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Cigarette Smoke Extract Alters Gene Expression in PDL Fibroblasts

Objectives: Fibroblasts are the primary cell of the periodontal ligament (PDL) and are responsible for the production of collagen and remodeling of the PDL by phagocytosing collagen fibers. Periodontal disease is increased among smokers in both incidence and severity. It is believed that the primary mechanism of this increase is the systemic effect of smoking, such as the inhibition of the immune response. This study looks at the direct effect that smoking has on PDL fibroblasts and their production of various matrix components and remodeling enzymes.

Methods: PDL cells were plated for one day and then treated with various concentrations of Cigarette Smoke Extract (CSE). PDL cell survival was quantified following exposure to CSE, and their ability to contract 3-dimensional collagen gels was examined. Changes in transcript expression following CSE treatment was compared using Reverse transcriptase PCR analysis for Matrix Metalloproteases (MMPs), Collagens, and Integrins.

Results: PDL cell induced collagen gel contraction was reduced at CSE concentrations about 1.5%. Treatment with CSE selectively increased the expression of Collagen 5 α 3 and decreased Collagen 11 α 1. CSE increase the expression of MMP-1 and MMP-3. CSE also increased the expression of Integrin α 2 (a collagen receptor).

Conclusions: This study shows that cigarette smoking does indeed have local effects on the cells of the periodontal ligament. CSE reduced PDL cell survival and their ability to contract collagen matrices. CSE also altered the expression of molecules known to provide the structural integrity of the ligament, by altering collagen synthesis, remodeling and cell adhesion.