Changes in vascular system during experimental tooth movement

Giancarlo Cordasco[1], Angela Militi[1], Valentina Nigrone[1], Giovanni Matarese[1], Marco Portelli[1], Antonina Pisani[2], Antonio Centofanti[2], Giuseppina Cutroneo[2]

[1] Department of Orthodontics, University of Messina, Italy
[2] Department of Biomorphology and Biotechnologies, University of Messina, Italy

Orthodontic tooth movement is characterized by remodeling changes in dental and paradental tissues, including dental pulp, periodontal ligament (PDL), alveolar bone, and gingiva. These tissues, when exposed to varying degrees of magnitude, frequency, and duration of mechanical loading, express macroscopic and microscopic changes. The activation of the vascular system in the compressed PDL is an indispensable process in periodontal remodeling during orthodontic movement. The initial response of the mechanically compressed or expanded periodontal tissue is release of vasoactive neuropeptides, the blood vessels respond with increased of permeability and extravasation of leukocytes into the interstitial tissue and activation of a variety of osteogenic cells. The aim of this study was to clarify the involvement of Vascular endothelial growth factor (VEGF) in periodontal tissue remodeling during orthodontic tooth movement. Vascular endothelial growth factor (VEGF) is mediator for angiogenesis, exert various biological functions such as vascular permeability and migration of human monocytes and is involved in bone resorption and formation. For the study we utilized a coilspring NiTi 50 gr. and in vivo samples of 15 maxillaries and mandibolar premolars of patients aged from 13 to 18 years subject to orthodontic treatment. These teeth was extracted at 7and 21 days from application of force respectively. The extraction of the PDL was effectuated scarifying the radicular surface on the pressure and tension side. The results were compared with periodontal ligament samples of the normal homologous teeth (control). The periodontal ligament samples were fixed in 3% paraformaldehyde in a 0,2M phosphate buffer at pH 7,4.The following primary antibodies mouse monoclonal anti-VEGF were used. Section were then observed and photographen using Zeiss LSM 510 confocal microscope. Were analyzed fluorescence intensity and compared with the control side. In the compressive side were strongly positive for VEGF at 1 wk after the start of tooth movement, suggesting that VEGF may be involved in the early stages of periodontal remodeling during orthodontic tooth movement, when occur rapid changes in local blood circulation. Moderate VEGF expression was also evident on the tension side. In the last observation periods at 21 days, VEGF signal showing insignificant decrease when compared with the control group. This can correspond to the period of regenerative processes in these same tissues which comprises deposition of new bone, with new regenerated fibrillar elements, which in turn replaces the previously increased vascular volume to control levels. These findings suggest that VEGF plays a crucial role in periodontal remodeling during orthodontic tooth movement by acting directly on bone resorption and formation and on angiogenesis.