

## Letter to Editor

# Biomechanical analysis of cervical range of motion and facet contact force after a novel artificial cervical disc replacement

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We read with great interest the study published by Zhao et al. [1] in *American Journal of Translational Research* entitled "Biomechanical analysis of cervical range of motion and facet contact force after a novel artificial cervical disc replacement". The authors designed a novel artificial disc prosthesis based on the physiological convex of cervical endplate, with the advantage of maintaining the integrity of the vertebral endplate and increasing the contact area between the prosthesis and endplate. An in vitro test with cadaveric cervical specimens was conducted to study its effect on cervical range of motion (ROM) and facet contact force compared with Prestige LP and anterior cervical discectomy and fusion (ACDF). They found that the novel cervical prosthesis could preserve the normal cervical ROM and facet joint force similarly with Prestige LP, and both better than ACDF. This is a significant study commending a novel cervical prosthesis which is more suitable for cervical endplate. However, we believed that the method in the evaluation of the ROM of adjacent levels was in a controversial area.

In the study, the three-dimensional motion testing was performed through the pure moment-input method, by applying an axial preload of 50 N to the C2 vertebra to simulate head weight, and a pure moment of  $\pm 2.0$  N-m was applied to simulate flexion-extension, lateral bending and axial rotation. They found the ROMs of adjacent levels showed no statistical difference in different groups.

However, the pure moment-input method is not appropriate to evaluate adjacent-level effects (ALE). Because this method produces the same moment at all spinal levels. The adjacent levels will not be affected no matter which kind of prosthesis is implanted.

The Hybrid test method, which was first presented by Panjabi et al. [2], may be an alternative one. In the Hybrid test method, the unconstrained pure moment is applied using standard Flexibility method to produce no-injury intervertebral motions, then the total ROM ( $tROM_{Intact}$ ) could be measured. After the implantation of prosthesis, the spinal construct is subjected to increasing pure unconstrained moment until the total range of motion of the construct ( $tROM_{Construct}$ ) equals  $tROM_{Intact}$ . The ROM of adjacent levels could be calculated by the formula:  $ALE_{ROM} (\%) = 100 \times (iROM_{Construct} - iROM_{Intact}) / iROM_{Intact}$ , where  $iROM$  is the intervertebral range of motion at the adjacent level. Accuracy of the multidirectional Hybrid method, which uses the popular unconstrained pure moment to produce well defined rotation-input had been verified by many studies [3-5]. We believe it could be more appropriate to evaluate the ROM of adjacent levels.

### Disclosure of conflict of interest

None.

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## Letter to the Editor

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