

ORIGINAL PAPER

Modifications of the dental pulp in marginal periodontitis. Electronmicroscopical contributions

V. DEVA¹⁾, MARIA VĂȚĂMAN²⁾, H. MANOLEA³⁾

¹⁾*Department of Morphology and Semiology of the Stomatognathic System,
University of Medicine and Pharmacy of Craiova*

²⁾*Department of Endodontics,
"Gr. T. Popa" University of Medicine and Pharmacy, Iassy*

³⁾*Research Center for Microscopic Morphology and Immunology,
University of Medicine and Pharmacy of Craiova*

Abstract

Histological studies on teeth with marginal periodontitis, but without cavity lesions have shown a frequent apparition of modifications in the pulp tissue structure. In this study, by using the electron microscopy method, we have shown a series of interesting aspects of the intimate modifications that appear on the level of all components of the pulp tissue. The observations show that the degree of affecting can be correlated to the type of marginal periodontitis, and at the same time they contribute to a right evaluation of the defensive abilities of the pulp of the teeth with marginal periodontitis.

Keywords: dental pulp, periodontitis, electron microscopy.

☞ Introduction

Morphological-functional correlations between the dental pulp and the marginal periodontium have been known for a long time. The marginal periodontium communicates with the dental pulp through a number of linking canals, namely the lateral, secondary, and accessory canals, which are situated mainly in the apical third of the dental root, more frequent on the level of molars and premolars [1].

An electron microscopic study on the furcation region of permanent molars has revealed the existence of the accessory canals on this level at almost half the examined molars [2].

Pulp-periodontal communications can also occur by means of the dental tubules in case of pathological radicular perforations or of vertical fractures [3], or by means of local anatomical particularities, such as the presence of a radicular lingual groove on the level of the superior lateral incisors [4].

Other arguments for the interdependency between the marginal periodontium and the dental pulp have been brought up, such as their common embryonic origin, the presence of a bacterial, viral or mycosis microflora similar in both tissues, the histopathological modifications that appear on periodontitis teeth without cavities, the beneficial effects of devitalizing periodontitis teeth on the evolution of the periodontal disease, etc. [5, 6].

If there is an inflammatory process on the pulp level, it is possible that no pathological manifest appeared in the marginal periodontium [7].

Yet, the necrosis and especially the pulp gangrene

represent risk factors for the apparition of the periodontal disease, which can occur when the microbial germs spread along the lateral radicular canals, and the lesion develops along the lateral area of the root [8].

Although there are obvious proofs of the existence of the communication canals, a mechanism of direct transmission of the periodontal infection towards the pulp tissues has not been elucidated yet, and explanations about the pulp pathology that appears with the loss of the epithelial insertion are scarce [9].

Yet, pathogenic bacteria and inflammatory products which appear in the periodontal disease can achieve the dental pulp level, and histological studies carried on teeth extracted following to severe evolutions of marginal periodontitis have proven the apparition of major modifications in the dental pulp [10, 11].

The pathological modifications that occur in the dental pulp are more important as the periodontal disease evolves to a more advanced stage, and the bacterial plaque is closer to the apical third of the root [12].

The photon microscopy researches carried on teeth with marginal periodontitis lacking cavity lesions have proved the frequent, almost constant, apparition of histopathological modifications in the structure of the pulp tissue [13].

These modifications consist of important layers of secondary dentin, degenerative alterations of the odontoblasts, fibrosis, calcium sedimentation, alterative lesions of the endothelial walls etc. [5].

The electron microscopic studies aim to determine the intimate modifications that appear on the level of the

pulp tissue components. In a study carried on cats, on the dental pulp of periodontal teeth, Ghoddusi notes the presence of a cellular infiltrate specific to a chronic inflammation, odontoblasts that presents many mitochondria and secretory vesicles, capillaries with many fenestrations situated immediately below the odontoblastic layer [14].

The present study aims to bring into attention some intimate aspects related to the modifications that occur in the dental pulp of the teeth with chronic marginal periodontitis.

☞ Material and methods

For this study we have used 15 teeth with 2nd and 3rd degree of mobility. After their extraction, performed using an anesthetic without vasoconstrictors, the teeth were fractured and the dental pulp was carefully extracted and fixed in a glutaraldehyde solution.

The resulting pieces were processed according to the techniques of electron microscopy, included in epoxydic resin, sliced by means of ultramicrotome, and finally examined with a Philips CM10 electron microscope.

☞ Results

The results of our electron microscopy study, on the modifications of the dental pulp in marginal periodontitis, are shown below in Figures 1–8.

Histological studies on teeth with marginal periodontitis, but without cavity lesions have shown a frequent apparition of modifications in the pulp tissue structure. A series of interesting aspects of the intimate modifications that appear on the level of all components of the pulp tissue was revealed.

