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Comparative Finite Element Modeling Study of Anterior Cervical Arthrodesis versus Cervical Arthroplasty

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Disclosures



- Disclosures-No Relevant Disclosures

Introduction & Background

Cervical disc arthroplasty (CDA) has the potential advantage over ACDF&P by:

Preserving ROM

Lessening adjacent segment degeneration

Potentially decreasing the need for adjacent level surgeries

Hypothesis:

3 different CDA's show the potential advantages of CDA over ACDF&P, however different designs and different constraints will affect spine kinematics.

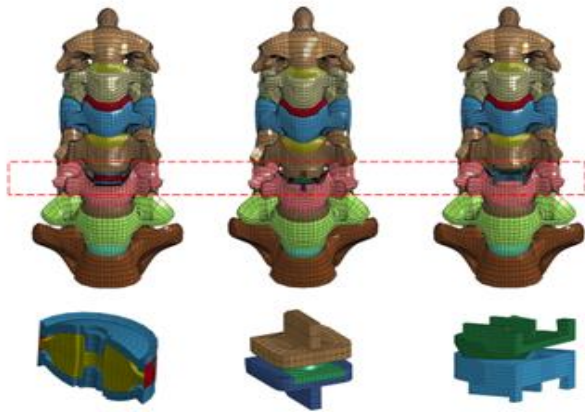
Material and Methods:

3 different CDA were tested in a validated subaxial C-spine finite element model at the C5-6 level using both pure moment at 2 Nm and hybrid moment assessing the range of motion (ROM), intradiscal pressures, and facet loads at the index, and adjacent rostral and caudal levels and compared to intact.

Results

ACDF&P

- Increased motion both cephalad and caudal to the fusion
- Increased Facet Forces at adjacent levels
- Increased Intradiscal pressures
- Decrease posterior column loads, and intradiscal pressures



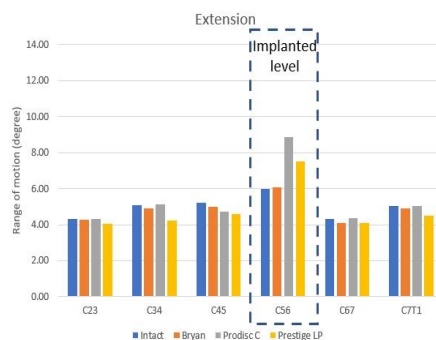
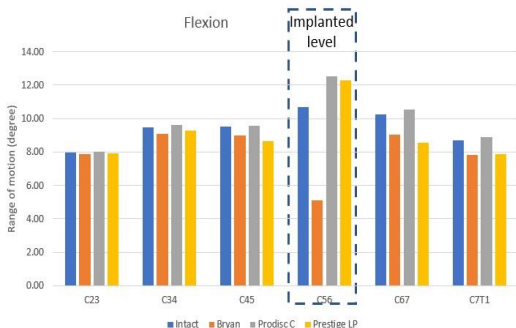
Finite element modeling of C5-6 cervical total disc replacement with Bryan, Prodisc C and Prestige LP (from left to right)

Cervical Disc Arthroplasty

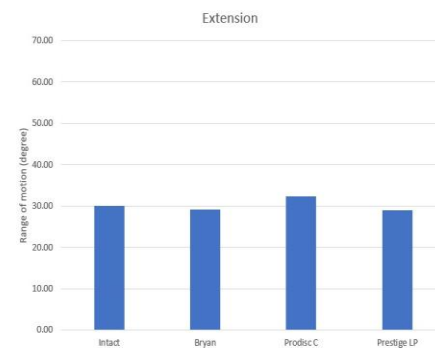
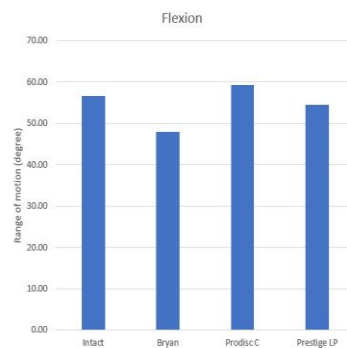
- The Metal on Polymer 2-piece (ProDisc-C) and the metal on metal 2-piece (Prestige-LP):
- both resulted in Increased Motion at the index level & Increased Facet Forces at the index level
- Prestige-LP and ProDisc-C both decreased ROM, facet forces at cephalad and caudal adjacent levels
- Prestige-LP and Bryan increased intradiscal pressures at adjacent segments
- The index level showed Increased posterior column loads with all 3 CDA's compared to ACDF&P
- The 1- piece CDA (Bryan) produced a less dramatic biomechanical alteration than the Prestige-LP or Prodisc-C

