

Investigation of Cutting Quality and Surface Roughness in Abrasive Water Jet Machining of Bone

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Abstract

The abrasive water jet machining is known as a cold cutting process, and can be effective for developing cut in the bone in orthopaedic surgery to prevent thermal necrosis. This research ~~has~~ examined surface roughness and cutting quality of bovine femur bone using abrasive water jet machining. Further, the effect of three parameters was studied including water pressure, traverse speed, and type of abrasive particles ~~has been studied~~. The feed rate of the abrasive particles was considered 100 gr/min, and the levels resulting obtained from pure water jet cutting, bone powder abrasive water jet machining, and sugar abrasive water jet machining were compared with each other. Application of bone powder as an abrasive particle caused improved surface quality, when compared with pure water jet, and in the best case, it resulted R_a and R_z values of 7.36 and 54.76 μm , respectively at the pressure of 3500 bar and traverse speed of 50 mm/min. ~~the~~ The minimum surface roughness was obtained using sugar abrasive particles at the pressure of 3500 bars and traverse speed of 50 mm/min. ~~the~~ The measured values of R_a and R_z parameters measured at the most desirable state were 3.87 and 19.72 μm , respectively. The results ~~indicated suggested~~ that use of sugar as an abrasive material, in comparison with pure water jet and bone powder water jet, ~~has~~ resulted in improved surface quality. Further, elevation of water pressure and reduction of traverse speed ~~have~~ had a significant effect on improving surface roughness.

Keywords

Bone, Orthopaedic Surgery, Abrasive Water Jet Machining, Abrasive Particles, Surface Roughness

Introduction