Biodegradable Magnesium Implants for Bone Repair

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Inert metal bone implants are commonly used to treat typical bone injuries but are often associated with complications such as stress shielding and refractures due to their stronger mechanical strength, and require a second surgery for removal, leading to increased healthcare costs and morbidity. Conversely, magnesium-based bone implants are biocompatible and biodegradable, but they have a high rate of corrosion that may cause the implant to degrade before the bone fracture heals, limiting their use in clinical practice. If the grain sizes of the magnesium samples are refined through melt processing, this will enhance the mechanical properties of the sample and reduce the rate of corrosion. In this experiment, a magnesium composite containing 94 weight(wt)% pure magnesium, 2 wt% scandium, and 2 wt% strontium alloy incorporated with 2% bioactive glass nano ceramic particles (Mg-2Sc-2Sr-2BG) was prepared to see how the fabrication process of the magnesium composite affects grain size and mechanical properties when compared with pure magnesium (Pure Mg). Commercial magnesium was used as a control. Microstructure analysis and the mechanical testing revealed that the smaller grain size correlated with the magnesium sample's mechanical strength. The smaller grain sizes and uniform shape and distribution of the grains and bioactive glass resulted in the mean elastic modulus, compressive strength and yield strength of the magnesium composite being close to that of the human cortical bone, suggesting that it has the most favorable mechanical properties for a magnesium-based bone implant. These results shed light on the development of new magnesium-based bone implants, which can potentially revolutionize the treatment of bone injuries.

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