Cigna Medical Coverage Policies – Musculoskeletal
Cervical Total Discectomy Arthroplasty

Effective July 1, 2025

Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

This evidence-based medical coverage policy has been developed by eviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

CMM-602: Cervical Total Disc Arthroplasty

CMM-602.1: General Guidelines

Application of Guideline

- The determination of medical necessity for the performance of cervical total disc arthroplasty is always made on a case-by-case basis.
- For additional timing and documentation requirements, see **CMM-600.1: Prior Authorization Requirements**.

Urgent/Emergent Indications/Conditions

- The presence of urgent/emergent indications/conditions warrants definitive surgical treatment. **Imaging findings noted in the applicable procedure section(s) are required**.
  - The following criteria are **NOT** required for confirmed urgent/emergent conditions:
    - Provider-directed non-surgical management
    - Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Urgent/emergent conditions for cervical total disc arthroplasty include **ANY** of the following:
  - Myelopathy or Cord signal changes on MRI due to cord compression
  - Central cord syndrome
  - Documentation of progressive neurological deficit on two separate physical exams
  - **ANY** of the following due to a neurocompressive pathology
    - Motor weakness of grade 3/5 or less of specified muscle(s)
    - Rapidly progressive symptoms of motor loss
    - Bowel incontinence
    - Bladder incontinence/retention
  - A condition otherwise meeting criteria listed in the applicable procedure section(s) with documentation of severe debilitating pain and/or dysfunction to the point of being incapacitated

CMM-602.2: Initial Primary Cervical Total Disc Arthroplasty

Initial primary cervical total disc arthroplasty is considered **medically necessary** for **ANY** of the following conditions when **ALL** of the associated criteria have been met:

Radiculopathy

- Individual is age 18 to 60 years old
- Individual is skeletally mature
- Cervical disc prosthesis approved by the FDA or for an FDA approved indication and in accordance with FDA labeling

- The planned implant(s) will be used in the reconstruction of cervical disc(s) at C3-C7, following discectomy
- The planned implant(s) is/are for a single-level or contiguous two-level replacement(s)
- The individual is a candidate for single-level or two-level anterior cervical decompression(s) and interbody fusion(s) per **CMM-601.4: Initial Primary Anterior Cervical Discectomy and Fusion (ACDF)**
- No previous surgeries at the operative level
- Subjective symptoms include **BOTH** of the following:
  - Significant level of pain on a daily basis defined clinically significant functional impairment (e.g., inability to perform household chores, prolonged standing, etc.)
  - Unremitting radicular pain to shoulder girdle and/or upper extremity resulting in disability
- Objective physical exam findings include **ANY** of the following:
  - Dermatomal sensory deficit
  - Motor deficit (e.g., biceps, triceps weakness)
  - Reflex changes
  - Shoulder abduction relief sign
  - Nerve root tension sign (e.g., Spurling's maneuver)
  - Unremitting radicular pain to shoulder girdle and/or upper extremity without concordant objective physical exam findings
- Less than clinically meaningful improvement with at least **TWO** of the following (unless contraindicated):
  - Prescription strength analgesics, steroids, gabapentinoids, and/or NSAIDs for six (6) weeks
  - Provider-directed exercise program prescribed by a physical therapist, chiropractic provider, osteopathic or allopathic physician for six (6) weeks
  - Epidural steroid injection(s) or selective nerve root block(s) performed at the same level(s) as the requested surgery
- **Absence** of clinically significant cervical instability on plain X-rays with **ANY** of the following findings:
  - Subluxation or translation of more than 3.5 mm on static lateral or dynamic flexion/extension views
  - Sagittal plane angulation of more than 11 degrees between adjacent segments on static or dynamic flexion/extension views
  - Kyphotic deformity/significant reversal of lordosis or spondylolisthesis
- MRI/CT shows neural structure compression at the requested level(s) that is concordant with the individual's symptoms **and** physical exam findings and that is caused by **ANY** of the following:
  - Herniated disc(s) (retained disc material or a recurrent disc herniation)
  - Synovial cyst or arachnoid cyst
  - Central/lateral/foraminal stenosis
  - Osteophytes

- Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)

Myelopathy

- Individual is age 18 to 60 years old
- Individual is skeletally mature
- Cervical disc prosthesis approved by the FDA or for an FDA approved indication and in accordance with FDA labeling
- The planned implant(s) will be used in the reconstruction of cervical disc(s) at C3-C7, following discectomy
- The planned implant(s) is/are for a single-level or contiguous two-level replacement(s)
- The individual is a candidate for single-level or two-level anterior cervical decompression(s) and interbody fusion(s) per **CMM-601.4: Initial Primary Anterior Cervical Discectomy and Fusion (ACDF)**
- No previous surgeries at the operative level
- Subjective symptoms include **ANY** of the following:
  - Upper/lower extremity weakness, numbness, or pain
  - Fine motor dysfunction (buttoning, handwriting, clumsiness of hands)
  - Gait disturbance
  - New-onset bowel or bladder dysfunction
  - Frequent falls
- Objective physical exam findings include **ANY** of the following:
  - Grip and release test
  - Ataxic gait
  - Hyperreflexia
  - Hoffmann sign
  - Babinski sign
  - Tandem walking test demonstrating ataxia
  - Inverted brachial radial reflex
  - Increased muscle tone or spasticity
  - Clonus
  - Myelopathic hand
- **Absence** of clinically significant cervical instability on plain X-rays with **ANY** of the following findings:
  - Subluxation or translation of more than 3.5 mm on static lateral or dynamic flexion/extension views
  - Sagittal plane angulation of more than 11 degrees between adjacent segments on static or dynamic flexion/extension views
  - Kyphotic deformity/significant reversal of lordosis or spondylolisthesis

- MRI/CT shows findings that are concordant with the individual's symptoms **and** physical exam findings and that are caused by **EITHER** of the following:
  - Cervical spinal cord compression
  - Cervical spinal stenosis

CMM-602.3: Failed Cervical Total Disc Arthroplasty Implant

For a revision of a failed cervical total disc arthroplasty to a cervical fusion, see the applicable cervical fusion guideline below:

- For Anterior Cervical Fusion, see **CMM-601.8: ACDF Following Failed Cervical Disc Arthroplasty Surgery**
- For Posterior Cervical Fusion, see **CMM-604.7: Posterior Cervical Fusion (with or without Decompression) Following Failed Cervical Disc Arthroplasty Surgery**

CMM-602.4: Adjacent Segment Disease Secondary to Cervical Total Disc Arthroplasty

Cervical total disc arthroplasty performed for adjacent segment disease secondary to cervical total disc arthroplasty is considered **medically necessary** for **ANY** of the following conditions when **ALL** of the associated criteria have been met:

Radiculopathy

- The prior cervical total disc arthroplasty procedure at an adjacent level was performed at least six (6) months prior
- Individual is age 18 to 60 years old
- Individual is skeletally mature
- Cervical disc prosthesis approved by the FDA or for an FDA approved indication and in accordance with FDA labeling
- The planned implant(s) will be used in the reconstruction of cervical disc(s) at C3-C7, following discectomy
- The planned implant is for a single-level adjacent segment replacement
- The individual is a candidate for single-level anterior cervical decompression and interbody fusion per **CMM-601.7: Adjacent Segment Disease**
- No previous surgeries at the operative level
- Subjective symptoms include **BOTH** of the following:
  - Significant level of pain on a daily basis defined as clinically significant functional impairment (e.g., inability to perform household chores, prolonged standing, etc.)
  - Unremitting radicular pain to shoulder girdle and/or upper extremity resulting in disability
- Objective physical exam findings include **ANY** of the following:
  - Dermatomal sensory deficit
  - Motor deficit (e.g., biceps, triceps weakness)