Results

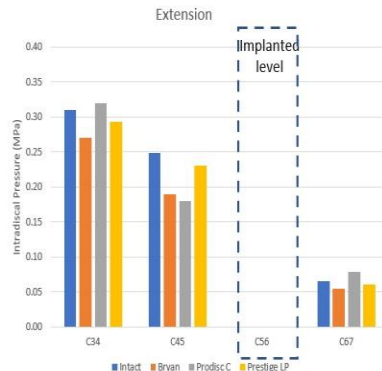
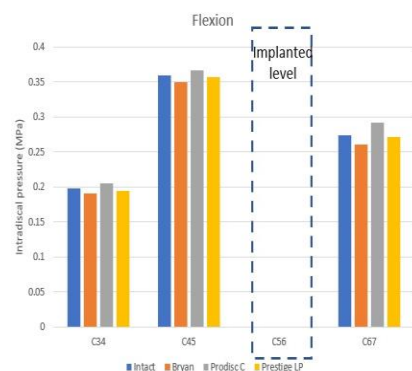
Range of motion



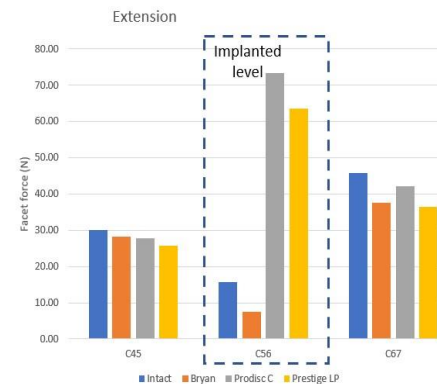
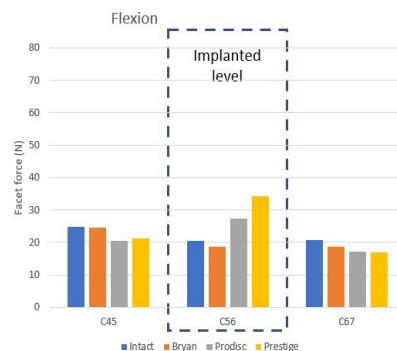
Total Range of Motion (C2-T1)



Intradiscal Pressure



Facet Forces



Conclusion/Discussion

ACSD&P almost eliminated motion at the index level while it increased ROM both above and below at adjacent levels

The 2-piece CDA's both demonstrated more ROM at index level and less ROM at each adjacent level but shifts loads to the posterior column

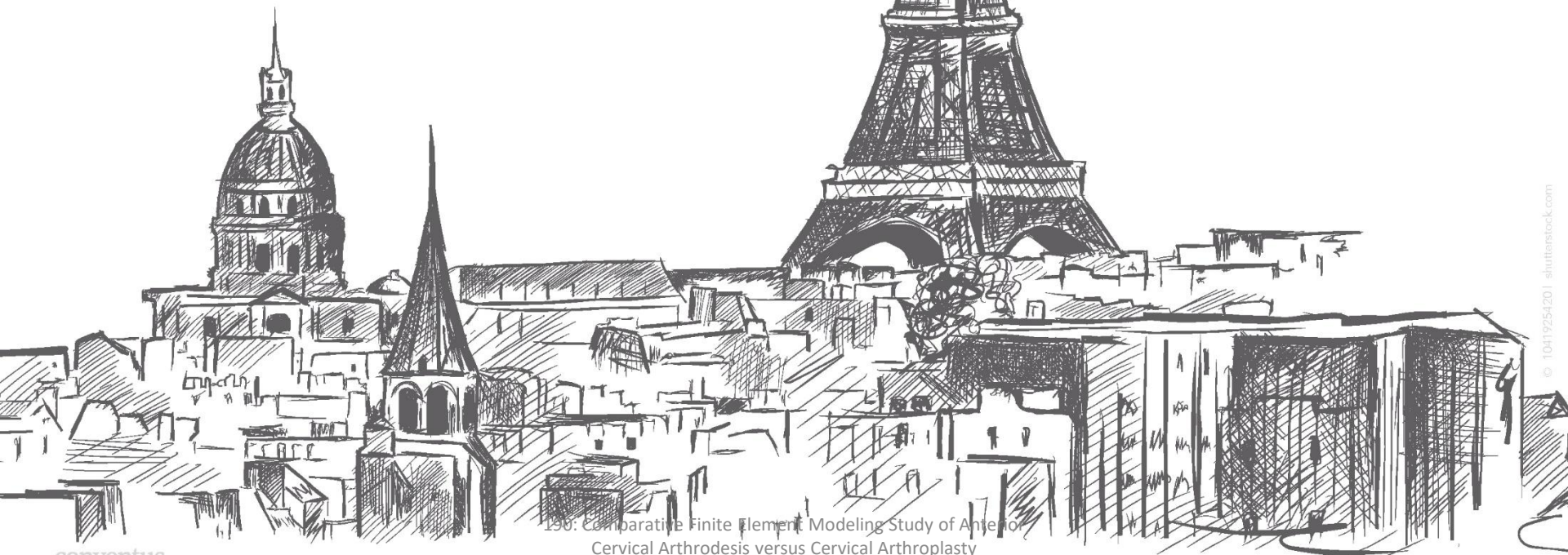
The 1- piece CDA resulted in less extreme biomechanics compared to the ACDF&P and less than the 2-piece CDA's. This may be due to its enclosed design that more closely mimics the natural disc

The difference in constraints between the metal and polymer may explain the different adjacent level kinematics.

Less posterior column load changes may decrease the incidence of heterotopic ossifications and facet arthropathy over time.

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