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Inflammatory Changes Caused by Lipopolysaccharide in Odontoblasts

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Abstract : Objectives: Odontoblasts are the outermost cell layer of dental pulp and form the dentin. Importance of bacterial products, e.g. lipoteichoic acid (LTA), a cell wall component of Gram-positive bacteria and lipopolysaccharide (LPS), a cell wall component of Gram-negative bacteria, have been indicated in the pathogenesis of pulpitis. Gram-positive bacteria are more prevalent in superficial carious lesion while the amount gram-negative is higher in the deep lesions. Objective of this study was to investigate the effect of these bacterial products on inflammatory response of pulp tissue. Interleukins (IL) were of special interest. Various ILs have been observed in the dentin-pulp complex of carious tooth in vivo. Methods: Tissue culture method was used for testing the effect of LTA and LPS on human odontoblasts. Enzymatic isolation technique was used to extract living odontoblasts for cell cultures. DNA microarray and quantitative PCR (qPCR) were used to characterize the changes in the expression profile of the tissue cultured odontoblasts. Laser microdissection was used to cut healthy and affected dentin and odontoblast layer directly under carious lesion for experiments. Cytokine array detecting 80 inflammatory cytokines was used to analyze the protein content of conditioned culture media as well as dentin and odontoblasts from the carious teeth. Results: LPS caused increased gene expression IL-1α, and -8 and decrease of IL-1β, 12 , -15 and -16 after 1h treatment, while after 24h treatment decrease of IL-8, -11 and 23 mRNAs was observed. LTA treatment caused cell death in the tissue cultured odontoblasts but in in the cell culture but not in cell culture. Cytokine array revealed at least 2-fold down-regulation of IL-1β, -10 and -12 in response to LPS treatment. Cytokine array of odontoblasts of carious teeth, as well as LPS-treated tissue-cultured odontoblasts, revealed increased protein amounts of IL-16, epidermal growth factor (EGF), angiogenin and IGFBP-1 as well as decreased amount of fractalkine. In carious dentin, increased amount of IL-1β, EGF and fractalkine was observed, as well as decreased level of GRO-1 and HGF. Conclusion: LPS caused marked changes in the expression of inflammatory cytokines in odontoblasts. Similar changes were observed in the odontoblasts cut directly under the carious lesion. These results help to shed light on the inflammatory processes happening during caries.

Keywords : inflammation, interleukin, lipoteichoic acid, odontoblasts
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