

## Cervical adjacent segment pathology following fusion: Is it due to fusion?

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### Abstract

Adjacent segment pathology affects 25% of patients within ten years of anterior cervical discectomy and fusion (ACDF). Laboratory studies demonstrate fused segments increase adjacent level stress including elevated intradiscal pressure and increased range of motion. Radiographic adjacent segment pathology (RASP) has been associated to ACDF in multiple statistically significant studies. Randomized controlled trials (RCTs) comparing anterior cervical discectomy and arthroplasty (ACDA) and ACDF have confirmed ACDF accelerates RASP. The question of greatest clinical interest is whether ACDA, artificial disc surgery, results in fewer adjacent level surgeries than ACDF. Current RCT follow up results reveal only non statistically significant trends favoring ACDA yet the post operative periods are only two to four years. Statistically significant increased RASP in ACDF patients however is already documented. The RCT patients' average ages are in the mid forties with an expected longevity of up to forty more years. Early statistically significant increased RASP in the ACDF patients supports our prediction that given sufficient follow up of ten or more years, fusion will lead to statistically significant higher rate of adjacent level surgery compared to artificial disc surgery.

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**Key words:** Cervical; Discectomy; Fusion; Arthroplasty; Adjacent; Degeneration

**Core tip:** Cervical artificial disc surgery has brought the expectation of a lower rate of adjacent segment pathology. Randomized controlled trials (RCTs), currently have only two to four years follow ups and the results regarding adjacent segment surgery indicate only non statistically significant trends favoring the anterior cervical discectomy and arthroplasty (ACDA). Higher rates of radiographic adjacent level pathology, after anterior cervical discectomy and fusion (ACDF) is already documented. We predict that as the RCT average age mid forty-year-old patients continue to their almost forty year expected longevity, adjacent level surgery rates after ACDF will also increase in comparison to the ACDA patients.

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### ADJACENT SEGMENT PATHOLOGY

The advent of anterior cervical discectomy and arthroplasty (ACDA) has brought the expectation of reduced adjacent level disease that may lead to additional surgery<sup>[1,2]</sup>. Randomized control trials (RCT), conducted in the United States for a variety of cervical artificial discs have a control arm consisting of anterior cervical discectomy and fusion (ACDF). Thus, these studies may give definitive answers to the much discussed and debated question; Does fusion surgery lead to adjacent segment pathology?

Adjacent segment pathology (ASP) is a serious problem after ACDF. Hilibrand *et al*<sup>[3]</sup> reported that 25% of patients experienced symptomatic clinical ASP (CASP) within ten years of ACDF. Fused cervical segments have been documented to increase adjacent level stress in multiple ways including: increased pressure and increased range of motion<sup>[4-9]</sup>.

Radiographic adjacent segment pathology (RASP), has been linked to ACDF in multiple statistically significant studies<sup>[10]</sup>. Baba *et al*<sup>[11]</sup> reported 25% new spinal stenosis adjacent to ACDF. Gore *et al*<sup>[10]</sup> reported 25% new and 25% progression of degenerative disc changes at adjacent segments within five years of ACDF. Goffin *et al*<sup>[12]</sup> reported that 92% of patients developed RASP within five years of ACDF. They concluded that RASP was correlated also to CASP as an independent effect above the natural history of cervical degenerative disc disease. Not all randomized RCTs looked at RASP but those that have, confirmed that ACDF accelerates RASP. Coric *et al*<sup>[13]</sup> found much less RASP after the artificial disc compared to fusion. At two year follow-up, 24.8% of ACDF patients compared to 9% of ACDA had RASP with very high statistical significance, ( $P = 0.0001$ ). Beaurain *et al*<sup>[14]</sup> for the Moby-C RCT, also at two year follow-up 34.6% RASP with ACDF compared to 17.5% after ACDA. Looking at all the available data, most will agree that there is an overwhelming and robust evidence for increased RASP with ACDF as opposed to ACDA.

But does fusion lead to more adjacent level surgeries than an artificial disc? Currently published and/or available data from RCTs show a trend, albeit statistically insignificant, towards increased ASP surgeries<sup>[1]</sup>. Most current RCT reports have only a two year follow up and not surprisingly there is no statistically significant difference between ACDF and ACDA with respect to CASP. Two, or even four year follow ups are too short a time when dealing with DDD that may take decades to become symptomatic. Most of the RCT patients were in their 40's and they are expected to live 30 or 40 more years. The increased RASP and the trend of increased CASP in the ACDF patients portend what is obvious. Cervical fusion accelerates adjacent segment pathology and will lead to increased adjacent segment surgery. We predict that given sufficient length of follow-up (at least 10 years), fusion will lead to statistically significant increased rate of adjacent level surgery as opposed to artificial disc.

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