Introduction: Spinal fusion surgery is a common procedure for the treatment of various spinal diseases. Several growth factors, including BMP-2 and OP-1 have been used in spinal fusion for the induction of bone formation, but complications have been reported due to the lack of suitable carrier. The aims of this study is to examine the efficacy of osteoconductive carrier, Insoluble Bone Gelatin (ISBG), for OP-1 in rabbit lumbar intertransverse process fusion model.

Materials and Methods: NZW rabbits (n=32) underwent lumbar intertransverse process fusion procedures at L5-L6. The animals were divided into four groups based on the materials implanted: (1) Autograft group, (2) ISBG group, (3) OP-1 group and (4) ISBG+OP-1 group. Spinal fusion masses were evaluated by manual palpation, radiographic, micro-CT Scanning, biomechanical testing, and histological analysis 6 weeks after surgery.

Results: The ISBG+OP-1 group demonstrated significantly higher fusion rates (P<0.05) based on manual palpation, higher radiographic scores (P<0.05) and greater bone volume in micro-CT than other groups. In biomechanical testing, the fusion masses of ISBG+OP-1 group had less range of motions than other groups (P<0.05). Mature new bone formation was observed covering the surface of transverse processes in all four groups in histological findings. Continuous trabeculae connected two transverse processes in ISBG+OP-1 group. In other groups, obvious gaps were noted in fusion masses.

Discussion: Although the osteoinductive ability of growth factors has been assessed in many in vitro experiments, there isn't a suitable carrier for these exogenous growth factors in the induction of bone formation. In this study, we have shown that ISBG+OP-1 group demonstrated significantly higher fusion rate, radiographic scores and bone volume than other groups. Biomechanical testing also showed that fusion masses induced by ISBG+OP-1 led to significant ROM decreases in main direction motion than other three groups. In conclusion, ISBG is effective as a carrier of growth factor OP-1 in a rabbit posterolateral intertransverse model, which closely simulates the lumbar arthrodesis procedure commonly performed in human. This type of carrier allows earlier and stronger fusion. These encouraged results support continued human clinical trials to select the optimal formula as a bone substitute in spinal fusion.