10-YEAR OUTCOMES FROM A PROSPECTIVE RANDOMIZED TRIAL COMPARING 2-LEVEL CERVICAL ARTHROPLASTY TO 2-LEVEL ANTERIOR CERVICAL FUSION: NDI AND NEUROLOGICAL SUCCESS RATES, ADVERSE EVENTS, SECONDARY SURGERIES, AND RANGE OF MOTION

Summary of Study Design and Outcomes[1]

1. Matthew F. Gornet et al. Two-level cervical arthroplasty versus anterior cervical discectomy and fusion: 10-year outcomes of a prospective, randomized investigational device exemption clinical trial. *J Neurosurg Spine* 31:508–518, 2019

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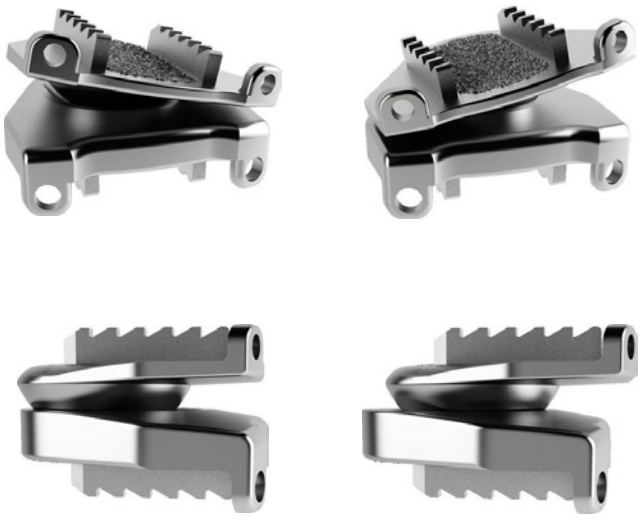
STUDY DESIGN

The Prestige™ LP Investigational Device Exemption (IDE) trial was a prospective, multi-center, randomized controlled trial (RCT) comparing patient outcomes after cervical disc arthroplasty surgery with the Prestige™ LP Cervical Disc (CDA), or anterior cervical discectomy and fusion (ACDF) surgery to treat symptomatic cervical disc disease (intractable radiculopathy and/or myelopathy at two contiguous levels between C3-C7. The primary study endpoint used to compare safety and effectiveness of CDA versus ACDF was a composite measure called Overall Success, which is based on NDI (Neck Disability Index) scores; serious implant-associated or implant/surgical procedure–associated adverse events (AE), associated second surgeries, and neurological status.

The study was designed as a Bayesian non-inferiority trial with a margin of 10%. Bayesian statistical methods were predefined and used to determine non-inferiority. If noninferiority in overall success was established for CDA compared to ACDF, the CDA treatment was safe and effective, and then superiority was evaluated. Success rates for individual effectiveness endpoints were compared between the two treatment groups; when noninferiority of CDA was established, superiority was evaluated. Outcomes with posterior probability of superiority of > 95% were considered as statistically superior.



Prestige™ LP Cervical Disc, Titanium Ceramic Composite Ball in Trough articulation is designed to allow for a minimum of 10 degrees lateral bending (from neutral) and a minimum of 10 degrees flexion/extension (from neutral), unlimited axial rotation (constrained by ligaments and posterior elements) and A/P translation (sagittal plane).

STUDY INCLUSION/EXCLUSION SUMMARY

Inclusion Criteria

- Radiculopathy and/or myelopathy
  - Two adjacent levels (C3-C7)
    - Herniated disc
  - Osteophyte formation
- Preoperative ND Score ≥ 30
- At least 6 weeks failed non-operative treatment
- >18 years of age
- No previous surgery at index or adjacent level(s)

Exclusion Criteria

- Significant cervical anatomical deformity
- Fused level adjacent to index level
- Spondylosis (bridging osteophytes, loss of motion, disc collapse >50%)
- Severe facet joint pathology
- Osteopenia or osteomalacia
- Spinal metastases
- Infection
- Diabetes
- Allergy to stainless steel, titanium, or a titanium alloy

OUTCOME MEASURES

Primary Outcome Measure

Overall Success

	Success
15 point improvement in NDI Score	✓
Maintenance or improvement in Neurological Status	✓
No serious adverse event associated with the device	✓
No 2nd surgeries at treated level classified as failure*	✓

