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An experimental sheep model for large bone critical defect reconstruction with 3D biomimetic porous titanium (Ti6Al4V) scaffolds

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The main goal of the treatment of large bone defect is directed to guarantee a precocious loading of the affected limb. In this paper, the authors propose a new experimental approach using biomimetic porous titanium scaffold made with Electron Beam melting technology that evidenced to be suitable to reach the purpose. An *in vivo* study was undertaken performing a complete resection in the diaphysis of the right tibia of six sheep, replaced with a five centimeters framework of EBM-sintered titanium. After surgery, the sheep were allowed to move freely in the stables. The outcome was evaluated by periodical X-ray and clinical investigations with a follow-up of 12 months. At 12 months, the sheep were euthanized and the tibia were subjected to histological analysis. After nine months, the plates were removed and X-ray showed a remodelling of periosteal callus with a well-defined cortical bone and the scaffolds were completely integrated in the diaphysis. The histological investigations were executed on bone-metal interface and showed bone growth among the titanium bars, bone trabeculae have bridged the titanium trabeculae suggested a good tissue-metal interaction. This implant, used to repair large bone critical defects in a large animal model, can guarantee the immediate body weight-bearing, a precocious functional recovery while the geometry of the porous implants seems to promote osteointegration. In conclusion, this kind of implant, used to repair large bone critical defects in a large animal model, can guarantee the desirable immediate bodyweight-bearing, a precocious functional recovery and a good osteointegration.

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