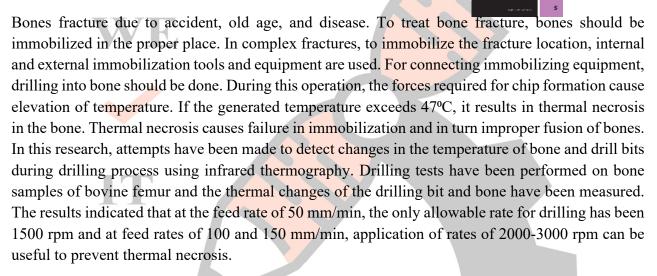
Experimental investigation of temperature rise in bone drilling with cooling: A comparison between modes of without cooling, internal gas cooling, and external liquid cooling

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Abstract



Keywords

Bone, Internal Fixation, Drilling, Temperature Rise, Thermal Necrosis, Infrared Thermography

Introduction

One of the most important stages of internal fixation of bone in the site of fracture is drilling. In the next stage, a self-tapering screw is closed for fixation of plug and cord at the site of the created hole. This process is influenced by different factors including plastic deformation of chips, friction between the drilling bit and chips, as well as friction between the chips and the hole wall. These result in heat generation in the drilling site. Part of the heat generated during bone drilling process can be transferred by blood stream and interstitial fluids. Some parts can also be transferred by the chips towards outside the hole. However, part of the generated heat is transferred to the bone through conduction heat transfer. On the other hand, heat conductivity coefficient of bone is poor. According to research, the heat conductivity coefficient of human bone in the cortical bone has been reported to be 0.38-2.3 W/mK [1]. This means that due to the poor heat conductivity of bones, the heat generated during the process is not able to be transferred rapidly from the bone to the surrounding environment, thereby causing localized temperature rise at the site of hole. Temperature rise at the site of drilling causes alteration of the nature of Alkaline phosphatase of the bone, which is a precursor for incidence of thermal necrosis, cell death, death of bone tissue, and diminished mechanical strength of the drilling site [2]. The bone strength is of importance in orthopedic surgery,