- Reflex changes
- Shoulder abduction relief sign
- Nerve root tension sign (e.g., Spurling's maneuver)
- Unremitting radicular pain to shoulder girdle and/or upper extremity without concordant objective physical exam findings

➢ Less than clinically meaningful improvement with at least **TWO** of the following (unless contraindicated):
- Prescription strength analgesics, steroids, gabapentinoids, and/or NSAIDs for six (6) weeks
- Provider-directed exercise program prescribed by a physical therapist, chiropractic provider, osteopathic or allopathic physician for six (6) weeks
- Epidural steroid injection(s) or selective nerve root block(s) performed at the same level(s) as the requested surgery

➢ Imaging studies of the cervical spine including flexion/extension lateral views demonstrate successful cervical total disc arthroplasty at the adjacent level

➢ **Absence** of clinically significant cervical instability on plain X-rays with **ANY** of the following findings:
- Subluxation or translation of more than 3.5 mm on static lateral or dynamic flexion/extension views
- Sagittal plane angulation of more than 11 degrees between adjacent segments on static or dynamic flexion/extension views
- Kyphotic deformity/significant reversal of lordosis or spondylolisthesis

➢ MRI/CT shows neural structure compression at the requested level(s) that is concordant with the individual's symptoms **and** physical exam findings and that is caused by **ANY** of the following:
- Herniated disc(s) (retained disc material or a recurrent disc herniation)
- Synovial cyst or arachnoid cyst
- Central/lateral/foraminal stenosis
- Osteophytes

➢ Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)

Myelopathy

➢ Individual is age 18 to 60 years old

➢ Individual is skeletally mature

➢ Cervical disc prosthesis approved by the FDA or for an FDA approved indication and in accordance with FDA labeling

- The planned implant(s) will be used in the reconstruction of cervical disc(s) at C3-C7, following discectomy
- The planned implant is for a single-level adjacent segment replacement
- The individual is a candidate for single-level anterior cervical decompression and interbody fusion per **CMM-601.7: Adjacent Segment Disease**
- No previous surgeries at the operative level
- Subjective symptoms include **ANY** of the following:
  - Upper/lower extremity weakness, numbness, or pain
  - Fine motor dysfunction (buttoning, handwriting, clumsiness of hands)
  - Gait disturbance
  - New-onset bowel or bladder dysfunction
  - Frequent falls
- Objective physical exam findings include **ANY** of the following:
  - Grip and release test
  - Ataxic gait
  - Hyperreflexia
  - Hoffmann sign
  - Babinski sign
  - Tandem walking test demonstrating ataxia
  - Inverted brachial radial reflex
  - Increased muscle tone or spasticity
  - Clonus
  - Myelopathic hand
- **Absence** of clinically significant cervical instability on plain X-rays with **ANY** of the following findings:
  - Subluxation or translation of more than 3.5 mm on static lateral or dynamic flexion/extension views
  - Sagittal plane angulation of more than 11 degrees between adjacent segments on static or dynamic flexion/extension views
  - Kyphotic deformity/significant reversal of lordosis or spondylolisthesis
- MRI/CT shows findings that are concordant with the individual's symptoms **and** physical exam findings and that are caused by **EITHER** of the following:
  - Cervical spinal cord compression
  - Cervical spinal stenosis

CMM-602.5: Non-Indications

Not Medically Necessary

- Cervical total disc arthroplasty performed for degenerative disc disease as the sole indication is considered **not medically necessary**.

- Cervical total disc arthroplasty following a failed cervical total disc arthroplasty at the same level is considered **not medically necessary**.
- Cervical total disc arthroplasty performed without meeting the criteria listed in the **General Guidelines** (when applicable for urgent/emergent conditions) **and** the criteria in the applicable procedure-specific section (initial disc arthroplasty or adjacent segment disease) is considered **not medically necessary**.
- Cervical total disc arthroplasty is considered **not medically necessary** when **ANY** of the following **contraindications** are present:
  - Performed for the revision of a failed cervical artificial total disc arthroplasty
  - Decreased bone mineral density defined by a T-score less than (worse than) -1.5 on a previous dual energy X-ray absorptiometry (DEXA) scan
  - Allergy or sensitivity to titanium, aluminum, or vanadium
  - Active systemic infection
  - Revision of an infected cervical disc arthroplasty
  - Rheumatoid arthritis or other autoimmune disease
  - Paget's disease, osteomalacia, or any other metabolic bone disease
  - Severe poorly controlled diabetes mellitus requiring insulin treatment
  - There is imaging evidence of **ANY** of the following:
    - Significant cervical anatomical deformity or compromised vertebral bodies at the index level (e.g., ankylosing spondylitis, rheumatoid arthritis, or compromise due to current or past trauma)
    - Spinal metastases
    - Severe spondylosis at the level to be treated characterized by bridging osteophytes, marked reduction or absence of motion, or collapse of the intervertebral disc space of greater than 50% of its normal height
    - Severe facet joint arthropathy
    - Ossification of the posterior longitudinal ligament (OPLL)

Codes (CMM-602)

The inclusion of any code in this table does not imply that the code is under management or requires prior authorization. Refer to the applicable health plan for management details. Prior authorization of a code listed in this table is not a guarantee of payment. The Certificate of Coverage or Evidence of Coverage policy outlines the terms and conditions of the member's health insurance policy.

Code	Code Description/Definition
22856	Total disc arthroplasty (artificial disc), anterior approach, including discectomy with end plate preparation (includes osteophytectomy for nerve root or spinal cord decompression and microdissection), single interspace, cervical
+22858	Total disc arthroplasty (artificial disc), anterior approach, including discectomy with end plate preparation (includes osteophytectomy for nerve root or spinal cord decompression and microdissection), second level, cervical (List separately in addition to code for primary procedure)
22861	Revision including replacement of total disc arthroplasty (artificial disc), anterior approach, single interspace; cervical
22864	Removal of total disc arthroplasty (artificial disc), anterior approach, single interspace; cervical
+0095T	Removal of total disc arthroplasty (artificial disc), anterior approach, each additional interspace, cervical (List separately in addition to code for primary procedure)
+0098T	Revision including replacement of total disc arthroplasty (artificial disc), anterior approach, each additional interspace, cervical (List separately in addition to code for primary procedure)

Evidence Discussion (CMM-602)

Cervical Total Disc Arthroplasty

Risks of cervical disc arthroplasty include, but are not limited to, the following: infection; dysphagia; dysphonia; bleeding; recurrent laryngeal nerve injury; esophageal or tracheal injury; dural tear; hematoma; nerve root injury; spinal cord injury; paralysis; and, death. Complications related to the implant (e.g., migration, subsidence) are also possible. Indications for surgery include Individuals with underlying cervical degenerative disc disease with the clinical presentation of cervical radiculopathy or myelopathy. Given the possibility of significant surgical complications, proper surgical candidacy selection is crucial to minimize the risk benefit ratio. Supportive subjective symptoms and physical exam findings should be present and concordant with imaging findings as abnormal advanced imaging findings are not uncommon in asymptomatic Individuals.

