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In vitro evaluation of different surface topography for optimum cellular responses for bone substitutes

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Most of commercially prepared orthopedic prostheses are made of stainless steel, titanium or titanium alloys. However, being a developing country, accessibility of most of these materials are limited due to high cost of both raw materials and processing. Furthermore, the dimensions of most of the implants in the market are not appropriate for local patients. Thus, custom made prostheses have an advantage as the material used can be fashioned into desired dimensions with appropriate surface topography in order to furnish the local requirement. However, the material to be used should possess excellent biocompatibility and biofunctionality where optimum cellular response is one of the major requirements for the success of prostheses.

In the present study, we have used stainless steel (SS) due to their relatively low cost and reasonable corrosion resistance. Samples of 1cm diameter were prepared using SS AISI 316 L, (China) rods and polished using SiC papers (ATLAS, China) with different grit sizes: P100, P200, P600 and P1200, while keeping polishing time (30 min), speed (200 m/min) and the force of the machine (Inc-co Hand held belt sander, China) constant. All the samples were sterilized by gamma irradiation (Co-60, 25 KGy) after heating up to 200 ºC.

The cytotoxicity of SS after introducing different surface micro-structures was assessed by MTT assay and the cellular responses to different surface micro-structures were determined by evaluating cell proliferation, total DNA and total protein content using human osteoblast-like cell line (HOS CRL-1543, ATCC) *in- vitro*. Statistical analysis was done using GraphPad Prism5 (USA) software.

According to the results, samples of SS did not elicit any toxic substance and surface modification has not affected the surface chemistry. The surfaces abraded with P100 and P200 encouraged initial cell proliferation and subsequent cell growth whereas surfaces modified with P600 and P1200 encouraged long term cell proliferation and development while performance of P1200 was better. This preliminary study demonstrates rough surfaces encourage initial osteoblast-like cell proliferation whereas relatively smooth surfaces support long term cell proliferation which warrants further investigation to determine the effects of surface micro-structures on differentiation of cells and bone nodule formation.