Investigation on Pullout Strength between Different Design of Cannulated Pedicle Screw and Osteoporosis Bones to Obtain an Optimum Design

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Abstract:
Pedicle screws are widely used for the treatment of spinal instability by spine fusion. This treatment can be performed at any level in the spine (cervical, thoracic or lumbar) and prevents any movement between the fused vertebrae. However screw loosening is a major problem of spine fusion, contributing to delayed patient recovery. This appears to be a minor problem for fixation and fusion of healthy, non-osteoporotic bone. Screw loosening happen when insertion torque and angle that are not suitable for pedicle screw which affected the screw pullout strength. Based on optimum torque and angle in finite element analysis, loosening of screw in spine fusion can be minimized by increasing the screw pullout strength. The highest of pull out strength can minor the loosening of screw. Four insertion angle of pedicle screw were used which are 0°, 10°, 20° and 30°. Besides that, effect of insertion torque on pullout strength can be seen on Equivalent von Mises stress value when applied three value of moment to pedicle screw-bone with constant of insertion angle. The lowest stress for pedicle screw can give a better fixation with bone and thus can increase the pullout strength. We found that the insertion angle 10° give higher pullout strength of pedicle screw-synthetic bone which indirectly will minimizing the effect of the screw loosening from bone. Besides that, insertion torque with 1200 Nm give a lower Equivalent von Mises stress which it cause the less effect on fixation between screw and bone and thus has potential in minimizing the loosening to pedicle screw.

Keywords: Pedicle Screw; Finite Element Analysis; Screw Loosening; Insertion Torque And Angle; Optimization

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