Effect of pore size on mechanical attributes of bone mimicking biomaterial via computer simulation model

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ABSTRACT

Fabrication of bio-materials is a progressing field in the domain of tissue engineering. Synthetic bio-materials are a substitute to diseased tissue. In ideal condition the fabricated tissue must mimic native tissue structurally as well as functionally [1]. To match the fabricated material functionally, the material must demonstrate a biocompatible behaviour. Whereas for the material to be structurally close to the native tissue, the material must possess mechanical attributes that are near to the native tissue and also it must be strong enough to withstand forces acting on it when implanted in vivo. Millions are spent each year for research into development of biocompatible and tissue mimicking materials. However, little or no attention is paid to as how the fabricated material will behave under physiological conditions. Bone tissue engineering is one area where researchers put in efforts to develop bone substitutes that are claimed to be functionally and structurally near to native tissue. Usually, the researchers report biocompatibility of a material with great expertise but with less emphasis on the material properties. Our concern here is to save millions that are being spent each year without going through a proper biomaterial designing process. We propose that a material must first be designed through software then it must be analysed for its mechanical properties and then it must go through prototyping and biocompatibility tests. Bone is a porous tissue with great variation in pore size and porosities [2]. However, the effect of pore size on how the material will behave under mechanical forces *in vivo* is poorly characterised. In this study we report the effect of pore size (200, 400 & 800 µm) on the mechanical attributes of a synthetic polymer scaffold via computer simulation model. We designed the material on solid works with varying pore sizes and its deformation, stress and strain was analysed using ANSYS R15.0. It was observed that increasing the pore size may significantly reduce implant success. It can be suggested that anticipated site of implantation of a biomaterial must be given utmost importance with respect to the force it is going to withstand.

Keywords: *computational modelling, biomaterial properties, material modelling, biomaterial simulation.*

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