MICROELEMENT COMPOSITION AND STRUCTURE OF HUMAN TOOTH TISSUE BIOMINERAL PHASE

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Bone and tooth biomineral phase can accumulate from environment trace elements, particularly heavy metals. Chemical composition and properties of tooth biomineral component reflect physiological peculiarities of organism functions and can give important information for ecological monitoring of residence region. In many regions of Russia pathological processes in hard tooth tissue of different etiology (increased abrasion, caries lesions, tooth hypersensitivity, etc.) are closely connected with negative ecological situation, especially in Urals region. The aim of present work was to study by inductively coupled plasma – mass-spectrometry (ICP-MS) and Raman spectroscopy the microelement composition and structure of human tooth tissues and its alteration due to progressing of diseases, e.g. increased tooth abrasion and caries. Teeth of different degree of integrity were studied – intact, carious of various depth and localization and also with increased abrasion. All ICP-MS measurements were made by ELAN 9000 (PerkinElmer). A method of layer-by-layer dissolution by acid etching of tooth enamel was developed. Laser ablation sampling of teeth surfaces with Cetac LSX500 was performed as well. Raman spectra were obtained by LabRAM (Horiba Scientific). Groups of trace elements concentrating in intact and affected enamel in different ways were separated; element incorporation features depended on a degree of tooth tissue integrity. Diseased teeth had contained the microelements in lesser concentrations as compared with intact teeth. The majority of them represented essential microelements (e.g. Cr, Co, Ni, Mn, Zn, As, Se), micro-quantities of which are known to be a part of enzyme composition of human organism. Bone inorganic and organic phase conversion during pathological processes was examined: degree of bone apatite crystallinity, mineral-organic ratio, carbonate-ion relative concentration and its inter-positional distribution were calculated.

Keywords: hydroxyapatite, Raman spectroscopy, microelemental composition.