Multiple studies have shown that the vast majority of Individuals with cervical radiculopathy will improve with a 4-6 week course of non-operative treatment. At least (six) 6 weeks of non-operative management is also noted as a recommendation in the North American Spine Society (NASS) *Coverage Policy Recommendations: Cervical Artificial Disc Replacement*. However, for Individuals with myelopathy or other urgent/emergent conditions (e.g., progressive neurologic deficit), a trial of non-operative treatment would not be necessary.

Contraindications to cervical disc arthroplasty, as noted in the North American Spine Society (NASS) *Coverage Policy Recommendations: Cervical Artificial Disc Replacement*, include the following: infection; osteoporosis/osteopenia; instability; allergy or sensitivity to implant materials; severe spondylosis; severe facet joint arthropathy; rheumatoid arthritis; ankylosing spondylitis; deformity; ossification of the posterior longitudinal ligament; and, malignancy.

Jackson et al. (2020) noted higher rates of postoperative complications and worse functional outcomes in Individuals with psychological disorders undergoing spinal surgery. It was concluded that proper identification and treatment of these conditions prior to surgery may significantly improve many outcome measures in this population.

References (CMM-602)

1. Acosta FL, Ames CP. Cervical Disc Arthroplasty: General Information. *Neurosurg Clin North Am*. 2005; 16(4):603-607. doi:10.1016/j.nec.2005.07.003.
2. Ahrens M, Tsantrizos A, Donkersloot P, et al. Nucleus replacement with the DASCOR™ disc arthroplasty device: interim two-year efficacy and safety results from two prospective, non-randomized multicenter European studies. *Spine* (*Phila Pa 1976*). 2009;34(13):1376-1384. doi:10.1097/BRS.0b013e3181a3967f.
3. Ament JD, Yang Z, Nunley P, Stone MB, Kim KD. Cost-effectiveness of cervical total disc replacement vs fusion for the treatment of 2-level symptomatic degenerative disc disease. *JAMA Surg*. 2014;49(12):1231-1239.
4. Anderson PA, Sasso RC, Riew KD. Comparison of adverse events between the BRYAN® artificial cervical disc and anterior cervical arthrodesis. *Spine*. 2008;33(12):1305-1312.
5. Auerbach JD, Jones KJ, Fras CI, Balderston JR, Rushton SA, Chin KR. The prevalence of indications and contraindications to cervical total disc replacement. *Spine J*. 2008;8(5):711-716.
6. Bao Q-B, Yuan HA. Artificial disc technology. *Neurosurg Focus*. 2000;9(4):e14. doi:10.3171/foc.2000.9.4.14.

7. Barbagallo GM, Assietti R, Corbino L, Olindo G, Foti PV, Russo V, Albanese V. Early results and review of the literature of a novel hybrid surgical technique combining cervical arthrodesis and disc arthroplasty for treating multilevel degenerative disc disease: opposite or complementary techniques? *Eur Spine J*. 2009;18(Suppl 1):29-39.
8. Bartels RH, Donk R, Verbeek AL. No justification for cervical disk prostheses in clinical practice: a meta-analysis of randomized controlled trials. *Neurosurgery*. 2010;66(6):1153-1160.
9. Barton C, Kalakoti P, Bedard NA, Hendrickson NR, Saifi C, Pugely AJ. What Are the Costs of Cervical Radiculopathy Prior to Surgical Treatment? *Spine*. 2019;44(13):937-942. doi:10.1097/brs.0000000000002983.
10. Bertagnoli R, Duggal N, Pickett GE, et al. Cervical total disc replacement, part two: clinical results. *Orthop Clin North Am*. 2005;36:355-362.
11. Bond M, McIntosh G, Fisher C et al. Treatment of Mild Cervical Myelopathy. *Spine* (*Phila Pa 1976*). 2019;44(22):1606-1612. doi:10.1097/brs.0000000000003124.
12. Boonstra AM, Schiphorst Preuper HR, Balk GA, Stewart RE. Cut-off points for mild, moderate, and severe pain on the visual analogue scale for pain in patients with chronic musculoskeletal pain. *Pain*. 2014;155(12):2545-2550. doi:10.1016/j.pain.2014.09.014.
13. Boselie TF, Willems PC, van Mameren H, de Bie R, Benzel EC, van Santbrink H. Arthroplasty versus fusion in single-level cervical degenerative disc disease. *Cochrane Database Syst Rev*. 2012;9:CD009173. doi:10.1002/14651858.CD009173.pub2.
14. BlueCross BlueShield Association (BCBSA) Technology Evaluation Center (TEC). *Artificial vertebral disc replacement*. TEC Assessment Program. 2007;22(2).
15. BlueCross BlueShield Association (BCBSA) Technology Evaluation Center (TEC). *Artificial intervertebral disc arthroplasty for treatment of degenerative disc disease of the cervical spine*. TEC Assessment Program. 2007;22(12). Republished 2009;24(3).
16. Blumenthal SL, Ohnmeiss DD, Guyer RD, et al. Reoperations in cervical total disc replacement compared with anterior cervical fusion: results compiled from multiple prospective food and drug administration investigational device exemption trials conducted at a single site. *Spine*. 2013;38:1177-1182.
17. Blumenthal SL, Ohnmeiss DD, Guyer RD, Hochschuler SH. Prospective study evaluating total disc replacement: preliminary results. *J Spinal Disord Tech*. 2003;16(5):450-454.
18. Blumenthal SL, Ohnmeiss DD, Guyer R, et al. Artificial intervertebral disks and beyond: a North American Spine Society Annual Meeting Symposium. *Spine J*. 2002;2(6):460-463. doi:10.1016/s1529-9430(02)00540-5.
19. Boselie TF, Willems PC, van Mameren H, de Bie R, Benzel EC, van Santbrink H. Arthroplasty versus fusion in single-level cervical degenerative disc disease. *Cochrane Database Syst Rev*. 2012;9:CD009173.
20. Boswell MV, Shah RV, Everett CR, et al. Interventional techniques in the management of chronic spinal pain: evidence-based practice guidelines. *Pain Phys*. 2005;8:1-47.
21. Brinjikji W, Luetmer PH, Comstock B, et al. Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. *AJNR Am J Neuroradiol*. 2015;36(4):811-816. doi:10.3174/ajnr.A4173.
22. Bryan VE Jr. Cervical motion segment replacement. *Eur Spine J*. 2002;11(Suppl 2):S92-S97. doi:10.1007/s00586-002-0437-3.
23. Burkus JK, Haid RW, Traynelis VC, Mummaneni PV. Long-term clinical and radiographic outcomes of cervical disc replacement with the Prestige® disc: results from a prospective randomized controlled clinical trial. *J Neurosurg Spine*. 2010;13(3):308-318.
24. California Technology Assessment Forum (CTAF). *Artificial disc replacement for degenerative disc disease of the cervical spine*. Updated Oct 2009.
25. Cepoiu-Martin M, Faris P, Lorenzetti D, Prefontaine E, Noseworthy T, Sutherland L. Artificial cervical disc arthroplasty: a systematic review. *Spine (Phila Pa 1976)*. 2011;36(25):E1623-E1633.
26. Chatley A, Kumar R, Jain V, Behari S, Sahu R. Effect of spinal cord signal intensity changes on clinical outcome after surgery for cervical spondylotic myelopathy. *J Neurosurg Spine*. 2009;11(5):562-567. doi:10.3171/2009.6.spine091.
27. Chen J, Fan SW, Wang XW, Yuan W. Motion analysis of single-level cervical total disc arthroplasty: a meta-analysis. *Orthop Surg*. 2012;4(2):94-100.
28. Cheng L, Nie L, Hou Y. Fusion versus BRYAN® cervical disc in two-level cervical disc disease: a prospective, randomized study. *Int Orthop*. 2009;33(5):1347-1351.
29. Childress MA, Becker BA. Nonoperative Management of Cervical Radiculopathy. *Am Fam Physician*. 2016;93(9):746-754.
30. Cohen SP, Hanling S, Bicket MC, et al. Epidural steroid injections compared with gabapentin for lumbosacral radicular pain: multicenter randomized double blind comparative efficacy study. *BMJ*. 2015;350:h1748. doi:10.1136/bmj.h1748.
31. Coric D, Cassis J, Carew JD, Boltes MO. Prospective study of cervical arthroplasty in 98 patients involved in 1 of 3 separate investigational device exemption studies from a single investigational site with a minimum 2-year follow-up. Clinical article. *J Neurosurg Spine*. 2010;13(6):715-721. doi: 10.3171/2010.5.SPINE09852.

