Motion preservation following anterior cervical discectomy

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Anterior cervical decompression is an accepted treatment option for the management of cervical radiculopathy and/or myelopathy secondary to degenerative disc disease. This procedure is usually followed by an interbody fusion, which may be supplemented with instrumentation. Concern regarding the potential for accelerated adjacent level degeneration with symptomatic axial pain or neural compromise prompted the development of cervical arthroplasty devices. A number of artificial cervical discs, with differing designs and biomechanical properties, aim to allow motion at the surgical level following cervical discectomy. Whereas early radiographic data confirm either preserved or increased range of motion (ROM) at the surgical level following arthroplasty, there are little data to support the use of one particular device over another.

Ryu and colleagues examined the radiographic changes in the cervical spine at a minimum of 2 years follow-up after insertion of either a single-level Bryan disc (Medtronic Sofamor Danek) or a Prodisc-C disc (Synthes Spine). Consecutive patients undergoing insertion of either device were identified retrospectively. Clinical outcomes were measured with the visual analog scale and Neck Disability Index scores. Range of motion, functional spinal unit (FSU) height, and heterotopic ossification were measured on static and dynamic radiographs while facet arthrosis, disc degeneration, and uncinate degeneration were assessed on CT. Prosthesis size and positioning at the surgical level were recorded from anteroposterior and lateral radiographs. At final follow-up, the Bryan disc showed a smaller FSU angle and greater ROM at the surgical level in comparison to the Prodisc-C, yet clinical outcomes did not differ significantly between the 2 groups.

Although the data in the paper by Ryu et al. are interesting, this study has a number of important limitations. The strength of the conclusions is limited by the retrospective, consecutive patient design. Moreover, the relatively small number of patients enrolled in each group undermines statistical power. In addition, the results may be biased by differences in surgical experience with a given device. The authors acknowledge that the Prodisc-C was placed too far ventrally within the disc space in some instances. While suboptimal device placement may be a reality of the “learning curve,” presumably optimal placement is essential to producing optimal results, especially in the context of small sample sizes. Nonetheless, this study serves to highlight many of the issues surrounding cervical arthroplasty.

Ryu et al. should be commended for including a broad spectrum of radiographic outcome measures and trying to relate these to in vivo clinical outcomes. Should arthroplasty devices maintain pathological ROM or restore it? What is the optimal balance between ROM and segmental alignment following insertion of an arthroplasty device? These questions are pertinent, as previous authors have questioned if device placement should optimize ROM or segmental alignment. Ryu et al. report that the Bryan disc conferred a smaller FSU angle and greater ROM at the surgical level in comparison to the Prodisc-C, yet clinical outcomes did not differ significantly between the 2 groups. A recent randomized control trial reported no differences in clinical outcomes in patients treated with anterior cervical discectomy (ACD), anterior cervical discectomy and fusion (ACDF), and ACDF with instrumentation, despite radiographic evidence of kyphosis in the ACDF group. Careful patient selection may be the most important factor in successful operative management of cervical radiculopathy and/or myelopathy. Comparisons between arthroplasty devices may be premature as it is yet unknown if motion preservation...
confers any benefit to patients. A number of randomized control trials reported preserved ROM in patients undergoing cervical arthroplasty in comparison with patients undergoing ACDF within 1 to 2 years of surgery. Two of these studies reported superior clinical results in the arthroplasty group. These results indicate that cervical arthroplasty may be a viable alternative to ACDF in the first 2 years after surgery. Although preserved ROM is intuitively appealing, it is important to consider that ACD produces clinical improvement over this period of time as well, regardless of what is placed in the disc space afterwards. Patients were not blinded to their treatment assignment in these randomized control studies, which introduces a potential response bias. Heller et al. reported that 117 patients refused to participate in a study comparing ACDF to arthroplasty after randomization (37 assigned to arthroplasty and 80 assigned to ACDF). Furthermore, postoperative patient management was not standardized across treatment arms. The results of these studies must be interpreted with caution.

Ryu et al. present an interesting comparison between different arthroplasty devices, but the larger question regarding the role of cervical arthroplasty in the treatment of cervical spondylosis requires further study. Long-term results of randomized trials and longitudinal cohort studies are required, in addition to long-term follow-up in patients undergoing ACDF. It remains unclear if adjacent level degeneration is accelerated following arthrodesis, or simply reflects the natural progression of multilevel cervical spondylosis.

References


Response

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We would like to thank Dr. Fehlings and Dr. Rabin for their thoughtful comments and commendation. Our study demonstrates that each different type of cervical artificial disc had significantly different forms of postoperative ROM and alignment, but clinical outcomes did not have any significant relationship to these differences after a minimum 2-year follow-up. In my opinion, our study cannot be the definitive answer to the pertinent questions these authors raise, because the study had some important limitations, particularly the relatively low statistical power due to the small number of patients enrolled in each group and the short-term follow-up. I definitely agree that long-term randomized trials in larger numbers of patients are required. Nonetheless, our study highlights interesting issues in cervical arthroplasty that have never been reported, such as the influence of the type of cervical artificial disc on facet arthrosis and the effects of the presence of ossification of the posterior longitudinal ligament on the occurrence of heterotopic ossification at the surgical level. But the results may be biased by differences in surgical experience with a given device. It is our hope that our study raises more concerns about the use of a particular artificial disc and its unique effects on the postoperative clinical course of cervical degenerative diseases. (DOI: 10.3171/2009.10.SPINE09757)