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Mechanical properties of an elastically deformable cervical spine implant

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Title: Mechanical properties of an elastically deformable cervical spine implant.

Background: Anterior cervical surgery is widely accepted and time-tested surgical procedure for treating cervical radiculopathy and myelopathy. However, There is concern about the high adjacent segment degeneration rate and implant subsidence after the surgery using the traditional polyetheretherketone cage.

Research question: We creatively designed a polyurethane cervical implant that can continuous load-sharing through elastic deformation and decrease postoperative stress concentration at adjacent segments.

Design: A biomechanical test.

Methods: The design rationality and safety of this novel implant was evaluated based on several mechanical parameters including compression test, creeping test, push-out test and subsidence test.

Results: The results showed that the novel cervical implant remained intact under the compressive axial load of 8000 N and continues to maintained the elastic deformation phase. The minimum push-out load of the implant was 181.17 N, which was significantly higher than the maximum compressive shear load of 20 N experienced by a normal human cervical intervertebral disc. Besides, the creep recovery behaviour of the implant closely resembled what has been reported for natural intervertebral discs and clinically applied cervical devices in literature. Under the load of simulating daily activities of the cervical spine, the implant longitudinal displacement was only 0.54 mm.

Discussion: In conclusion, this study showed that the current design of the elastically deformable implant was reasonable and stable to fulfil the mechanical requirements of a cervical prosthesis under physiological loads. After a more comprehensive understanding of bone formation and stress distribution after implantation, this cervical implant is promising to be applied to certain patients in clinical practice.

Fig. 1

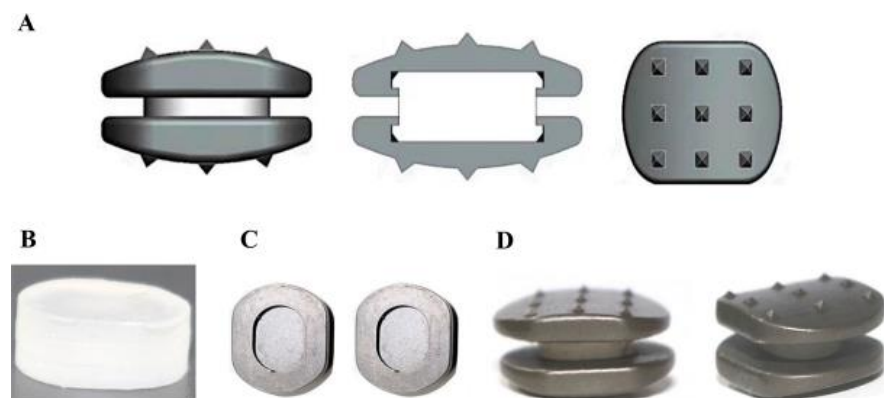


Fig. 2

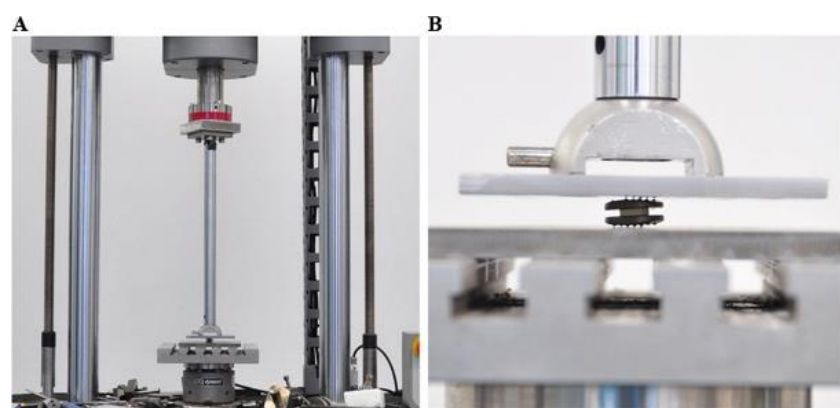


Fig. 3



Fig. 4

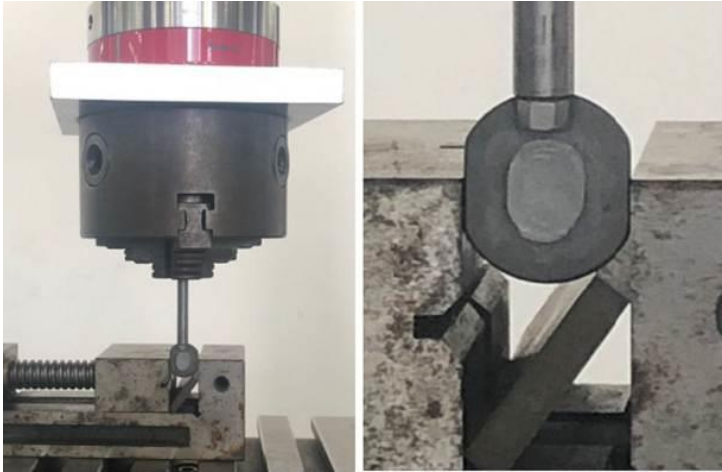


Fig. 5

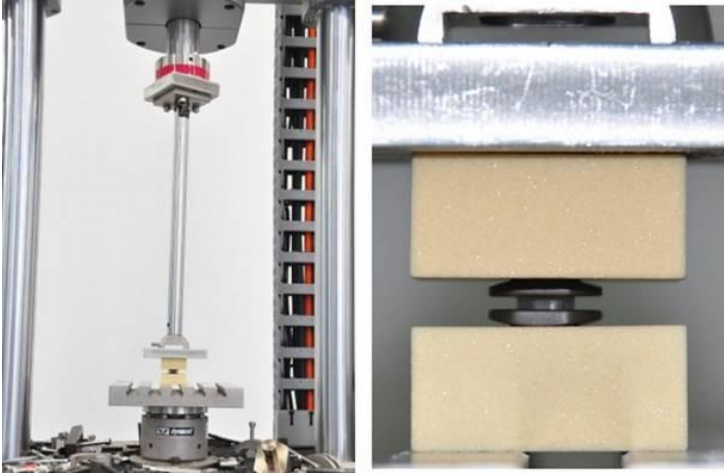


Fig. 6

