Joint Event
11th International Conference on
OSTEOPOROSIS, ARTHRITIS & MUSCULOSKELETAL DISORDERS
&
10th INTERNATIONAL CONFERENCE ON ARTHROPLASTY
December 04-05, 2017 | Madrid, Spain

An *in vivo* study of three artificial cervical discs: Are unconstrained designs susceptible to migration?

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Statement of the Problem: Artificial cervical discs (ACDs) have been used, instead of the conventional ACDF in the military. ACDs have potential advantages of motion preservation and reduction of adjacent segment degeneration. Disc implants are classified as constrained, semi-constrained, and unconstrained device types. There have been independent reports of anterior migration and, sometimes disintegration, of non-constrained artificial discs. *In vivo* studies investigating the potential migration of the artificial disc are limited.

Purpose: The objective of this study is to examine the migration aspects in cervical discs using an *in vivo* model capable of simulating the axial load on the neck, and this mimics the human.

Methods: C3-C4 ACD was performed with commercial implants in twelve adult alpine caprines. There were three groups: Group A received constrained; group B received semi-constrained; group C received unconstrained ACD. Intra- and postoperative radiographs were performed to confirm hardware position. Goats were monitored for six months postoperatively. All goats tolerated cervical arthroplasty well and had satisfactory placement of the ACD implant on intra-operative radiography. There was no migration of the implants in Groups A and B. Complete anterior extrusion of the inferior plate out of the disc space and disintegration of the implant occurred within one week after surgery in three goats in Group C. The fourth goat had anterior extrusion at five weeks.

Conclusions & Significance: Biomechanical responses under flexion/extension loading depend on the type of the ACD. Unconstrained ACD implants rely on axial loading and limited range of motion of the disc segment to preserve integrity. Unconstrained ACD implants may not be the most efficacious in individuals with a hypermobile neck and/or occupation involving head supported mass/helmets resulting in additional axial loads and repetitive motions of the cervical spinal column regions.

Recent Publications

1. Alvin MD, et al. (2014) Cervical arthroplasty: a critical review of the literature. The Spine Journal 14 (9):2231-2245.
2. Ozbek Z, et al. (2017) Implant migration in cervical disk arthroplasty. World Neurosurgery 97:390-397.
3. Tsermoulas G and Bhattathiri PS (2013) Anterior migration of prosthesis following cervical arthroplasty. British Journal of Neurosurgery 27(1):132-133.
4. Wagner S C, et al. (2014) Implant migration after Bryan cervical disc arthroplasty. The Spine Journal 14(10):2513-2514.
5. Wagner S C, et al. (2016) Traumatic migration of the bryan cervical disc arthroplasty. Global Spine Journal 6(1): e15-20.

Biography

Jamie L Baisden is a Professor of Neurosurgery at the Medical College of Wisconsin specializing in Complex Spine. She has completed fellowships in Complex Spinal Surgery and Spinal Cord Medicine and has a Master's in Medical Management from USC. Her research interests include spinal biomechanics, spinal trauma, and evidence based medicine guideline development for spinal disorders.

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