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Title	Biomechanical analysis of screw configurations on plate fixation in humeral shaft fracture: A Finite element analysis
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Abstract

A standard technique of humeral shaft fracture treatment is plate and screw fixation. Bicortical screws are commonly used for fixing in this procedure. However, several previous studies reported that the tip of bicortical screws could damage the surrounding radial nerve. To avoid the problem of nerve injury, this study evaluated various optimization of screw fixation configurations in the humeral shaft fracture treatment which did not penetrate to the nerve region using finite element analysis. Simplified humerus fracture models were fixed by six different configurations of various screw lengths. All models were tested virtually under axial compression, torsion, and bending conditions. The construct stability was determined by stiffness, relative displacement, and von Mises stress output parameters. The non-inserted screw at the risk area of the radial nerve injury model provided lower stability, when considered by the lowest stiffness in torsion, the highest relative displacement in torsion and bending, compared to other configurations. For the prediction of von Mises stress, the model of all unicortical screws fixation configuration provided the highest magnitude. There was not any difference of the stress occurring when replacing among bicortical, unicortical, and unicortical abutting inserted techniques at the high-risk location. These results revealed an equivalent performance when using either unicortical or unicortical abutting screw fixations at the high-risk position, which might introduce the screw fixation configurations to reduce the risk of radial nerve injury.