32. Coric D, Nunley PD, Guyer RD, et al. Prospective, randomized, multicenter study of cervical arthroplasty: 269 patients from the Kineflex®|C artificial disc investigational device exemption study with a minimum 2-year follow-up: clinical article. *Neurosurg Spine*. [published correction appears in J *Neurosurg Spine*. 2012;16(3):322]. 2011;15(4):348-358. doi:10.3171/2011.5.SPINE10769.
33. Cunningham MR, Hershman S, Bendo J. Systematic review of cohort studies comparing surgical treatments for cervical spondylotic myelopathy. *Spine*. 2010;35(5):537-543.
34. Davis RJ, Nunley PD, Kim KD, et al. Two-level total disc replacement with Mobi-C® cervical artificial disc versus anterior discectomy and fusion: a prospective, randomized, controlled multicenter clinical trial with 4-year follow-up results. *J Neurosurg Spine*. 2015;22(1):15-25.
35. Davis RJ, Kim KD, Hisey MS, et al. Cervical total disc replacement with the Mobi-C® cervical artificial disc compared with anterior discectomy and fusion for treatment of 2-level symptomatic degenerative disc disease: a prospective, randomized, controlled multicenter clinical trial: clinical article. *J Neurosurg Spine*. 2013;19(5):532-545.
36. Delamarter RB, Bae HW, Pradhan BB. Clinical results of ProDisc-II® lumbar total disc replacement: report from the United States Clinical Trial. *Orthop Clin N Am*. 2005;36:301-313.
37. Delamarter RB, Murrey D, Janssen ME, et al. Results at 24 months form the prospective, randomized, multicenter Investigational Device Exemption trial of ProDisc-C® versus anterior cervical discectomy and fusion with 4-year follow-up and continued access patients. *SAS J.* 2010;4:122-128.
38. Delamarter R, Zigler JE, Balderston RA, Cammisa FP, Goldstein JA, Spivak JM. Prospective, randomized, multicenter Food and Drug Administration investigational device exemption study of the ProDisc-L® total disc replacement compared with circumferential arthrodesis for the treatment of two-level lumbar degenerative disc disease: results at twenty-four months. *J Bone Joint Surg Am*. 2011;93(8):705-715. doi:10.2106/JBJS.I.00680.
39. Ding C, Hong Y, Liu H, Shi R, Hu T, Li T. Intermediate clinical outcome of BRYAN® Cervical Disc replacement for degenerative disk disease and its effect on adjacent segment disks. *Orthopedics*. 2012;35(6):e909-e916.
40. Durbhakula MM, Ghiselli G. Cervical Total Disc Replacement, Part I: Rationale, Biomechanics, and Implant Types. *Orthop Clin North Am*. 2005;36(3):349-354.
41. ECRI Institute. *Artificial intervertebral disc replacement (AIDR) for lumbar degenerative disc disease (DDD). Emerging Technology Evidence Report*. Plymouth Meeting (PA): ECRI Institute; 2009a October 14.
42. ECRI Institute. *Artificial intervertebral disc replacement for symptomatic cervical disc disease. Emerging Technology Evidence Report*. Plymouth Meeting (PA): ECRI Institute; June 5, 2009b.
43. ECRI Institute. *Artificial intervertebral disc replacement for cervical disc disease. Evidence report*. September 2012. Plymouth Meeting (PA): ECRI Institute; September 2012.
44. Farshad M, Burgstaller JM, Held U, et al. Do preoperative corticosteroid injections increase the risk for infections or wound healing problems after spine surgery? *Spin*e. 2018;43(15):1089-1094.
45. Fejer R, Jordan A, Hartvigsen J. Categorising the severity of neck pain: Establishment of cut-points for use in clinical and epidemiological research. *Pain*. 2005;119(1-3):176-182. doi:10.1016/j.pain.2005.09.033.
46. Foley DP, Sasso WR, Ye JY, et al. Twenty-Year Radiographic Outcomes Following Single-Level Cervical Disc Arthroplasty: Results From a Prospective Randomized Controlled Trial. *Spine (Phila Pa 1976)*. 2024;49(5):295-303. doi:10.1097/BRS.0000000000004888.
47. Fekete TF, Porchet F. Overview of disc arthroplasty-past, present and future. *Acta Neurochir Wien*. 2010;152(3):393-404.
48. Gandhi AA, Kode S, DeVries NA, Grosland NM, Smucker JD, Fredericks DC. Biomechanical Analysis of Cervical Disc Replacement and Fusion Using Single Level, Two Level and Hybrid Constructs. *Spine (Phila Pa 1976).* 2015;40(20):1578-1585. doi:10.1097/BRS. 0000000000001044.
49. Garrido BJ, Taha TA, Sasso RC. Clinical outcomes of BRYAN® cervical disc arthroplasty a prospective, randomized, controlled, single site trial with 48-month follow-up. *J Spinal Disord Tech*. 2010;23(6):367-371.
50. Goedmakers CMW, de Vries F, Bosscher L, Peul WC, Arts MP, Vleggeert-Lankamp CLA. Long-term results of the NECK trial—implanting a disc prosthesis after cervical anterior discectomy cannot prevent adjacent segment disease: five-year clinical follow-up of a double-blinded randomised controlled trial. *Spine J*. 2023;23(3):350-360. doi:10.1016/j.spinee.2022.11.006.
51. Goffin J, van Loon J, Van Calenbergh F, Lipscomb B. A clinical analysis of 4- and 6-year follow-up results after cervical disc replacement surgery using the BRYAN® Cervical Disc Prosthesis. *J Neurosurg Spine*. 2010;12(3):261-269.
52. Goldstein JA. *Cervical artificial disc replacement technologies*. *SPINE-health* . ©1999-2024 Veritas Health, LLC. Updated Sept 2019. Available at: https://www.spine-health.com/treatment/artificial-disc-replacement/cervical-artificial-disc-replacement-technologies.
53. Gornet MF, Schranck FW, Copay AG, Kopjar B. The Effect of Workers' Compensation Status on Outcomes of Cervical Disc Arthroplasty. *J Bone Joint Surg Am*. 2016;98:93-99.
54. Grob D, Porchet F, Kleinstück FS, et al. A comparison of outcomes of cervical disc arthroplasty and fusion in everyday clinical practice: surgical and methodological aspects. *Eur Spine J*. 2010;19(2):297-306.

