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Drilling Quantification and Bioactivity of Machinable Hydroxyapatite : Yttrium phosphate Bioceramic Composite

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Abstract : The use of Hydroxyapatite bioceramics as restorative implants is widely known. These materials can be manufactured by pressing and sintering route to a particular shape. However machining processes are still a basic requirement to give a near net shape to those implants for ensuring dimensional and geometrical accuracy. In this context, optimising the machining parameters is an important factor to understand the machinability of the materials and to reduce the production cost. In the present study a method has been optimized to produce true particulate drilled composite of Hydroxyapatite Yttrium Phosphate. The phosphates are used in varying ratio for a comparative study on the effect of flexural strength, hardness, machining (drilling) parameters and bioactivity.. The maximum flexural strength and hardness of the composite that could be attained are 46.07 MPa and 1.02 GPa respectively. Drilling is done with a conventional radial drilling machine aided with dynamometer with high speed steel (HSS) and solid carbide (SC) drills. The effect of variation in drilling parameters (cutting speed and feed), cutting tool, batch composition on torque, thrust force and tool wear are studied. It is observed that the thrust force and torque varies greatly with the increase in the speed, feed and yttrium phosphate content in the composite. Significant differences in the thrust and torque are noticed due to the change of the drills as well. Bioactivity study is done in simulated body fluid (SBF) upto 28 days. The growth of the bone like apatite has become denser with the increase in the number of days for all the composition of the composites and it is comparable to that of the pure hydroxyapatite.

Keywords : Bioactivity, Drilling, Hydroxyapatite, Yttrium Phosphate
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