic dentin (sc), cellular cementum (cc), apical canal (Ap).
Figure 19: L.S. in crown of deciduous molar. Dead tract (Dt) Enamel caries (Ec) Artifact in dentin (A) .