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Titanium Surface Roughness Accelerates RANKL-dependent Differentiation in the Osteoclast Precursor Cell Line, RAW264.7

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Abstract:
The present study was a molecular analysis of the initial differentiation of osteoclast precursor RAW264.7 cells on titanium specimens. RAW264.7 cell line was cultured on titanium specimens of which the surfaces were finished by wet grinding with 2000-, 1200-, 600-, or 180-grit waterproof abrasive paper. Total RNA was extracted from cells cultured in the presence or absence of Receptor Activator of NF-κB Ligand (RANKL), prior to cDNA synthesis for real-time quantitative reverse transcriptase-polymerase chain reaction analysis. Titanium surfaces initially enhanced the expression of osteoclast differentiation markers including tartrate-resistant acid phosphatase and cathepsin K in RAW264.7 cells cultured with RANKL stimulation, in a roughness-dependent manner. The mRNA expressions of both RANKL receptor, RANK, and its adapter protein TNF receptor-associated factor 6 (TRAF6) increased when RAW264.7 cells were cultured on titanium specimens with roughened surfaces, as compared with that of control specimen with a polished surface. These results, taken together, suggested that titanium surface roughness facilitated osteoclast differentiation through the activation of the RANK-TRAF6 signaling network.

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