*Failed secondary surgeries included revisions, non-elective removals, and supplemental fixations

Secondary Outcome Measures

- Neck Pain Scores
- Arm Pain Scores
- SF-36 PCS
- FSU Height Success

PATIENT ACCOUNTABILITY AT 10 YEARS

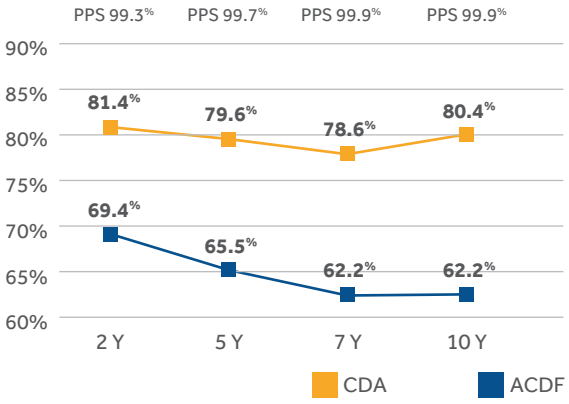
	Surgery	24 MO	60 MO	84 MO	120 MO
Patient Accountability for 2-Level					
Prestige LP (n=209)	209 (100%)	199 (95.2%)	167 (82.3%)	154 (76.6%)	148 (86.0%)
ACDF (n=188)	188 (100%)	160 (88.9%)	140 (80.0%)	127 (73.8%)	118 (84.9%)

Note: The post-op numbers exclude patient withdrawals and deaths over the long-term follow-up.

CLINICAL OUTCOME RESULTS

From 2 to 10 years, CDA demonstrated statistical superiority over ACDF for overall success, with rates at 10 years of 80.4% versus 62.2%, respectively (posterior probability of superiority [PPS] = 99.9%).

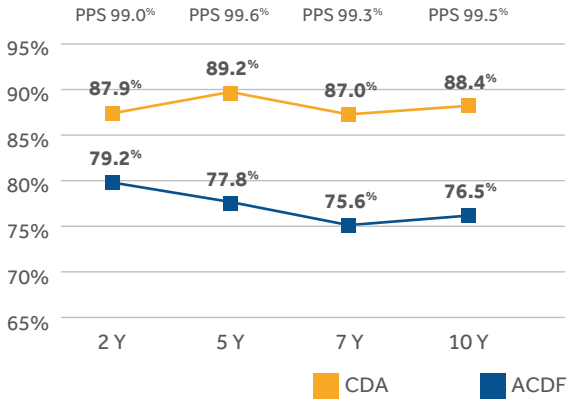
Overall Success*



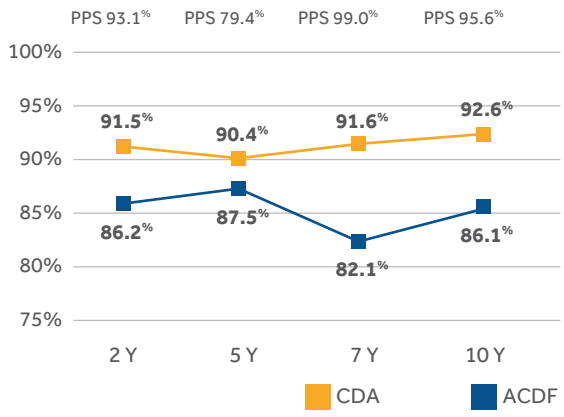
Risks of the Prestige Cervical Disc include, but are not limited to: development of new radiculopathy, myelopathy or pain.

From 2 to 10 years, CDA demonstrated statistical superiority over ACDF in Neck Disability Index (NDI) success with rates at 10 years of 88.4% versus 76.5% (PPS = 99.5%). The NDI Questionnaire is a patient self-reported measure of pain associated with activities of daily living. NDI Success is defined as >=15 point improvement from preop NDI score to postop NDI score.

NDI Success*



Neurological Success*



From 2 to 10 years, CDA demonstrated statistical superiority over ACDF in Neurological success with rates at 10 years of 92.6% versus 86.1% (PPS = 95.6%). Neurological Success is defined as maintenance or improved postoperative status based on motor function.

*Not adjusted for multiplicity.

