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Scanning Electron Microscopy of Angioarchitecture of Palatine Gingiva in Young Rabbits

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The angioarchitecture of young rabbits' palatine gingiva was studied by using the corrosion resin cast method. The vascular corrosion casts were obtained using low viscosity resin (Mercox® CL-2B) and were observed with scanning electron microscopy (SEM). The palatine gingiva had areas with various arrangements. The capillaries of the palatine gingiva and interdental papillae had numerous projections, but in the gingival sulcus, the blood vessels were arranged in a flattened network from their capillary extremities. The blood vessels supplying the alveolar bone were also clearly seen.

Key Words: palatine gingiva, alveolar bone, rabbits, angioarchitecture, SEM.

INTRODUCTION

The mucous membrane that protects the hard palate as well as the palatine gingiva has been characterized as masticatory mucosa (1-3). The lining epithelium is keratinized, squamous and stratified tissue and the interface of epithelium/connective tissue has numerous connective papillae (4).

According to McCuskey and Krasovich (5), the microvascular system brings the blood to the cells of organs, and provides the substances for the maintenance of an optimal microcirculation and thus, organ function. The close relationship between the complexity of microvascularization and functions of the tissue or organs was reported by Konerding (6) and McCuskey and Krasovich (5).

Jasinski and Miodonski (7) detected peculiar vessels in the palatine mucosa suggesting their involvement in gas exchange. Recently, Kronka (8) reported that a subepithelial vascular network was formed just below the epithelium in the palatine mucosa, showing capillaries directed to connective papillae. Furthermore, the microvascularization of the palatine mucosa contained larger vessels located deeper in the tissues (8).

Due to the importance of the integrity of palatine gingiva especially in Dentistry, the aim of this study was to analyze the three-dimensional characteristics of vascular arrangement related to tooth and adjacent alveolar bone using scanning electron microscopy.

MATERIAL AND METHODS

Seven young (15-45 days old) rabbits of both sexes were prepared for scanning electron microscopy. The animals were carefully anaesthetized with *iv* injection of sodium pentobarbital (30 mg/kg body weight). A polyethylene tube was introduced into the aorta for both perfusion and resin injection.

Perfusion was done with prewarmed heparinized saline (500 ml, 37°C) until the reflux out from the right atrium was similar to this rinsing solution. Subsequently, 30 ml of low viscosity resin (Mercox® CL-2B, Dainippon-ink Chemical Co. Ltd., Tokyo, Japan) prepared according to the manufacturer's instructions was injected with manual pressure.

The specimens were maintained at room temperature for approximately 2-3 h until resin polymerization was complete. They were then macerated in 10% sodium hydroxide solution for 3-5 days at room temperature. The vascular corrosion casts were rinsed in distilled water, dried, mounted on metal stubs and coated with gold. The material was observed with a

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JEOL 6100 scanning electron microscope.

RESULTS

The vascular corrosion casts demonstrated the angioarchitecture of the young rabbits' palatine gingiva and its association with alveolar bone. The microvascular systems of palatine gingiva, interdental papilla and gingival sulcus are shown in Figures 1 and 2. The distribution of several projections coming from fine superficial vessels related to palatine gingiva and to interdental papillae (Figures 1 and 2) followed the gingival margin. At the level of the gingival sulcus, the fine blood vessels formed a flattened network (Figure 2) that followed the dental surface without projections (Figure 3). The capillaries showed numerous anastomoses.

The microcirculation of the palatine gingiva revealed vessels with different diameters (Figure 4) that ran close to the surface of the alveolar bone with branches running into the vascular bone foraminae (Figure 5).

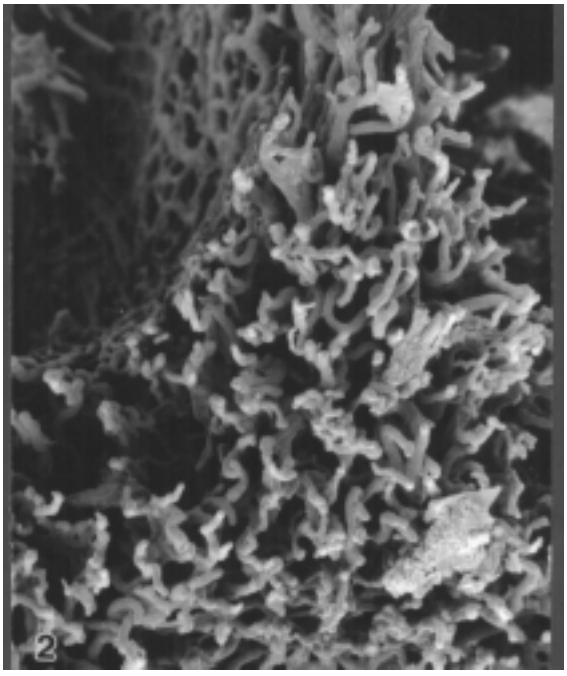

Figure 2. At higher magnification, different arrangements of blood vessels among palatine gingiva and interdental papilla and gingival sulcus are shown. Note a flattened network of superficial blood vessels at the gingival sulcus. Magnification: X90.