55. Heidecke V, Burkert W, Brucke M, Rainov NG. Intervertebral disc replacement for cervical degenerative disease-clinical results and functional outcome at two years in patients implanted with the BRYAN® cervical disc prosthesis. *Acta Neurochir Wien*. 2008;150(5):453-459. doi:10.1007/s00701-008-1552-7.
56. Heller JG, Sasso RC, Papadopoulos SM, et al. Comparison of BRYAN® cervical disc arthroplasty with anterior cervical decompression and fusion: clinical and radiographic results of a randomized, controlled, clinical trial. *Spine (Phila Pa 1976)*. 2009;34(2):101-107.
57. Hilton B, Tempest-Mitchell J, Davies B, Kotter M. Assessment of degenerative cervical myelopathy differs between specialists and may influence time to diagnosis and clinical outcomes. *PLoS ONE*. 2018;13(12). doi:10.1371/journal.pone.0207709.
58. Huang RC, Girardi FP, Lim MR, Cammisa FP. Advantages and disadvantages of nonfusion technology in spine surgery. *Orthop Clin N Am*. 2005;36:263-239.
59. Huppert J, Beaurain J, Steib JP, et al. Comparison between single- and multi-level patients: clinical and radiological outcomes 2 years after cervical disc replacement. *Eur Spine J*. 2011;20(9):1417-1426. doi:10.1007/s00586-011-1722-9.
60. International Society for the Advancement of Spine Surgery (ISASS). *Position Statement: Cervical Total Disc Arthroplasty*. Approved October 2009.
61. Jackson KL, Rumley J, Griffith M, Agochukwu U, DeVine J. Correlating Psychological Comorbidities and Outcomes After Spine Surgery. *Global Spine J*. 2020;10(7):929-939. doi:10.1177/2192568219886595.
62. Jackson RJ, Davis RJ, Hoffman GA, et al. Subsequent surgery rates after cervical total disc replacement using a Mobi-C® Cervical Disc Prosthesis versus anterior cervical discectomy and fusion: a prospective randomized clinical trial with 5-year follow-up. *J Neurosurg Spine*. 2016;24(5):734-45. doi:10.3171/2015.8.SPINE15219.
63. Jacob K, Patel M, Parsons A, et al. Level-specific Perioperative and Clinical Outcome Comparison: Cervical Disk Replacement Versus Anterior Cervical Diskectomy and Fusion at C5-C6 in Patients With Myeloradiculopathy. *JAAOS*. 2022;30(17):e1137-e1147. doi:10.5435/jaaos-d-21-01276.
64. Janssen ME, Zigler JE, Spivak JM, et al. ProDisc-C® total disc replacement versus anterior cervical discectomy and fusion for single-level symptomatic cervical disc disease: seven-year follow-up of the prospective randomized U. S. Food and Drug Administration investigational device exemption study. *J Bone Joint Surg Am*. 2015;97:1738-1747.
65. Jawahar A, Cavanaugh DA, Kerr EJ 3rd, Birdsong EM, Nunley PD. Total disc arthroplasty does not affect the incidence of adjacent segment degeneration in cervical spine: results of 93 patients in three prospective randomized clinical trials. *Spine J*. 2010;10(12):1043-1048. doi:10.1016/j.spinee.2010.08.014.
66. Ji GY, Oh CH, Shin DA, et al. Artificial Disk Replacement Combined With Fusion Versus 2-Level Fusion in Cervical 2-Level Disk Disease With a 5-Year Follow-up. *Clin Spine Surg*. 2017;30(5):E620-E627. doi:10.1097/bsd.0000000000000316.
67. Johansen TO, Sundseth J, Fredriksli OA, et al. Effect of arthroplasty vs fusion for patients with cervical radiculopathy: a randomized clinical trial. *JAMA Netw Open*. 2021;4(8):e2119606. doi:10.1001/jamanetworkopen. 2021.19606.
68. Kalsi-Ryan S, Singh A, Massicotte EM, et al. Ancillary Outcomes Measures for Assessment of Individuals with Cervical Spondylotic Myelopathy. *Spine*. 2013;38(22Suppl 1):S111-S122. doi:10.1097/BRS.0b013e3182a7f499.
69. Kim K, Hoffman G, Bae H, et al. Ten-Year Outcomes of 1- and 2-Level Cervical Disc Arthroplasty From the Mobi-C® Investigational Device Exemption Clinical Trial. *Neurosurgery*. 2021;88(3):497-505. doi:10.1093/neuros/nyaa459.
70. Kim SW, Limson MA, Kim SB, et al. Comparison of radiographic changes after ACDF versus BRYAN® disc arthroplasty in single and bi-level cases. *Eur Spine J*. 2009;18(2):218-231.
71. Kostuik JP. Intervertebral disk replacement. Experimental study. *Clin Orthop Relat Res*. 1997;(337):27-41. doi:10.1097/00003086-199704000-00004.
72. Kurtz SM, Peloza J, Siskey R, Villarraga ML. Analysis of a retrieved polyethylene total disc replacement component. *Spine J*. 2005;5(3):344-350.
73. Kurtz SM, van Ooij A, Ross R, et al. Polyethylene wear and rim fracture in total disc arthroplasty. *Spine J*. 2007;7:12-21.
74. Kushchayev SV, Glushko T, Jarraya M, et al. ABCs of the degenerative spine. *Insights Imaging*. 2018;9(2):253-274. doi:10.1007/s13244-017-0584-z.
75. Lafuente J, Casey ATH, Petzold A, Brew S. The BRYAN® cervical disc prosthesis as an alternative to arthrodesis in the treatment of cervical spondylosis. *J Bone Join Surg Br*. 2005;87(B):508-512.
76. Lanman T, Burkus J, Dryer R, Gornet M, McConnell J, Hodges S. Long-term clinical and radiographic outcomes of the Prestige® LP artificial cervical disc replacement at 2 levels: results from a prospective randomized controlled clinical trial. *J Neurosurg Spine*. 2017;27(1):7-19. doi:10.3171/2016.11.spine16746.
77. Laratta JL, Shillingford JN, Saifi C, Riew KD. Cervical Disc Arthroplasty: A Comprehensive Review of Single-Level, Multilevel, and Hybrid Procedures. *Global Spine J*. 2017;8(1):78-83. doi:10.1177/2192568217701095.
78. Lee BS, Nault R, Grabowski M, et al. Utility of repeat magnetic resonance imaging in surgical patients with lumbar stenosis without disc herniation. *Spine J*. 2019;19(2):191-198. doi:10.1016/j.spinee.2018.06.357.

