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Microvascular changes of periodontal tissue after inflammation using vascular injection method.

M. Matsuo^{1,2}, S. Takahashi³, S. Takahashi³, A. Iimura^{1,2}, S. Matsuo¹

¹Kanagawa Dental University, Dept. of Oral Science, Dental Anatomy, Yokosuka, Japan

²Kanagawa Dental University, Institute for Research of Disaster Dental Medicine in Yokosuka and Shonan, Yokosuka, Japan

³Kanagawa Dental University, Dept. of Oral Science, Dentistry of circulation control, Yokosuka, Japan

m.matsuo@kdu.ac.jp

Introduction : In this study, microcirculation changes in the periodontal tissues after experimental induction of the inflammation are examined. A vascular resin cast model was used to observe the morphological changes of vasculature under scanning electron microscope (SEM). Also laser Doppler flowmetry (LDF) was used to estimate physiological changes in gingival blood flow (GBF) in.

Materials and Methods : The microvascular resin cast method is a way to make three-dimensional observations of the vasculature [1]. This method is to inject the synthetic resin and dissolve the peripheral hard and soft tissues by hydrochloric acid (HCl) and potassium hydroxide (KOH). By using these decalcifying and maceration solutions, it is impossible to observe the relationship between the bone and vascular network. In this regard, the proteinase digestion method is useful for periodontal research. Unlike acid and alkaline digestion methods, this method does not decalcify newly formed immature bone at all, and makes the observation of new bone apposition possible [2]. All gingival blood flow was estimated by a LDF with a probe. These parameters were determined control and inflammation group. The output signals of gingival blood flow were analyzed using data analysis software.

Surgical procedures : Beagle dogs were divided into two groups for the performance of all experimental procedures, which adhered to the Animal Care Committee guidelines of our institution. To induce inflammation, dental floss was placed around the cervical area of teeth for ninety days (periodontitis group). Healthy periodontal tissue was used as Control group. After this period, resin cast models were created.

Results and Discussion : In SEM observation of the control group, gingival vasculature formed regular vascular loops with diameter of 10-30 μ m (Figure.1). These vessels were anastomosed by periodontal ligament. The vascular network of periodontal ligament forms a polygonal ring shape. Vessels in the periodontal ligament are anastomosed to gingival and alveolar bone vessels through Volkman's canal.

In the periodontitis group, gingival blood vessels changed into extended vascular loops (Figure.2). These infected glomerulus vascular loops grew towards the root apex. Glomerulus blood vessels are anastomosed with the vascular networks in the alveolar bone marrow at the back of the absorbed thin bone wall.

In the analysis of LDF, periodontitis (22.27 ± 2.17 mL/min/100g) group significantly decreased in GBF as compared to the Control (34.56 ± 2.92 mL/min/100g) group.

Conclusion : The findings of this study indicated that gingival vasculature changed easily by experimental inflammation and that it is difficult to maintain the vascular structure of periodontal tissue. Meticulous plaque control and adequate protection of microcirculation from inflammation in periodontal tissues would assure that infection would be amenable to treatment.

1. M. Matsuo, K. Takahashi, *Microscopy research and technique* 56 (2002), p.3-14.
2. M. Matsuo, Tamaki K. *Microvascular Reviews and Communications* 3 (2010), p.25-31.
3. MEXT-Supported Program for the Strategic Research Foundation at Private Universities, 2012-2014, P1-5.