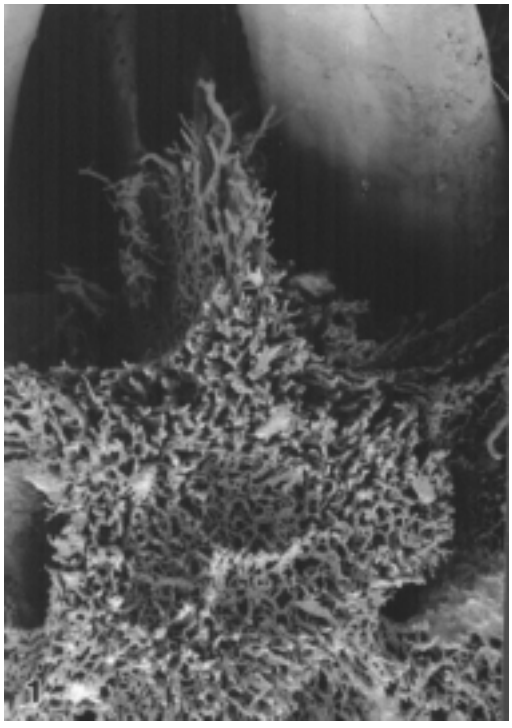

Figure 1. General view of a vascular corrosion cast. Scanning electron micrograph showing the angioarchitecture of the palatine gingiva. Note incisive tooth, interdental papilla and gingival sulcus. Magnification: X30.

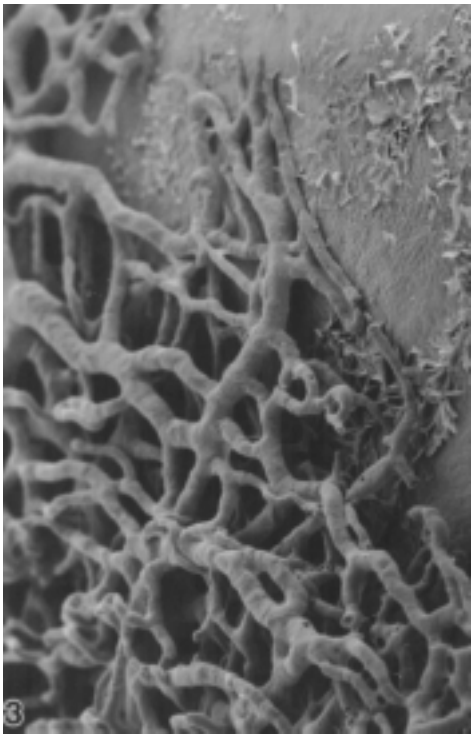

Figure 3. Scanning electron micrograph of the periodontal membrane. Observe the distribution of fine blood vessels following the shape of the tooth surface. Magnification: X180.

DISCUSSION

The results of this study clearly showed the distribution of capillaries in the palatine gingiva and interdental papillae. Numerous capillaries were encountered in the tissue that surrounds the teeth.

Lametschwandtner et al. (9) assumed that angioarchitecture means the three-dimensional arrangement of all vessels. Furthermore, the use of vascular corrosion casts in association with scanning electron microscopy may reproduce the vascular network and permit the morphological study of the microcirculation (10). The technique was originally described by Tanigushi et al. (11) and later modified by Murakami (10). The present study also demonstrated the benefits of this method, revealing the spatial arrangement of the microvessels of the palatine gingiva.

Despite of the fact that the animals were young, the palatine gingiva had a dense, complex vascular structure. Skaladzien et al. (12) reported that the underdevelopment of some vascular areas of the nasal mucosa in the human fetus is associated with the functional immaturity of the respiratory system. Strek et al. (13) observed that the microvasculature of the dorsal mucosa of the human fetal tongue is similar to that described for the tongue of children aged 6 months to 2 years. Naccarato et al. (14) examined the vascular network of well developed areas in adult gerbil nasal septum showing the presence of numerous arteriole and venule. Makiyama et al. (15,16) compared the angioarchitecture of the tongue of normal and malnourished young rats and found no significant differences.