79. Leven D, Meaike J, Radcliff K, Qureshi S. Cervical disc replacement surgery: indications, technique, and technical pearls. *Curr Rev Musculoskelet Med*. 2017;10(2):160-169. doi:10.1007/s12178-017-9398-3.
80. Loidolt T, Kurra S, Riew K, Levi A, Florman J, Lavelle W. Comparison of adverse events between cervical disc arthroplasty and anterior cervical discectomy and fusion: a 10-year follow-up. *Spine J*. 2021;21(2):253-264. doi: 10.1016/j.spinee.2020.10.013.
81. Lu VM, Mobbs RJ, Phan K. Clinical Outcomes of Treating Cervical Adjacent Segment Disease by Anterior Cervical Discectomy and Fusion Versus Total Disc Replacement: A Systematic Review and Meta-Analysis. *Global Spine J*. 2018;9(5):559-567. doi:10.1177/2192568218789115.
82. Luyao H, Xiaoxiao Y, Tianxiao F, Yuandong L, Ping Wang. Management of Cervical Spondylotic Radiculopathy: A Systematic Review. *Global Spine J*. 2022;12(8):1912-1924. doi:10.1177/21925682221075290.
83. Martin CW and the Work Comp Board (WCB) *Evidence Based Practice Group. Artificial cervical and lumbar disc implants: a review of the literature*. Apr 2005.
84. Matsumoto M, Fujimura Y, Suzuki N, et al. MRI of cervical intervertebral discs in asymptomatic subjects. *J Bone Joint Surg Br*. 1998;80(1):19-24. doi:10.1302/0301-620x.80b1.7929.
85. McAfee PC, Reah C, Gilder K, Eisermann L, Cunningham B. A Meta-Analysis of Comparative Outcomes Following Cervical Arthroplasty or Anterior Cervical Fusion: Results from Four Prospective Multi-center Randomized Clinical Trials and up to 1226 Patients. *Spine* (*Phila Pa 1976*). 2012;37(11):943-952. doi:10.1097/BRS.0b013e31823da169.
86. Mummaneni PV, Burkus JK, Haid RW, Traynelis VC, Zdeblick TA. Clinical and radiographic analysis of cervical disc arthroplasty compared with allograft fusion: a randomized controlled clinical trial. *J Neurosurg Spine*. 2007;6:198-209.
87. Murrey D, Janssen M, Delamarter R, et al. Results of the prospective, randomized, controlled multicenter Food and Drug Administration investigational device exemption study of the ProDisc-C® total disc replacement versus anterior discectomy and fusion for the treatment of 1-level symptomatic cervical disc disease. *Spine J*. 2009;9(4):275-286. doi:10.1016/j.spinee.2008.05.006.
88. Nabhan A, Ahlhelm F, Shariat K, et al. The ProDisc-C® Prosthesis: Clinical and radiological experience 1 year after surgery. *Spine*. 2007;32(18):1935-1941.
89. National Institutes for Health and Clinical Excellence (NICE). *Prosthetic intervertebral disc replacement in the cervical spine*. Interventional Procedure Guidance 341. May 2010.
90. National Institutes for Health and Clinical Excellence (NICE). *Prosthetic intervertebral disc replacement in the lumbar spine*. Interventional Procedure Guidance 306. Revised July 2009.
91. North American Spine Society (NASS) .*Coverage Policy Recommendations: Cervical Artificial Disc Replacement*. Feb 2024. Burr Ridge, IL. North American Spine Society (NASS). Available at: https://www.spine.org.
92. North American Spine Society (NASS). *Evidence-Based Clinical Guidelines for Multidisciplinary Spine Care: Diagnosis and Treatment of Cervical Radiculopathy from Degenerative Disorders*. 2010. Burr Ridge, IL. North American Spine Society (NASS). Available at: https://www.spine.org.
93. North American Spine Society (NASS). Hills BB, Kasliwal MK, eds. Cervical Radiographic Parameters in the Management of Cervical Spine Disorders: The Minimum that Needs to Be Measured. *SpineLine*. 2019;20(5)12-16.
94. Nunley P, Frank K, Stone M. Patient Selection in Cervical Disc Arthroplasty. *Int J Spine Surg*. 2020;14(s2):S29-S35. doi:10.14444/7088.
95. Nunley PD, Jawahar A, Kerr EJ 3rd, et al. Factors affecting the incidence of symptomatic adjacent-level disease in cervical spine after total disc arthroplasty: 2- to 4-year follow-up of 3 prospective randomized trials. *Spine* (*Phila Pa 1976*). 2012;37(6):445-451.
96. Nunna RS, Ryoo JS, Ostrov PB, et al. Single-level cervical disc replacement (CDR) versus anterior cervical discectomy and fusion (ACDF): A Nationwide matched analysis of complications, 30- and 90-day readmission rates, and cost. *World Neurosurg X*. 2023;21:100242. doi:10.1016/j.wnsx.2023.100242.
97. Ontario Health Technology Assessment Committee (OHTAC). OHTAC Recommendation: Updated Health Technology Policy Assessment (HPTA) on Artificial Disc Replacement for Lumbar and Cervical Degenerative Disc Disease. Updated Apr 2006. *Ont Health Technol Assess Ser*. 2006;6(10):1-98.
98. Papadopoulos S. The BRYAN® Cervical Disc System. *Neurosurg Clin North Am*. 2005;16:629-636.
99. Panagopoulos J, Hush J, Steffens D, Hancock MJ. Do MRI Findings Change Over a Period of Up to 1 Year in Patients With Low Back Pain and/or Sciatica? *Spine*. 2017;42(7):504-512. doi:10.1097/brs.0000000000001790.
100. Peng-Fei S, Yu-Hua J. Cervical disc prosthesis replacement and interbody fusion: a comparative study. *Int Orthop*. 2008;32(1):103-106. doi:10.1007/s00264-006-0287-4.
101. Phillips F, Allen T, Regan J, et al. Cervical Disc Replacement in Patients With and Without Previous Adjacent Level Fusion Surgery: A prospective study. *Spine (Phila Pa 1976)*. 2009;34(6):556-565. doi:10.1097/brs.0b013e31819b061c.
102. Phillips FM, Garfin SR. Cervical Disc Replacement. *Spine*. 2005;30(17S):S27-S33.