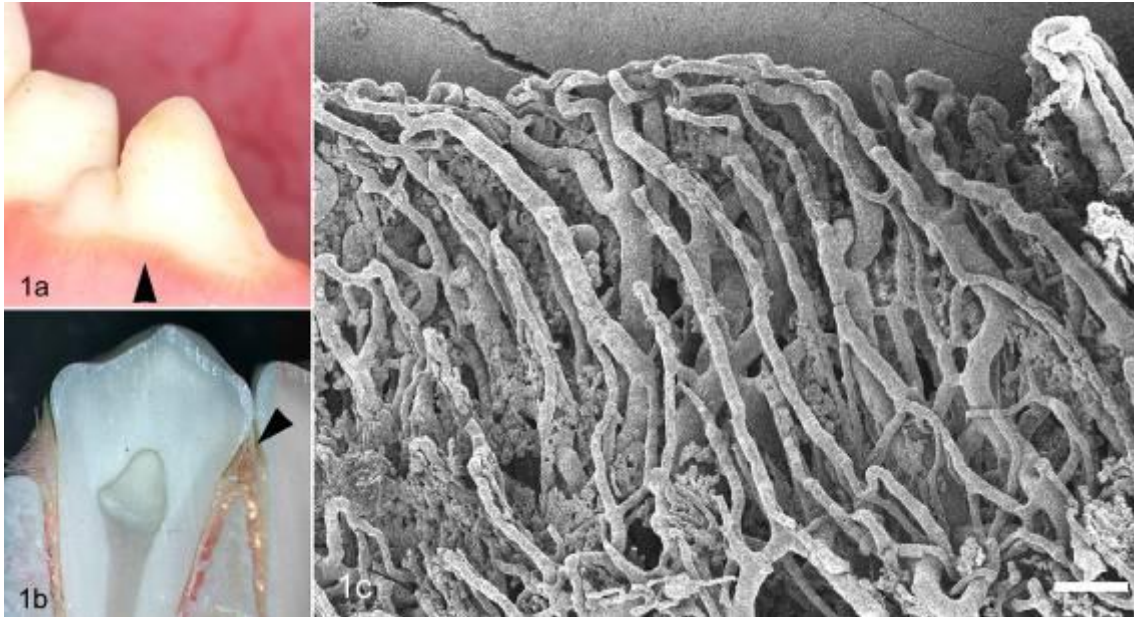


Figure 1.In the control group, healthy gingival blood vessels are shown along the tooth (a : arrow head). Gingival blood vessels of vascular resin cast model of healthy periodontal tissue indicated as arrowhead (b). SEM observation of resin cast model, gingival vasculature formed regular arrangement of U-turn vascular loops (c).

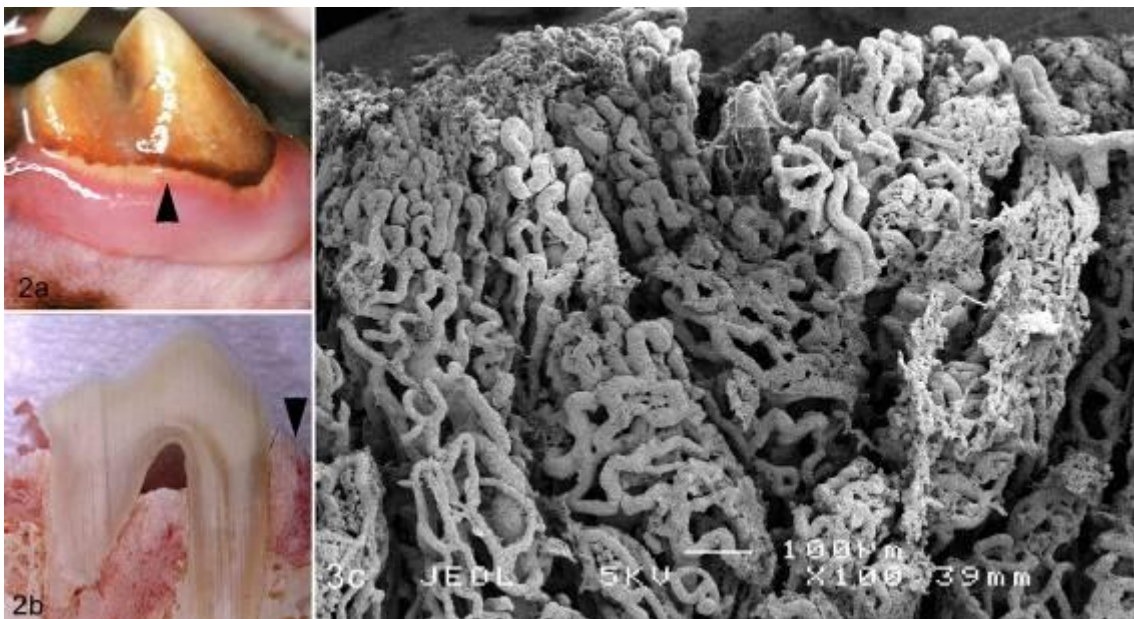


Figure 2.In the periodontitis group, inflamed gingival blood vessels are shown along the tooth which attached dental plaque and pus gathers along the gingival margin (a : arrow head). Gingival blood vessels of vascular resin cast model of inflamed periodontal tissue indicated as arrowhead (b). In the SEM observation, gingival blood vessels changed into extended glomerulus vascular loops (c).