A Meta-Analysis of Comparative Outcomes Following Cervical Arthroplasty or Anterior Cervical Fusion


A random-effects meta-analysis of 4 prospective, randomized, controlled US Food and Drug Administration Investigational Device Exemption clinical trials’ commonly determined endpoints was undertaken to analyze the combined outcomes of anterior cervical diskectomy and fusion (ACDF) vs cervical arthroplasty at 24-month follow-up.

Four cervical arthroplasty randomized clinical trials with comparable enrollment criteria and outcome measures were conducted on the following devices: Bryan Cervical Disc (Medtronic Sofamor Danek, Memphis, Tennessee), Prestige ST Cervical Disc System (Medtronic Sofamor Danek), ProDisc-C (Synthes Spine Company LP, West Chester, Pennsylvania), and PCM Cervical Disc (NuVasive, Inc, San Diego, California).

A total of 1608 patients with single-level degenerative disk disease with radiculopathy, myelopathy, or both were treated across 98 investigative sites. However, data were available for 1352 treated patients, of which only 1226 were evaluable at 24 months and able to be included in the current meta-analysis.

Patient outcome measures included 4 subcomponents: a patient-reported Neck Disability Index, maintenance or improvement of neurological status, serious adverse events related to the implant or surgical procedure, and avoidance of subsequent surgery or intervention at the index level (survivorship).

The results of the individual subcomponent meta-analyses, all of which favored arthroplasty, were Neck Disability Index success (pooled odds ratio [OR], 0.786; 95% confidence interval [CI], 0.589-1.050; *P* = .103), neurological status (OR, 0.552; 95% CI, 0.364-0.835; *P* = .005), and survivorship (OR, 0.510; 95% CI, 0.275-0.946; *P* = .033). Only the survivorship endpoint suggested low heterogeneity.

In addition, in all studies, overall success was determined by success in all 4 subcomponents and was achieved by 77.6% of the arthroplasty patients and by 70.8% of the ACDF patients (OR, 0.699; 95% CI, 0.539-0.908; *P* = .007).

These findings suggest that cervical arthroplasty is superior to ACDF in overall success, neurological success, and survivorship outcomes at 24 months postoperatively.
In this meta-analysis of 4 prospective, randomized, controlled US Food and Drug Administration Investigational Device Exemption clinical trials, the results suggest that cervical arthroplasty is superior to anterior cervical diskectomy and fusion (ACDF) in overall success, neurological success, and survivorship outcomes at 24 months postoperatively.

Although most surgeons would agree that cervical arthroplasty has been shown to be a viable alternative to ACDF, a few points are worth noting. First, there is the issue of superiority of neurological success in the arthroplasty group. Given that an adequate decompression is an integral part of both procedures, no logical reason seems to exist for one group to have a superior result over the other unless an inherent bias is found for a more radical or extensive decompression in the arthroplasty group. Another concern is the survivorship outcome at 24 months. It seems intuitive that following an ACDF, the likelihood is low of having to intervene at the index level once a solid fusion has been obtained. However, cervical arthroplasty is a motion-preserving device and as such would be expected to have a time-dependent failure rate related to loosening and wear, as seen in hip and knee arthroplasty. Therefore, it stands to reason that although arthrodesis procedures may have a lower survivorship rate earlier on, the survivorship rate for that index level would be high once a solid fusion is obtained. Conversely for arthroplasty, one would expect that the survivorship rate would decrease with time as the effects of wear and loosening come into play. It is also worth noting that no significant difference was found in the Neck Disability Index between the 2 groups.

Despite these issues, it is clear from all 4 studies that cervical arthroplasty is a successful procedure with outcomes at least as good as that of cervical arthrodesis. As with any motion-preserving devices, long-term studies will be critical to determine the true longevity of these devices.

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