103. Phillips F, Geisler F, Gilder K, Reah C, Howell K, McAfee P. Long-term Outcomes of the US FDA IDE Prospective, Randomized Controlled Clinical Trial Comparing PCM Cervical Disc Arthroplasty With Anterior Cervical Discectomy and Fusion. *Spine (Phila Pa 1976)*. 2015;40(10):674-683. doi:10.1097/brs.0000000000000869.
104. Phillips F, Lee J, Geisler F, et al. A Prospective, Randomized, Controlled Clinical Investigation Comparing PCM Cervical Disc Arthroplasty With Anterior Cervical Discectomy and Fusion. *Spine (Phila Pa 1976)*. 2013;38(15):E907-E918. doi:10.1097/brs.0b013e318296232f.
105. Phillips FM, Tzermiadianos MN, Voronov LI, et al. Effect of two-level total disc replacement on cervical spine kinematics. *Spine (Phila Pa 1976)*. 2009;34(22):E794-E799. doi:10.1097/BRS.0b013e3181afe4bb.
106. Pickett GE, Rouleau JP, Duggal N. Kinematic Analysis of the Cervical Spine Following Implantation of an Artificial Cervical Disc. *Spine*. 2005;30(17):1949-1954.
107. Porchet F, Metcalf NH. Clinical outcomes with the Prestige® II cervical disc: preliminary results from a prospective randomized clinical trial. *Neurosurg Focus*. 2004;17(3):36-43.
108. Pracyk JB, Traynelis VC. Treatment of the Painful Motion Segment: Cervical Arthroplasty. *Spine*. 2005;30(16S):S23-S32.
109. Quan GM, Vital JM, Hansen S, Pointillart V. Eight-year clinical and radiological follow-up of the BRYAN® cervical disc arthroplasty. *Spine (Phila Pa 1976)*. 2011;36(8):639-646.
110. Qi M, Xu C, Liu Y, et al. Comparison of clinical outcomes between cervical disc arthroplasty and anterior cervical discectomy and fusion for the treatment of single-level cervical spondylosis: a 10-year follow-up study. *Spine J*. 2023;23(3):361-368. doi:10.1016/j.spinee.2022.11.013.
111. Quinto ES Jr, Paisner ND, Huish EG Jr, Senegor M. Ten-Year Outcomes of Cervical Disc Arthroplasty Versus Anterior Cervical Discectomy and Fusion : A Systematic Review With Meta-Analysis. *Spine (Phila Pa 1976)*. 2024;49(7):463-469. doi:10.1097/BRS.0000000000004887.
112. Radcliff K, Coric D, Albert T. Five-year clinical results of cervical total disc replacement compared with anterior discectomy and fusion for treatment of 2-level symptomatic degenerative disc disease: a prospective, randomized, controlled, multicenter investigational device exemption clinical trial. *J Neurosurg Spine*. 2016;25(2):213-224. doi:10.3171/2015.12.spine15824.
113. Ren X, Wang W, Chu T, Wang J, Li C, Jiang T. The intermediate clinical outcome and its limitations of BRYAN® cervical arthroplasty for treatment of cervical disc herniation. *J Spinal Disord Tech*. 2011;24(4):221-229.
114. Ries ZG, Glassman SD, Vasilyev I, Metcalfe L, Carreon LY. Updated imaging does not affect revision rates in adults undergoing spine surgery for lumbar degenerative disease. *J Neurosurg Spine*. Published online Nov 2018. 2019;30(2):228-223. doi:10.3171/2018.8.spine18586.
115. Riina J, Patel A, Dietz JW, Hoskins JS, Trammell TR, Schwartz DD. Comparison of single-level cervical fusion and a metal-on-metal cervical disc replacement device. *Am J Orthop*. 2008;37(4):E71-E77.
116. Rihn JA, Harrod C, Albert TJ. Revision cervical spine surgery. *Orthop Clin N Am.* 2012;43(1):123-136.
117. Robertson JT, Metcalf NH. Long-term outcome after implantation of the Prestige® I disc in an end-stage indication: 4-year results from a pilot study. *Neurosurg Focus*. 2004;17(3):69-71.
118. Robertson JT, Papadopoulos SM, Traynelis VC. Assessment of adjacent-segment disease in patients treated with cervical fusion or arthroplasty: a prospective 2-year study. *J Neurosurg Spine*. 2005;(3):417-423.
119. Ryu KS, Park CK, Jun SC, Huh HY. Radiological changes of the operated and adjacent segments following cervical arthroplasty after a minimum 24-month follow-up: comparison between the BRYAN® and ProDisc-C® devices. *J Neurosurg Spine*. 2010;13(3):299-307.
120. Salari B, McAfee PC. Cervical total disk replacement: complications and avoidance. *Orthop Clin North Am.* 2012;43(1):97-107, ix.
121. Sasso RC, Anderson PA, Riew KD, Heller JG. Results of cervical arthroplasty compared with anterior discectomy and fusion: four-year clinical outcomes in a prospective, randomized controlled trial. *J Bone Joint Surg Am*. 2011;93(18):1684-1692.
122. Sasso RC, Best NM. Cervical kinematics after fusion and BRYAN® disc arthroplasty. *J Spinal Disord Tech*. 2008;21(1):19-22. doi:10.1097/BSD.0b013e3180500778.
123. Sasso RC, Best NM, Metcalf NH, Anderson PA. Motion analysis of BRYAN® cervical disc arthroplasty versus anterior discectomy and fusion: results from a prospective, randomized, multicenter, clinical trial. *J Spinal Disord Tech*. 2008;21(6):393-399. doi:10.1097/BSD.0b013e318150d121.
124. Sasso RC, Smucker JD, Hacker RJ, Heller JG. Artificial disc versus fusion: a prospective, randomized study with 2-year follow-up on 99 patients. *Spine (Phila Pa 1976)*. 2007;32(26):2933-2942. doi:10.1097/BRS.0b013e31815d0034.
125. Sasso RC, Smucker JD, Hacker RJ, Heller JG. Clinical Outcomes of BRYAN® Cervical Disc Arthroplasty: A Prospective, Randomized, Controlled, Multicenter Trial With 24-month Follow-up. *J Spinal Disord Tech*. 2007;20(7):481-491. doi:10.1097/BSD.0b013e3180310534.
126. Sasso WR, Ye J, Foley DP, Sheetal Vinayek, Sasso RC. 20-year Clinical Outcomes of Cervical Disc Arthroplasty. *Spine (Phila Pa 1976)*. 2024;49(1):1-6. doi:10.1097/brs.0000000000004811.