The results show that the degree of affecting can be correlated to the type of marginal periodontitis. At the same time they contribute to a right evaluation of the defensive abilities of the teeth's pulp with marginal periodontitis.

☞ Discussions

The study of the dental pulp sections has show modifications on the level of all constitutive elements of the pulp tissue: cells, fibres, extracellular matrix, blood vessels, nerves (Figure 1).

Modifications have also been found on the own cells of the pulp tissue, but specific to the degree of disease of the pulp tissue is the presence of a lymphoplasmacyte and macrophage infiltrate, which depends on the type of marginal periodontitis. We have noticed both fibroblasts with a normal morphology, and fibroblasts that had suffered vacuolisations, as a result of a low supply of oxygen (Figure 2).

The defensive cells can be found in various stages of metabolic activity, according to their localization within the pulp, relative to the area exposed to the noxious factor. Thus, we have found active polymorphonuclears (Figure 3), but there also have been noticed cells that presented vacuolar aspects, breaks and disappearing of the crests, vacuolisations in hyaloplasm, dilatations and

fragmenting of the endoplasmic reticulum, going even to necrobiotic processes (Figure 4).

The pulp lymphocytes can be sensibilised by the microbes settled in the periodontal bags and by their products. Also, the pulp cells that had already suffered necrosis processes or some substances used in periodontal local therapy combined with the proteins of the pulp tissue can become antigenic.

The existence of plasmacytes, which appear by blastic transformation of the lymphocytes, pleads for an immunological response (Figure 5).

Moreover, the electron microscopic examination of this antibodies generating cell highlights the intensely secretory stage in which it has been caught with the dilatation of the endoplasmic reticulum and the presence of an amorphous electron-opaque intra-cisternal material (Figure 6).

At the level of the fibres, it was revealed an increase of the number of the collagen fibres, which leads to the apparition of a fibrosis process with little fundamental substance between fiber fascicles (Figure 7).

Degenerative modifications have also been noticed on the level of the nervous fibers, both on the myelinated and non-myelinated ones, with gaps in the myelin sheath, vacuolisations on the level of the axoplasm, accompanied by leaks of axonal substance (Figure 8).

☞ Conclusions

The microscopic and ultramicroscopic observations realized on the material studied by us have shown modifications appeared on the level of all pulp components. The degree of structural decay depends on the type of marginal periodontitis and on the localization regarding the area exposed to the noxious factor.

The noticing of plasmacytes in various functional aspects, and especially intensely secretory leads to the conclusion that the pulp defense on teeth with chronic marginal periodontitis has an important immunologic component.

The correct evaluation of the stage of disease of the dental pulp on periodontitis teeth, of the defensive abilities of the pulp against the noxious factors in the affected periodontium constitute a necessary condition for a correct clinical approach on the endodontal-periodontal lesions.

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Figure 1 – Overview of a fibroblast with condensed nucleus, three cells of lymphocyte origin, myelinated axon in the process of degeneration (EM image, $\times 3\ 560$)

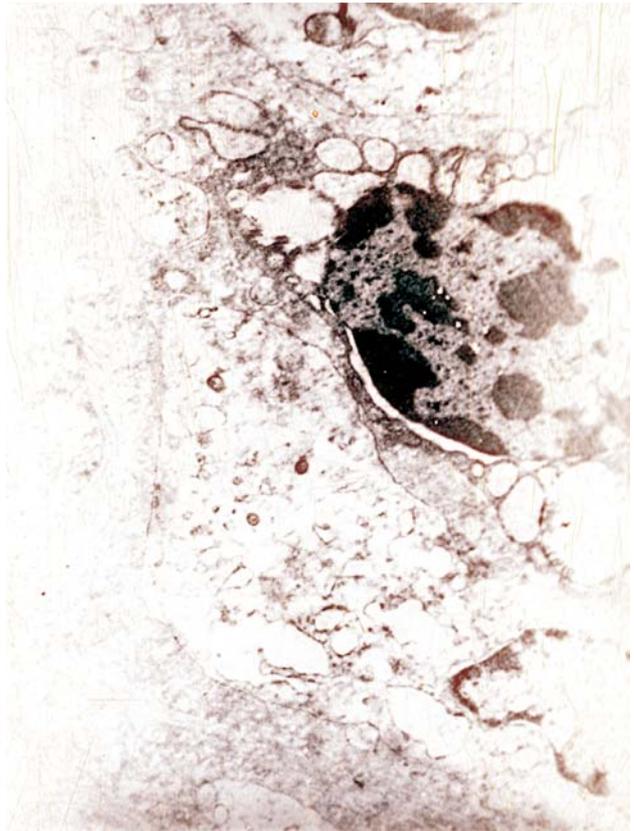


Figure 2 – Highly vacuolated fibroblast, sign of hypoxia (EM image, $\times 7\ 400$)



