Zirconia, particularly, tetragonal zirconia polycrystals (TZP) have been used in medical and dental fields with their outstanding mechanical properties, biocompatible and esthetic performance. The importance of 3-dimensional (3-D) surface characterization in evaluating cellular response has been noted in addition to conventional 2-D surface characterization. Moreover, the synergetic effect with micro- and nano-topography was reported in enhancing the cell response on the biomaterial surfaces. This study aimed to clarify the influence of surface topography on osteoblast-like cell behavior to TZP. Mirror-polished; blasted with 50- or 150-µm alumina (SB50 and SB150); and SB150 acid-etched with hydrofluoric acid (SB150E) were prepared on TZP. Titanium specimen with alumina-blasted and acid-etched was also prepared as a control. The Sa (average roughness) and Sdr (developed interfacial area ratio) values were evaluated using an electron beam 3-D surface roughness analyzer (ERA-8900FE; Elionix, Tokyo, Japan). Initial attachment and proliferation assay of mouse osteoblast-like cells MC3T3-E1 were performed with WST-1-based colorimetry. In addition, alkaline phosphatase (ALP) activity as well as the gene expressions of type 1 collagen and osteocalcin was determined as a differentiation of the cells. Significantly higher Sdr values were obtained in the SB150E than in the other specimens despite no apparent difference in Sa values was observed between SB150 and SB150E, indicating that both micro- and nano-topographies produced on the SB150E surfaces. Although no clear differences were observed in initial cell attachment among specimens, the proliferation rate and expression of ALP activity on the SB150E specimens was significantly higher than those on the other specimens. These results indicate that the creation of micro- and nano-topographies on TZP by surface treatment offers a promising method for enhancing the proliferation and differentiation of MC3T3-E1 cells.

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