127. Schluessmann E, Aghayev E, Staub L, Moulin P, Zweig T, Röder C; SWISSspine Registry Group. SWISSspine: the case of a governmentally required HTA-registry for total disc arthroplasty: results of cervical disc prostheses. *Spine (Phila Pa 1976)*. 2010;35(24):E1397-E1405.
128. Sekhon LHS, Duggal N, Lynch JJ, et al. Magnetic Resonance Imaging Clarity of the BRYAN®, Prodisc-C®, Prestige® LP, and PCM® Cervical Arthroplasty Devices. *Spine (Phila Pa 1976)*. 2007;32(6):673-680. doi:10.1097/01.brs.0000257547.17822.14.
129. Shafshak TS, Elnemr R. The Visual Analogue Scale Versus Numerical Rating Scale in Measuring Pain Severity and Predicting Disability in Low Back Pain. *J Clin Rheumatol*. 2020;27(7):1. doi:10.1097/rhu.0000000000001320.
130. Shim DA, Yi S, Yoon DH, Him KN, Shin HC. Artificial disc replacement combined with fusion versus two-level fusion in cervical two-Level disc disease. *Spine (Phila Pa 1976)*. 2009;34(11):1153-1161. doi:10.1097/BRS.0b013e31819c9d39.
131. Shim CS, Lee S-H, Shin H. Charite™ versus ProDisc®: A Comparative Study of a Minimum 3-Year Follow-up. *Spine (Phila Pa 1976)*. 2007;32(9):1012-1018. doi:10.1097/01.brs.0000260795.57798.a0.
132. Singh M, Balmaceno-Criss M, Anderson G, et al. Anterior cervical discectomy and fusion versus cervical disc arthroplasty: an epidemiological review of 433,660 surgical patients from 2011 to 2021. *Spine J*. 2024;24(8):1342-1351. doi:10.1016/j.spinee.2024.02.016.
133. Shriver MF, Lubelski D, Sharma AM, Stenimetz MP, Benzel EC, Mroz TE. Adjacent segment degeneration and disease following cervical arthroplasty: a systematic review and meta-analysis. *Spine J*. 2016;16(2):168-181.
134. Swezey RL. Conservative treatment of cervical radiculopathy. *J Clin Rheumatol*. 1999;5(2):65-73. doi:10.1097/00124743-199904000-00006.
135. Thayer L, Tiffany E, Carreira D. Addressing Smoking in Musculoskeletal Specialty Care. *J Bone Joint Surg Am*. 2021;103(22):2145-2152. doi:10.2106/jbjs.21.00108.
136. Traynelis VC and Treharne RW. Use of the Prestige® LP Artificial Cervical Disc in the spine. *Expert Rev Med Devices*. 2007;4(4):437-440.
137. Upadhyaya CD, Wu JC, Trost G, et al. Analysis of the three United States Food and Drug Administration investigational device exemption cervical arthroplasty trials. *J Neurosurg Spine*. 2012;16(3):216-228. doi:10.3171/2011.6.SPINE10623.
138. Uschold TD, Fusco D, Germain R, Tumialan LM, Chang SW. Cervical and Lumbar Spinal Arthroplasty: Clinical Review. *AJNR Am J Neuroradiol*. 2012;33(9):1631-1641. doi:10.3174/ajnr.A2758.
139. U.S. Food & Drug Administration (FDA). Summary of Safety and Effectiveness Data (SSED) PMA P040006*: Charite™ Artificial Disc*. Available at: https://www.accessdata.fda.gov/cdrh_docs/pdf4/p040006b.pdf.
140. U.S. Food & Drug Administration (FDA). Summary of Safety and Effectiveness Data (SSED) PMA P170036: *M6-C™ Artificial Cervical Disc.* Available at: https://www.accessdata.fda.gov/cdrh_docs/pdf17/P170036B.pdf.
141. U.S. Food & Drug Administration (FDA). Summary of Safety and Effectiveness Data (SSED) PMA P090029: *Prestige® LP Cervical Disc*. Available at: https://www.accessdata.fda.gov/cdrh_docs/pdf9/p090029b.pdf.
142. U.S. Food & Drug Administration (FDA). Summary of Safety and Effectiveness Data (SSED) PMA P070001*: ProDisc-C® Total Disc Replacement*. Available at: https://www.accessdata.fda.gov/cdrh_docs/pdf7/p070001b.pdf.
143. U.S. Food & Drug Administration (FDA). Summary of Safety and Effectiveness Data (SSED) PMA P200022/S003: *Simplify® Cervical Artificial Disc*. Available at: https://www.fda.gov/medical-devices/recently-approved-devices/simplifyr-cervical-artificial-disc-p200022s003.
144. Walraevens J, Demaerel P, Suetens P, et al. Longitudinal prospective long-term radiographic follow-up after treatment of single-level cervical disk disease with the BRYAN® Cervical Disc. *Neurosurgery*. 2010;67(3):679-687. doi:10.1227/01.NEU.0000377039.89725.F3.
145. Wang G. *Health Technology Assessment: Artificial Disc Replacement*. Washington State Department of Labor and Industries. Updated Nov 2004.
146. Weinberg D, Chugh AJ, Gebhart JJ, et al. Magnetic resonance imaging of the cervical spine under-represents sagittal plane deformity in degenerative myelopathy patients. *Int J Spine Surg*. 2016;10:32.doi:10.14444/3032.
147. Willems PC, Elmans L, Anderson PG, van der Schaaf DB, de Kleuver M. Provocative Discography and Lumbar Fusion. *Spine*. 2007;32(10):1094-1099.
148. Wu JC, Huang WC, Tsai TY, Fay LY, Ko CC, Tu TH, Wu CL, Cheng H. Multilevel Arthroplasty for Cervical Spondylosis: More Heterotopic Ossification at 3 Years of Follow-up. *Spine (Phila Pa 1976)*. 2012;37(20):E1251-E1259.
149. Yajun W, Yue Z, Xiuxin H, Cui C. A meta-analysis of artificial total disc replacement versus fusion for lumbar degenerative disc disease. *Eur Spine J*. 2010;19(8):1250-1261. doi:10.1007/s00586-010-1394-x.
150. Yaksi A, Özgönenel L, Özgönenel B. The Efficiency of Gabapentin Therapy in Patients With Lumbar Spinal Stenosis. *Spine*. 2007;32(9):939-942. doi:10.1097/01.brs.0000261029.29170.e6.
151. Yang YC, Nie L, Cheng L, Hou Y. Clinical and radiographic reports following cervical arthroplasty: a 24-month follow-up. *Int Orthop*. 2009;33(4):1037-1042.
152. Yang S, Wu X, Hu Y, Li J, Liu G, Xu W, Yang C, Ye S. Early and intermediate follow-up results after treatment of degenerative disc disease with the BRYAN® cervical disc prosthesis: single- and multiple-level. *Spine*. 2008;33(12):E371-E377.

153. Yang B, Li H, Zhang T, He X, Xu S. The incidence of adjacent segment degeneration after cervical disc arthroplasty (CDA): a meta analysis of randomized controlled trials. *PLoS One*. 2012;7(4):e35032.
154. Yi S, Kim KN, Yang MS, et al. Difference in occurrence of heterotopic ossification according to prosthesis type in the cervical artificial disc replacement. *Spine (Phila Pa 1976)*. 2010;35(16):1556-1561.
155. Yi S, Lee DY, Ahn PG, Kim KN, Yoon do H, Shin HC. Radiologically documented adjacent-segment degeneration after cervical arthroplasty: characteristics and review of cases. *Surg Neurol*. 2009;72(4):325-329.
156. Yin L, Zhang J, Wu Y, Li J, Yang Q. Increased signal intensity of spinal cord on T2W magnetic resonance imaging for cervical spondylotic myelopathy patients. *Medicine (Baltimore)*. 2020;99(49):e23098. doi:10.1097/md.0000000000023098.
157. Zhang J, Meng F, Ding Y, et al. Comprehensive Analysis of Hybrid Surgery and Anterior Cervical Discectomy and Fusion in Cervical Diseases. *Medicine*. 2020;99(5):e19055. doi:10.1097/md.0000000000019055.
158. Zhao YB, Sun Y, Chen ZQ, Liu ZJ. Application of cervical arthroplasty with BRYAN® cervical disc: long-term X-ray and magnetic resonance imaging follow-up results. *Chin Med J Engl*. 2010;123(21):2999-3002.
159. Zeller JL. Artificial spinal disk superior to fusion for treating degenerative disk disease. *JAMA*. 2006;296(22):2665-2666.
160. Zhang X, Zhang X, Chen C, et al. Randomized, Controlled, Multicenter, Clinical Trial Comparing BRYAN® Cervical Disc Arthroplasty with Anterior Cervical Decompression and Fusion in China. *Spine* (*Phila Pa 1976*). 2012;37(6):433-438. doi:10.1097/BRS.0b013e31822699fa.
161. Zigler JE, Delamarter R, Murrey D, Spivak J, Janssen M. ProDisc-C® and ACDF as Surgical Treatment for Single Level Cervical Symptomatic Degenerative Disc Disease: Five-Year Results of an FDA Study. *Spine* (*Phila Pa 1976*). 2013;38(3):203-209. doi:10.1097/BRS.0b013e318278eb38.
162. Zigler JE. Clinical results with ProDisc®: European experience and U.S. Investigation Device Exemption Study. *Spine*. 2003;28(20S):S163-S166.
163. Zindrick M, Harris MB, Humphreys SC, et.al. Cervical disc arthroplasty. *J Am Acad Orthop Surg*. 2010;18(10):631-637. doi:10.5435/00124635-201010000-00006.