Kindlová (17), studying the vascular bed of the marginal periodontium of rat molars, detected that although there is continuity of microvascular systems in a developed periodontium, they retain their structural differences. The present study shows the different arrangements of microcirculation at 3 regions of young rabbit palatine gingiva. Kindlová (17) also noted proximity between blood vessels and alveolar bone, finding branches entering the gingival epithelium. Our results showed thick vessels supplying both palatine gingiva and alveolar bone with capillary branches of different diameters. Weeks and Sims (18), studying ageing rats, also noted a flattened network subjacent to the sulcus epithelium, with twisted vascular loops situated on buccal and lingual crevices which were slightly different compared to our data obtained with young rabbits,

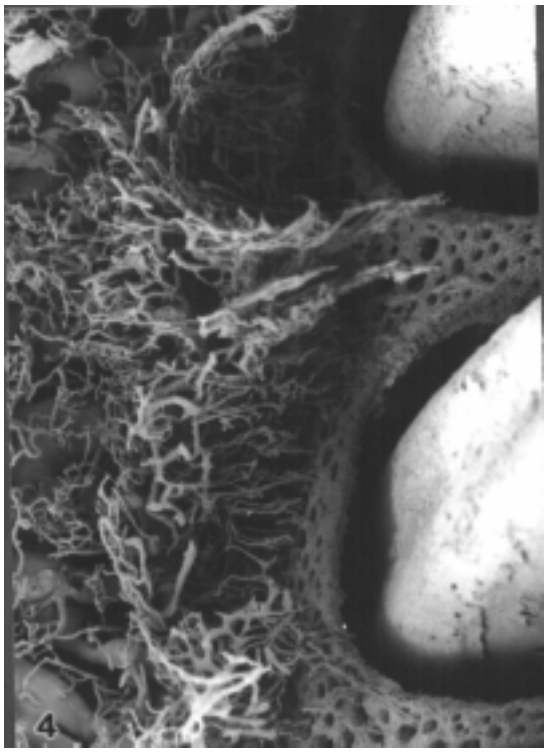

Figure 4. Vascular corrosion cast showing that thicker vessels located deeper in tissues are related to palatine gingiva and alveolar bone. Magnification: X30.

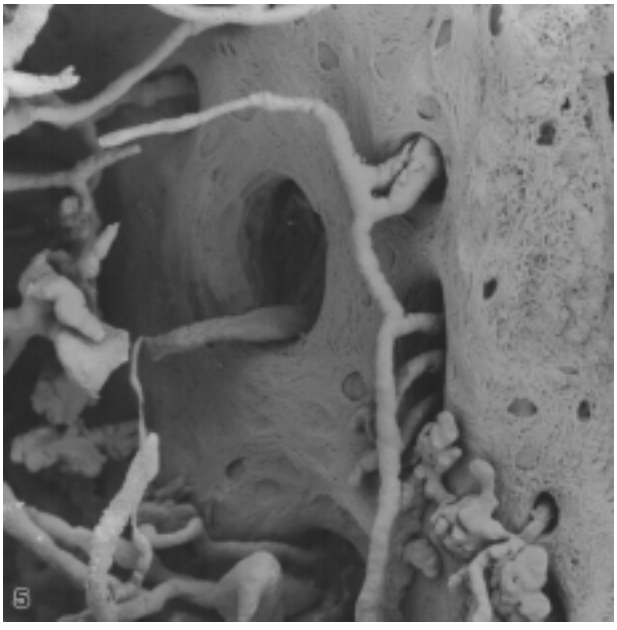

Figure 5. Scanning electron micrograph of a vascular corrosion cast showing that the incoming blood vessels run close to the alveolar bone surface. Note small vessels entering the bone foraminae. Magnification: X370.

in which we observed simple hair-pin capillary loops.

The association between scanning electron microscopy and vascular corrosion casts makes the three-dimensionality of palatine gingiva microvasculature in young rabbits evident. The angioarchitecture showed a close relationship between microvessels and the superficial shape of teeth and indicates the need for careful manipulation of palatine mucosa.

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RESUMO

Kronka MC, Watanabe I-s, Silva MCP. Microscopia eletrônica de varredura da angioarquitetura da gengiva palatina de coelhos jovens. Braz Dent J 2001;12(3):163-166.

A angioarquitetura da gengiva palatina de coelhos jovens foi estudada utilizando-se o método de modelos de corrosão vascular. Os modelos de corrosão foram obtidos a partir da injeção de resina de baixa viscosidade (Mercox® Cl-2B) sendo, posteriormente observados ao microscópio eletrônico de varredura (MEV). A gengiva palatina apresentou áreas de diferentes disposições vasculares. Os capilares da gengiva palatina e da papila interdental emitiam diversas projeções, não detectadas, porém, no sulco gengival, onde a rede capilare mostrava-se de arranjo irregular, aplainado. Os vasos sangüíneos, nutrindo o osso alveolar, também foram observados.

Unitermos: gengiva palatina, osso alveolar, coelhos, angioarquitetura, MEV.

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