ADVERSE EVENTS AND ASSOCIATED SECONDARY SURGERIES

The CDA group had fewer serious (grade 3–4) implant related or implant/surgical procedure–related adverse events (3.8% vs 8.1%; posterior mean 95% Bayesian credible interval [BCI] of the log hazard ratio [LHR] -0.92 [-1.88, -0.01]). The CDA group also had statistically fewer secondary surgical procedures at the index levels (4.7%) than the ACDF group (17.6%) (LHR [95% BCI] -1.39 [-2.15, -0.61]) as well as at adjacent levels (9.0% vs 17.9%)LHR[95%BCI] -0.66 (-1.29, -0.01).

	Prestige LP (N=209)	Control (N=188)
Serious, possibly implant- or implant/procedure related Adverse Event (AE)	(7) 3.8%*	(14) 8.1%
Secondary Surgery at Either Index Level	(9) 4.7%*	(27) 17.6%
Secondary Surgery at adjacent level(s)†	(16) 9.0%*	(24) 17.9%

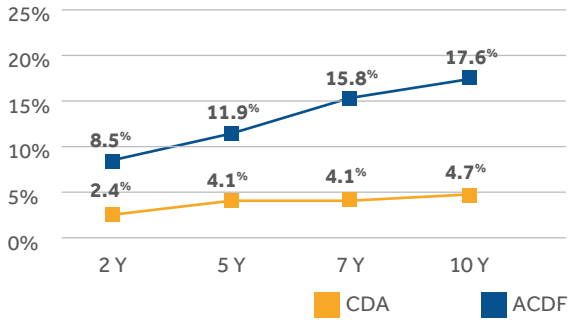
* CDA statistically less frequent than ACDF over time period

‡ Some patents had more than one secondary surgery; some secondary surgeries involved both index and adjacent levels.

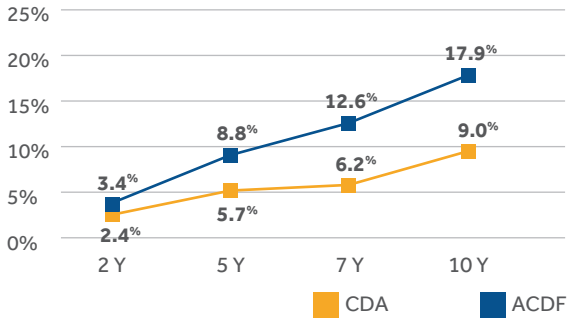
SECONDARY SURGERY TRENDS FROM 2 TO 10 YEARS POSTOPERATIVELY

The cumulative rates of any secondary surgery at treated levels through 10 years (Table 2) were 4.7% and 17.6% for the CDA and ACDF groups, respectively, a statistically significant difference (LHR [95% BCI] -1.39 [-2.15, -0.61]) favoring CDA. From 2 to 10 years postoperatively, rates of secondary surgeries involved with adjacent levels over time favored the CDA group (Bayesian posterior probability of superiority (PPS) >95%).

Secondary Surgeries at Index Levels



Cumulative Rate of Secondary Surgeries Involved in Adjacent Levels



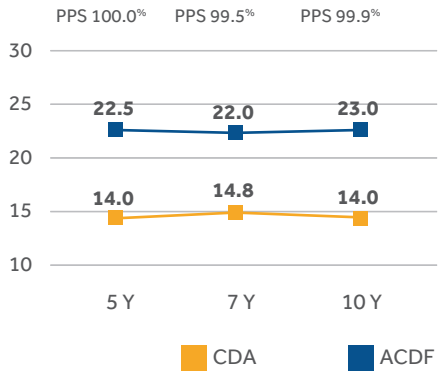
Risks of the Prestige LP Cervical Disc include, but are not limited to: development of new radiculopathy, myelopathy, or pain.

Risks of the Prestige LP Cervical Disc System include, but are not limited to: the need for subsequent surgical intervention.

