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Development of a Vacuum System for Orthopedic Drilling Processes and Determination of Optimal Processing Parameters for Temperature Control

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Abstract : In this study, a vacuum system was developed for orthopedic drilling processes, and the most efficient processing parameters were determined using statistical analysis of temperature rise. A reverse engineering technique was used to obtain a 3D model of the chip vacuum system, and the obtained point cloud data was transferred to Solidworks software in STL format. An experimental design method was performed by selecting different parameters and their levels, such as RPM, feed rate, and drill bit diameter, to determine the most efficient processing parameters in temperature rise using ANOVA. Additionally, the bone chip-vacuum device was developed and performed successfully to collect the whole chips and fragments in the bone drilling experimental tests, and the chip-collecting device was found to be useful in removing overheating from the drilling zone. The effects of processing parameters on the temperature levels during the chip-vacuuming were determined, and it was found that bone chips and fractures can be used as autograft and allograft for tissue engineering. Overall, this study provides significant insights into the development of a vacuum system for orthopedic drilling processes and the use of bone chips and fractures in tissue engineering applications.

Keywords : vacuum system, orthopedic drilling, temperature rise, bone chips
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