Figure 3 – Polymorphonuclear leucocyte infiltrated in the conjunctive matrix with vesicle endoplasmic reticulum highly dilated (EM image, $\times 4\ 600$)



Figure 4 – Inactive mature leucocyte. Vacuolated cytoplasm. Few mitochondria (EM image, $\times 9\ 400$)



Figure 5 – Plasmacytes. Vacuolated cytoplasm. Endoplasmic reticulum poorly developed (EM image, $\times 11\ 800$)

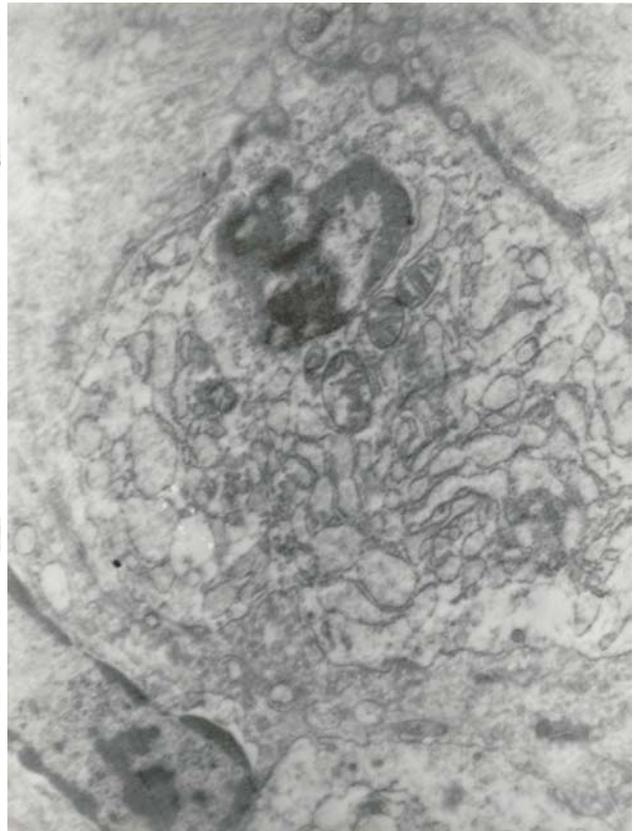


Figure 6 – Cytoplasm from a plasmacyte (EM image, $\times 4\ 600$)

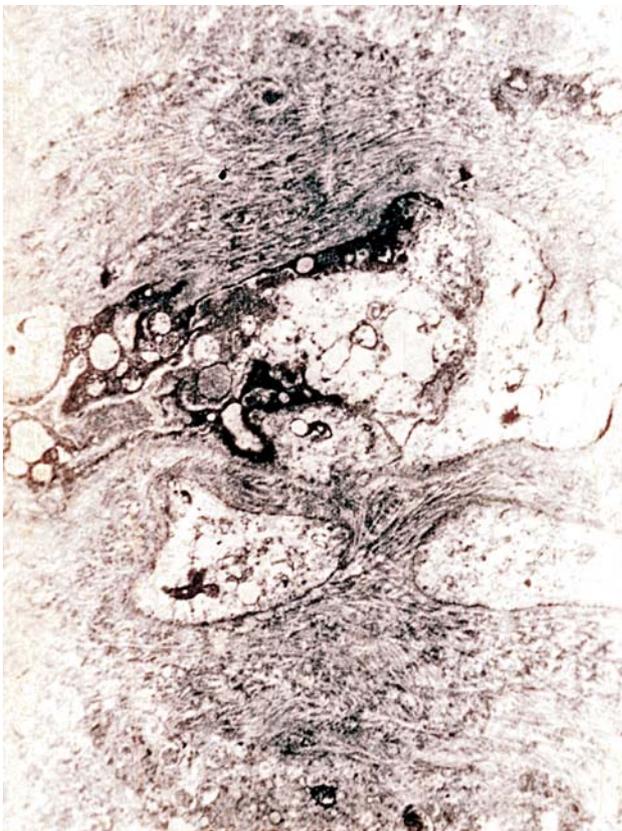


Figure 7 – Area of highly vacuolated cytoplasm. Connective matrix rich in fibres (EM image, $\times 11\ 800$)



Figure 8 – Myelinated axon in the process of degeneration (EM image, $\times 6\ 000$)

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Mailing address

Virgil Deva, Associate Professor, M. D., Ph. D, Department of Morphology and Semiology of the Stomatognathic System, University of Medicine and Pharmacy of Craiova, 2–4 Petru Rareş Street, 200349 Craiova, Romania; Phone 0251–524 442, E-mail: virgil_dv@yahoo.com

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