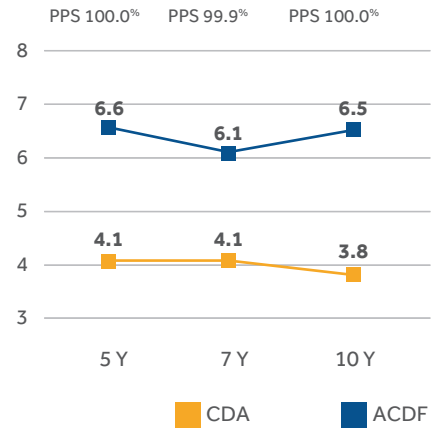
NECK DISABILITY INDEX, NECK/ARM PAIN, AND SF-36 PCS SCORES

Mean scores over time for both the CDA and ACDF groups for efficacy measures NDI score (A), neck pain score (B), arm pain score (C), and SF-36 PCS score (D). For NDI, neck pain, and arm pain, a lower score indicates less disability or pain. For SF-36 PCS, a higher score means better functioning. PPS based on the between-treatment comparisons of score improvements from preoperative; PPS > 95% considered statistically superior.

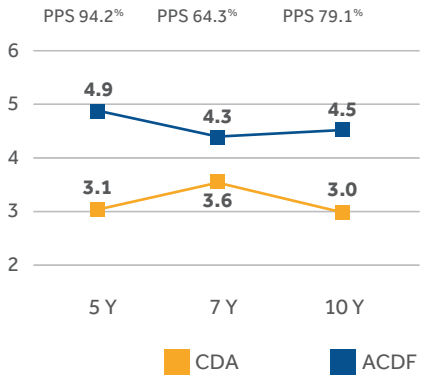
Mean NDI Score (A)



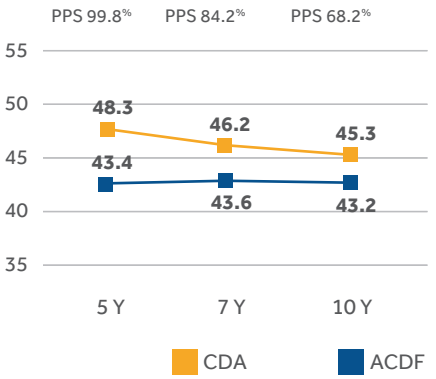
Mean Neck Pain Score (B)



Mean Arm Pain Score (C)



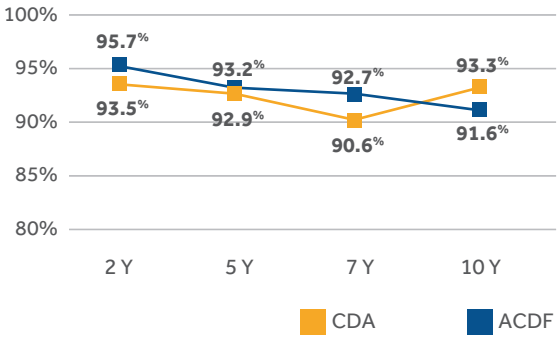
Mean SF-36 PCS Score (D)



RADIOLOGIC AND OTHER OUTCOME RESULTS

FSU Success Rate

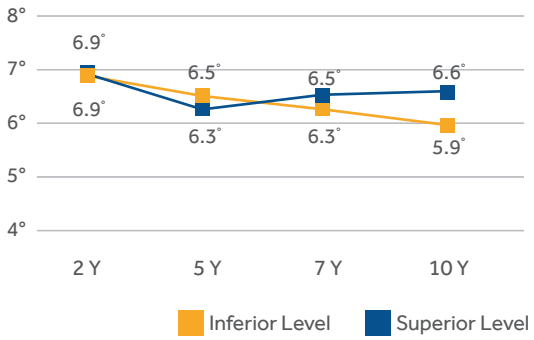
FSU success rates for the CDA and ACDF groups over time with no statistical difference at any point of long-term follow-ups. FSU success was defined as a ≤ 2mm decrease either anteriorly or posteriorly from 6 weeks postoperatively.



Risks of the Prestige LP Cervical Disc include, but are not limited to: bone formation (including heterotopic ossification) that may reduce spinal motion or result in a fusion, either at the treated level or at adjacent levels.

