

Enhanced Osseointegration of Bone-implant Interface by BMP-2 Gene Medication

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INTRODUCTION: The purpose of the study is to investigate the effects of BMP-2 gene therapy for the reconstruction of peri-implant bone defect and peri-implant osteolysis on the bone-implant interface.

METHODS: A 3mm bone defect around Ti alloy implant was created in bilateral lateral femur condyle of 18 adult Beagle dogs. (1) In the 28 defects of 14 dogs, two defects were left empty as blank group. By means of impaction grafting technique, the other 26 defects were filled with freeze-dried allograft, freeze-dried allograft loading autogenous bone marrow stromal cells (BMSCs) or freeze-dried allograft loading autogenous BMSCs transfected by Adv-BMP2 gene. (2) TiAlV particles were injected into bone-implant interface of 8 defects of the other 4 dogs for inducing peri-implant osteolysis. Eight weeks after injection, revision surgeries were performed and the osteolysis area were filled with freeze-dried allograft or freeze-dried allograft loading autogenous BMSCs transfected by Adv-BMP2 gene.

The healing and osseointegration of bone-implant interface were evaluated by histological, histomorphometric and biomechanical investigations at 6th weeks and 12th weeks after implantation.

RESULTS: The results were summarized as follows. (1) Histologically, at 6th weeks, new bone formation was found on the implant surface in gene group, and point contact between bone and implant was observed, the bone-implant contact (BIC) ratio was around 10%. And only soft tissue was found at bone-implant interface in all other groups. At 12th weeks, there was thick soft tissue membrane between new bone and implant in the blank group. In non-cell group and cell group, most of the interface was filled by connective fibrous tissue with point contact between bone and implant and BIC ratio was lower than 10%. In gene group, the interface was mainly filled by bone tissue and area contact between bone and implant was found, the BIC ratio was significantly higher than all the other groups ($P < 0.001$). The

mechanical strength of interface increased by time in all groups, with the gene group far higher than others at all the post-op. times ($P < 0.001$).

(2) Eight weeks after the TiAlV particles injection, typical osteolytic changes were found around the implant. At 12th weeks after revision, the BIC ratio and strength of interface in gene therapy group were higher than those of freeze-dried bone group.

CONCLUSIONS: As a conclusion, BMP-2 gene therapy can enhance the osseointegration of bone-implant interface. The results of management of peri-implant osteolysis could be improved by using IBG technique combined BMP-2 gene medication.