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A microsurgery boosted bone tissue engineering and regenerative medicine strategy

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Bone tissue engineering and regenerative medicine have achieved certain clinical success since the first clinical report of Quarto R et al in 2001, however, their widespread application in clinical setting has yet to be attained. Insufficient vascularization after the implantation of tissue-engineered bone grafts (TEBG) is generally considered as one of the key bottleneck factors. As the microsurgeons and clinician scientists, we are one of the first few groups in the world to conceive the idea to utilize microsurgical technique for prevascularization of TEBG during the implantation, providing grafts with instantaneous blood perfusion for a better survival and therapeutic outcome. We have established a microsurgical prevascularization technique by separating and inserting the surrounding vascular bundle into the TEBG, which is generated by seeding mesenchymal stem cells into the β -tricalcium phosphate scaffold. We have investigated the use of this microsurgical technique to prevascularize TEBG for treating critical-sized long bone defect in a number of animal models including mice, rat, rabbit, goat and rhesus monkey. Results from different animal models all demonstrated that compared to the non-vascularized TEBG, the implantation of microsurgically prevascularized TEBG can significantly enhance the new bone regeneration in the large bone defect with earlier defect union, improved mechanical properties and more neo-bone tissue formation. Furthermore, it was observed that prevascularized TEBG possessed significantly higher amount of capillary infiltration than the non-vascularized TEBG throughout the whole study with increased endogenous vascular endothelial growth factor (VEGF) expression. In conclusion, our studies demonstrated the clinical merit and the promising potential to apply microsurgical technique in bone tissue engineering and regenerative medicine and this microsurgical prevascularization procedure can couple with the implantation of TEBG to boost the therapeutic efficacy of TEBG for large bony defect treatment, especially in the load bearing applications.

Biography

Pei Guoxian has completed his Ph.D at the age of 25 years from First Military Medical University. He is the Professor and Chairman of Department of Orthopaedic Surgery, Xijing Hospital, The Fourth Military Medical University; He was served as the fifth Academic Degree Committee of the State Council subject review group, National Prize for progress in science and technology evaluation expert, The general secretary of International composite tissue allotransplantation, the member of Aian Orthopaedic Trauma Association, the Chairman of Chinese Microsurgery Society, the Chief Editor of Chinese Journal of Orthopaedic Trauma, the guest professor of Texas University.

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