Cervical Disc Arthroplasty Models

Cervical disc arthroplasty with a keel-less prosthesis can be a safe and effective alternative to fusion for degenerative disc disease in selected patients, with a possible reduction of adjacent segment degeneration (ASD) [1].

Baguera.

Bryan

Discover.

Kineflex C

Mobi-C

PCM

Prestige.

Prodisc C.

Secure-C

see Hybrid cervical disc arthroplasty.

Cervical total disc replacement devices

In the United States, cervical total disk arthroplasty (TDA) is US Federal Drug Administration (FDA) approved for use in both 1 and 2-level constructions for cervical disc disease resulting in myelopathy and/or radiculopathy. TDA designs vary in form, function, material composition, and even performance in vivo. However, the therapeutic goals are the same: to remove the painful degenerative/damaged elements of the intervertebral discoligamenous joint complex, to preserve or restore the natural range of spinal motion, and to mitigate stresses on adjacent spinal segments, thereby theoretically limiting adjacent segment disease (ASDis). Cervical vertebrae exhibit complex, coupled motions that can be difficult to artificially replicate. Commonly available TDA designs include ball-and-socket rotation-only prostheses, ball-and-trough rotation and anterior-posterior translational prostheses, as well as unconstrained elastomeric disks that can rotate and translate freely in all directions. Each design has its respective advantages and disadvantages. At this time, available clinical evidence does not favor 1 design philosophy over another. The superiority of cervical TDA over the gold-standard anterior cervical discectomy and fusion is a subject of great controversy. Although most studies agree that cervical TDA is at least as effective as anterior cervical discectomy and fusion at reducing or eliminating preoperative pain and neurological symptoms, the clinical benefits of motion preservation- that is, reduced incidence of ASDis-are far less clear. Several short-to-mid-term studies suggest that disk arthroplasty reduces the radiographic incidence of adjacent segment degeneration; however, the degree to which this is clinically significant is disputed. At this

time, TDA has not been clearly demonstrated to reduce symptomatic ASDis [2].

Biomechanical analysis

Scarce references could be found and compared regarding the cervical ADR devices' biomechanical differences that are consequently related to their different clinical results.

One fusion device (CJ cage system, WINNOVA) and three different cervical artificial discs (Prodisc-C Nova (DePuy Synthes), Discocerv (Scient'x/Alphatec), Baguera C (Spineart)) were inserted at C5-6 disc space inside the FE model and analyzed. Hybrid loading conditions, under bending moments of 1 Nm along flexion, extension, lateral bending and axial rotation with a compressive force of 50 N along the follower loading direction, were used in this study. Biomechanical behaviors such as segmental mobility, facet joint forces, and possible wear debris phenomenon inside the core were investigated.

The segmental motions as well as facet joint forces were exaggerated after ADR regardless of type of the devices. The Baguera C mimicked the intact cervical spine regarding the location of the center of rotation (COR) only during the flexion moment. It also showed a relatively wider distribution of the contact area and significantly lower contact pressure distribution on the core compared to the other two devices. A 'lift off' phenomenon was noted for other two devices according to the specific loading condition.

The mobile core artificial disc Baguera C can be considered biomechanically superior to other devices by demonstrating no 'lift off' phenomenon, and significantly lower contact pressure distribution on core [3].

1)
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3)
Lee JH, Park WM, Kim YH, Jahng TA. A biomechanical analysis of an artificial disc with a shock-absorbing core property by using whole-cervical spine finite element analysis. Spine (Phila Pa 1976). 2016 Jan 27. [Epub ahead of print] PubMed PMID: 26825785.