Biomechanical Evaluation of Intervertebral Fusion Process After Anterior Cervical Discectomy and Fusion: A Finite Element Study.

Objective

A solid interbody fusion is of critical significance in achieving satisfactory outcomes after anterior cervical discectomy and fusion (ACDF). However, the current radiographic techniques to determine the degree of fusion are inaccurate and radiative. This study aims to explore the feasibility of reflecting the fusion status after ACDF through the load changes borne by the interbody fusion cage.

Methods

The computed tomography (CT) scans preoperatively, immediately after surgery, at 3 months, and 6 months follow-up of a patient who underwent ACDF at C5/6 were used to construct the C2-C7 finite element (FE) models representing the different course of fusion stages. The Von Mises stress at the surfaces of instrumentation and the adjacent intervertebral disc and force at the facet joints were analyzed.

Results

The stress on the surfaces of the titanium plate and screws significantly decreased at 3 months and 6 months follow-up. A markedly changed stress distribution in extension among the three models was noted in different fusion stages. After solid fusion is achieved, the stress was more uniformly distributed interbody fusion in all loading conditions.

Conclusion

The stress on the surfaces of cervical instrumentation remarkably decreased in all loading conditions. After solid intervertebral fusion formed, the stress distributions on the surfaces of the interbody cage and screws were more uniform. The stress distribution in extension altered significantly in different fusion statuses.

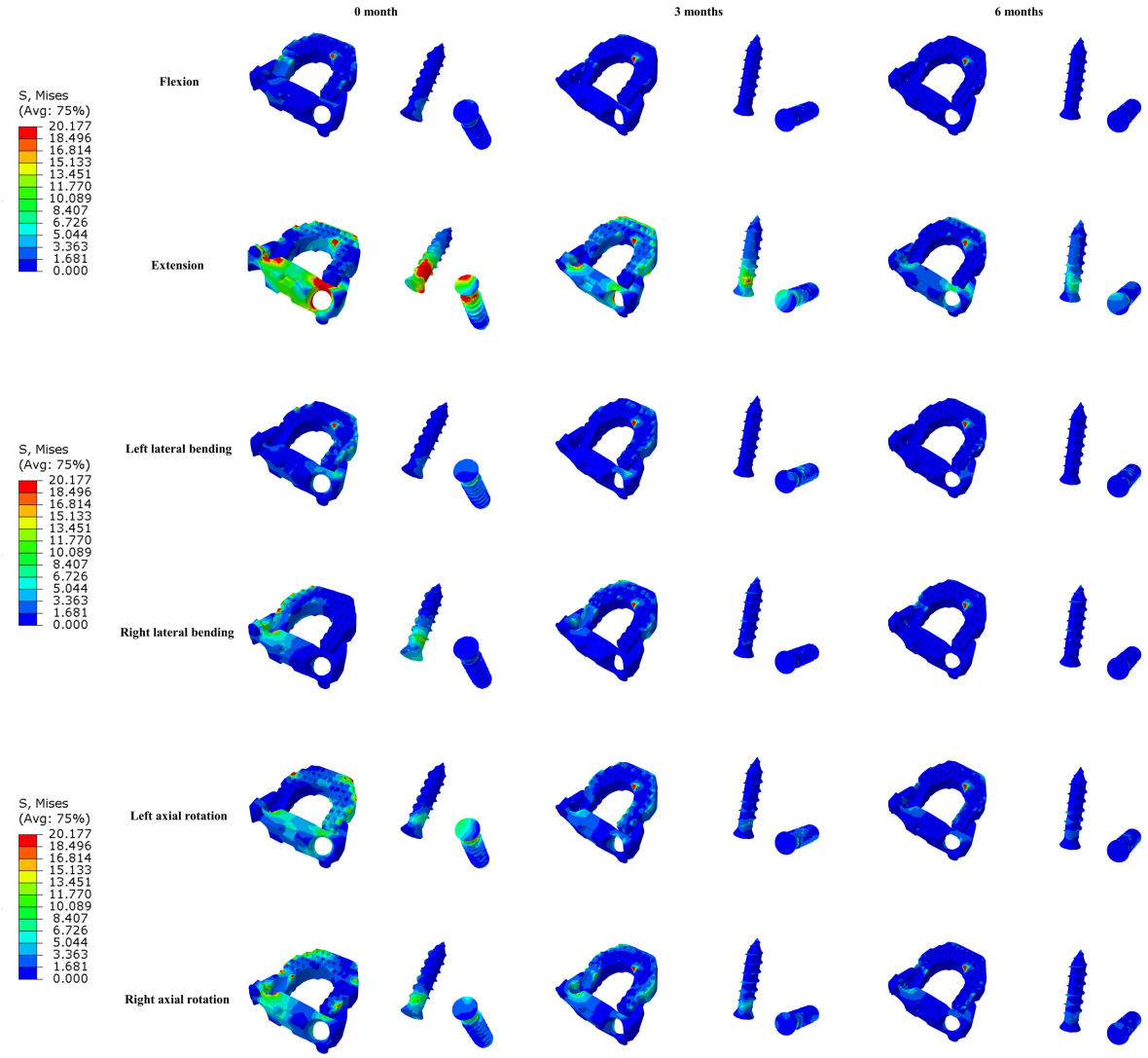

Fig. 6. The Von Mises stress distribution on the surfaces of interbody fusion cage and screws at different fusion stages in all loading conditions.