eP-03

Effects of Assembled Titanium Mesh Cage on the Improvement in Biomechanical Performance of Single-level Anterior Cervical Corpectomy and Fusion: A Finite Element Analysis

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Background: Anterior cervical corpectomy and fusion (ACCF) with Traditional Titanium Mesh Cages (TTMCs) can lead to complications such as cage subsidence, dysphagia, and implant-related issues. These complications suggest that the biomechanical stability of ACCF with TTMC may be insufficient. This study aims to evaluate whether a new Assembled Titanium Mesh Cage (ATMC) can improve the biomechanical performance after ACCF.

Methods: ACCF procedures using both TTMC and ATMC models were constructed and compared. The range of motion (ROM) of the surgical segments and stress peaks in various regions including the endplate, bone-screw interface, facet joints, and adjacent intervertebral discs were analyzed.

Results: The use of ATMC significantly reduced the postoperative ROM of the surgical segments by 80.7%-82.0% compared to ACCF with TTMC. Additionally, stress peaks at the endplate, bone-screw interface, and facet contact force (FCF) were higher in ACCF with TTMC compared to ATMC. TTMC also induced higher stress peaks in the C3/4 and C6/7 intervertebral discs (ranging from 0.2009-6.961 MPa and 0.2477-4.735 MPa, respectively), followed by the ATMC (ranging from 0.1322-3.820 MPa and 0.2227-4.104 MPa, respectively).

Conclusions: The utilization of ATMC, which includes enlarged spacers and emulates endplate geometries, effectively reduces the risks of cage subsidence and instrument-related complications in ACCF. Furthermore, ACCF with ATMC also decreases the risks of dysphagia, facet joint degeneration, and adjacent disc degeneration during the follow-up period by altering the fixing method while maintaining construct stability.

Fig. 1

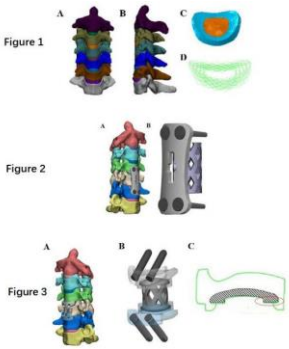

Fig. 2

Table 1. Material Properties Assigned to the Finite Element Model

Component	Element Type	Young Modulus (MPa)	Poisson Ratio	Cross-Sectional Area (mm^2)
Cortical bone	C3D4	12000	0.3	
Cancellus bone	C3D4	450	0.3	
Nucleus pulpous	C3D8H	1	0.49	
Screws	C3D4	110000	0.3	
Annulus fibers	T3D2	110	0.3	
Cages	C3D4	110000	0.3	
Anterior Longitudinal	T3D2	10	0.3	6.0
Posterior Longitudinal	T3D2	10	0.3	5.0
Capsular	T3D2	10	0.3	46.0
Ligamentum Flavum	T3D2	1.5	0.3	5.0
Interspinous	T3D2	1.5	0.3	10.0
Supraspinous Ligament	T3D2	1.5	0.3	5.0
Spacers	C3D4	110000	0.3	
Facet joint Cartilage	C3D4	10.4	0.4	
Endplates	C3D4	5.6	0.3	
Titanium alloy	C3D4	110000	0.3	

PEEK: polyetheretherketone.

Fig. 3

Figure 4

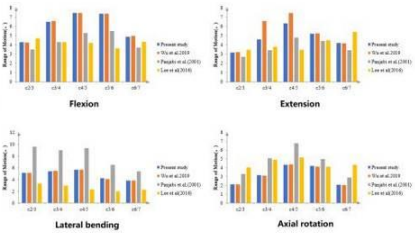

Figure 5

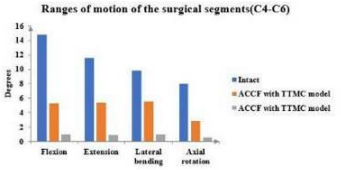

Figure 6

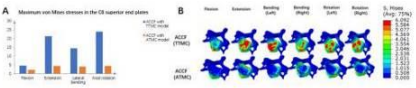

Fig. 4

Figure 7

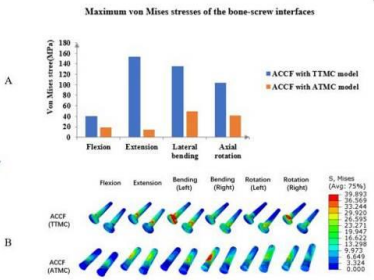

Figure 8

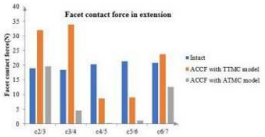

Fig. 5

Figure 9

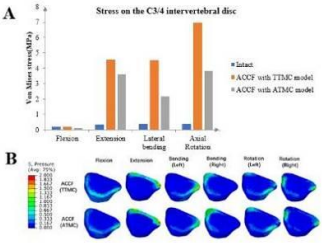

Figure 10