**Surface roughness and topography of dentin characterized by AFM**

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Dentin is a mineralized tissue constituent of a human tooth, which, in addition to the mineral component, contains an organic matrix organized into tubules, surrounded by the peritubular and intertubular dentin. Various dental treatments lead to changes in dentinal surface properties. Contemporary adhesive dental procedures consider dentinal etching by using the orthophosphoric acid to remove a smear layer and to open dentinal tubules to achieve conditions for adequate adhesion of the restorative material [1].

Atomic force microscopy (AFM) is proven as a valuable tool for characterizing the dentinal surface at the nanoscale after any chosen dental conventional or experimental surface treatment methods [2]. It can be used after different chemical treatments, as well as after physical methods used for surface preparation, such as conventionally or experimentally used lasers for dental treatment.

This study aimed to analyze the influence of conventional phosphoric acid treatment on dentinal surface topography and 3D roughness parameters using AFM.

The intact mandibular canine, extracted for orthodontic reasons, was cut into horizontal slices using a diamond saw disk. The samples were etched with orthophosphoric acid for 15 seconds and stored in a moist medium until examination. The structure of the dentin was examined by Veeco CP-II Atomic Force Microscope. Sample’s surface was scanned in contact mode with symmetrically etched silicon tip at 0.5 Hz scan rate. Areas of 20 μm × 20 μm were scanned with resolution of 256×256 pixels. The obtained topography data were processed by image analysis software (SPIP, Image metrology) and the following 3D roughness parameters were obtained : average surface roughness (Sa), root mean square height (Sq), maximum height (Sz), and surface skewness (Ssk).

Topography of dentinal surface will be presented by AFM 3D images. The Sa parameter of acid-etched dentin was 246.53 nm, and the Sq=307.23 nm, Sz = 2047.8 nm – presenting the existence of deep open tubular structures. The Ssk paremeter had mainly negative values (-0.431), which indicates a negative surface dominated with holes which could be considered as a favourable functional surface property for better load-bearing and adhesive-lubrication properties.

AFM is a valuable tool for quantitative functional roughness characterization and 3D presentation of the dentinal topography. The results presented in this study could be used as reference measurements, since the AFM could be used in determination of dentinal surface changes after different experimental laser treatments, or following the cold atmospheric plasma (CAP) surface modification, since CAP is a promising experimental method used in dental medicine research. Future perspectives offer potential new possibilities of “site-matching” analysis, giving the parallel 3D imaging and chemical fingerprinting on certain areas of interest by means of AFM-IR, which is a perspective of our further research.

REFERENCES

[1] Pelin I.M, Piednoir A, Machon D, Farge P, Pirat C, Ramos S.M.M. Adhesion forces between AFM tips and superficial dentin surface. J Colloid Interface Sci. 2012;376:262-8.

[2] Kubinek R, Zapletalova Z, Vujtek M, Novotny R, Kolara H, Chmelickova H. Examination of dentin surface using AFM and SEM. In: Méndez-Vilas A, Diaz J, editors. Modern Research and Educational Topics in Microscopy. Badajoz, Spain: Formatex; 2007. p.593-8.