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Anterior cervical discectomy and corpectomy for the treatment of cervical spondylosis, cervical disc herniation, and ossification of the posterior longitudinal ligament enjoy favorable rates of fusion and successful clinical outcomes. Although the complications from these procedures have been well described, the pathogenesis and clinical development of adjacent segment degeneration (ASD) are not fully understood. The definition of symptomatic ASD is the development of radicular or myelopathic signs and symptoms referable to a motion segment adjacent to prior cervical arthrodesis. The incidence, pathogenesis, prevalence, and potential treatment strategies for symptomatic ASD are discussed in this article.

Cervical Spine Arthroplasty Biomechanics

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Christian M. Puttlitz and Denis J. DiAngelo

The advent of cervical intervertebral disc replacement represents an exciting and new frontier in the treatment of myelopathy and discogenic pain. The goal of most disc arthroplasty designs is to attempt to approximate the normal spinal motion as much as possible. This survey article provides a general overview as to the goals of cervical disc replacement, the current state of knowledge concerning how these devices have been evaluated, and a commentary on future work that should be performed to characterize these devices fully.

Biomechanics of Lumbar Arthroplasty

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Neil R. Crawford

There are many issues to consider in evaluating the biomechanics of lumbar arthroplasty, which may consist of a nucleus replacement, a total disc replacement, or a mobile posterior device. The goal of spinal arthroplasty is to replicate or augment the function of the normal spinal elements, by taking into consideration both in the quantity and quality of motion that occurs across the replaced joint. This article describes the relevant parameters for studying the biomechanics of lumbar arthroplasty and briefly summarizes the current knowledge with regard to those parameters in some well-known lumbar nucleoplasty, facet replacement, and total disc arthroplasty devices.

Cervical Disc Arthroplasty: General Introduction

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Frank L. Acosta, Jr and Christopher P. Ames

Cervical disc arthroplasty is a relatively new motion-preserving technique for the treatment of symptomatic degenerative disc disease of the cervical spine. Unlike anterior discectomy and fusion, cervical disc replacement restores normal motion and a physiologic biomechanical environment to adjacent disc levels, thereby decreasing the incidence of adjacent segment disease. To date, cervical disc arthroplasty has been at least as effective as cervical fusion in providing symptomatic relief while reducing perioperative morbidity, eliminating the need for postoperative external immobilization, and allowing for earlier return to normal function. No significant complications have been associated with this procedure so far. Further study in the form of large, randomized, prospective studies is needed to make conclusions about the long-term efficacy of this procedure as well as to determine the patient populations that may benefit most from cervical disc arthroplasty.

General Considerations for Cervical Arthroplasty with Technique for Prodisc-C

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John H. Chi, Christopher P. Ames, and Bobby Tay

Motion-preserving spinal arthroplasty is a triumph of modern biomechanics, material sciences, and surgical technique. The ability to remove entire intervertebral discs and replace them with prostheses that preserve height and alignment as well as motion and stability, all the while alleviating the pain and spinal cord compression, is the result of nearly 50 years of progress in joint arthroplasty. Although the clear benefit or danger of artificial cervical discs is still unknown, they are already fundamentally changing the field of cervical spine surgery and are undoubtedly going to establish their place in the armamentarium for spinal surgeons. Short-term follow-up studies indicate that cervical arthroplasty is as safe and effective as traditional fusion surgery, but follow-up studies are no longer needed.

The Prestige Cervical Disc

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Vincent C. Traynelis

The Prestige LP artificial cervical disc is the most current generation of a disc that has been implanted for well over a decade. This article reviews the history of the device, clinical outcome data, and status of the current US Food and Drug Administration trial. The indications for arthroplasty and the technique for implantation of the Prestige artificial disc are discussed. Anterior reconstruction with the motion sparing Prestige artificial disc is an excellent treatment option for selected patients undergoing anterior cervical decompression.

The Bryan Cervical Disc System

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Stephen Papadopoulos

In May 2002, an Investigational Device Exemption (IDE) was granted by the US Food and Drug Administration (FDA) for clinical evaluation of the Bryan Cervical Disc System. The trial was designed to demonstrate equivalence with anterior discectomy and interbody fusion with plate fixation. Trial enrollment of over 500 patients was completed in 2004, and 2-year follow-up data are currently being collected and analyzed in preparation for submission to the FDA. This article describes the Bryan prosthesis, reviews several preclinical and clinical studies, and reports on the IDE study.

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Henry E. Aryan, Frank L. Acosta, Jr, and Christopher P. Ames	
<p>The Charité Artificial Disc is the first commercially available motion-preserving technology for the lumbar spine. The Charité is the first US Food and Drug Administration—approved artificial disc for the treatment of single-level lumbar degenerative disc disease from L4 to S1. With thousands of implantations worldwide since 1987, it has the longest clinical experience of any artificial disc. No other artificial disc has the substantial preclinical and clinical history that validates its use.</p>	
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<p>In this review, we focus on novel surgical techniques and spinal arthroplasty systems in active development. First, we discuss systems that allow for minimally invasive approaches to the lumbar disc space: (1) lateral approaches, (2) posterior approaches, and (3) oblique approaches. These techniques offer the potential for a minimally invasive lumbar arthroplasty system. Second, we discuss novel facet replacement technology. The facet joints, with the intervertebral disc, comprise the three-joint complex of the spinal unit. Facet joint health is thus crucial to proper disc biomechanics and function. Finally, we discuss dynamic neutralization of the lumbar spine with an artificial posterior tension band device. This allows for a certain degree of immobilization without fusion. Minimally invasive surgical approaches, facet arthroplasty, and posterior tension band devices may be the future of motion preservation spinal surgery.</p>	
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