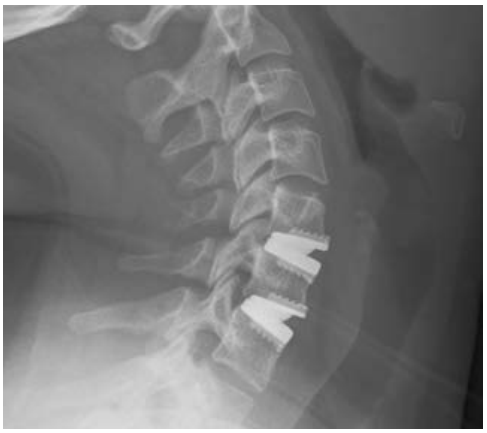
Angular Motion

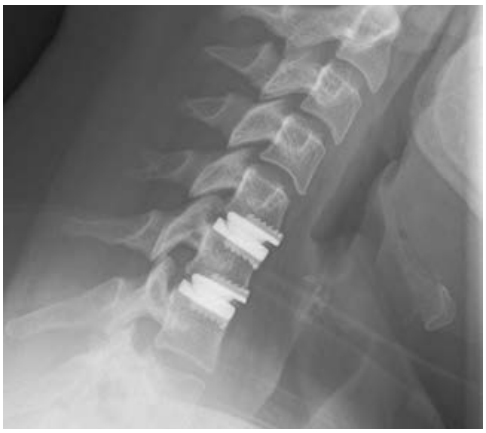
While motion ranged from 0.19-26.43°, the Prestige LP Cervical Disc provided an average of 5.9° angular motion at 10 years compared to 5.6° pre op for the inferior level, and an average of 6.6° angular motion at 10 years compared to 6.8° pre op for the superior level. The mean ROM over time at the superior and inferior levels of the CDA patients was maintained with no statistically significant changes between the preoperative and ten-year time point.



CONCLUSIONS

The low-profile Prestige LP Cervical Disc, implanted at two adjacent levels in this study, was statistically noninferior to ACDF in every outcome measure and was statistically superior in overall success rate as well as NDI success rate, neurological success rate, and mean NDI and neck pain scores. Improved clinical outcomes and segmental motion were maintained through 10 years after surgery, with a significantly lower rate of implant- or implant/procedure-related serious adverse effects and statistically lower rates of secondary surgeries at both index and adjacent levels.





BRIEF SUMMARY OF INDICATIONS, CONTRAINDICATIONS, AND WARNINGS FOR THE PRESTIGE LP CERVICAL DISC

The Prestige LP Cervical Disc is indicated in skeletally mature patients for reconstruction of the disc at one level from C3-C7 following single-level discectomy for intractable radiculopathy (arm pain and/or a neurological deficit) with or without neck pain, or myelopathy due to a single-level abnormality localized to the level of the disc space and at least one of the following conditions confirmed by imaging (CT, MRI, X-rays): herniated nucleus pulposus, spondylosis (defined by the presence of osteophytes), and/or visible loss of disc height as compared to adjacent levels. The Prestige LP Cervical Disc is implanted using an anterior approach. Patients should have failed at least 6 weeks of non-operative treatment or have had the presence of progressive symptoms or signs of nerve root/spinal cord compression in the face of continued non-operative management prior to implantation of the Prestige LP Cervical Disc.

The Prestige LP Cervical Disc should not be implanted in patients with an active systemic infection or localized infection at the surgical site; osteoporosis defined as a DEXA bone mineral density T-score equal to or worse than -3.5 or a T-score equal to or worse than -2.5 with vertebral compression fracture, or osteopenia defined as a DEXA bone mineral density T-score ≤ -1.0; allergy or sensitivity to titanium, aluminum or vanadium; marked cervical instability on neutral resting lateral or flexion/extension radiographs; translation >3.5mm and/or >11° rotational difference from that of either adjacent level; severe spondylosis at the level to be treated, characterized by bridging osteophytes, loss of disc height >50%, an absence of motion (<2°) as this may lead to a limited range of motion and may encourage bone formation (e.g. heterotopic ossification, fusion); severe facet joint arthropathy; significant cervical anatomical deformity or clinically compromised vertebral bodies at the affected level due to current or past trauma (e.g., by radiographic appearance of fracture callus, malunion or nonunion) or disease (e.g., ankylosing spondylitis, rheumatoid arthritis); significant kyphotic deformity or significant reversal of lordosis; or symptoms attributed to more than one cervical level.

The Prestige LP Cervical Disc should only be used by surgeons experienced in the surgical procedure who have undergone adequate hands-on training with this specific device, and are familiar with the implant components, instruments, procedure, clinical applications, biomechanics, adverse events, and risks associated with the Prestige LP Cervical Disc. A lack of adequate experience and/or training may lead to a higher incidence of adverse events, such as neurological complications.

The safety and effectiveness of this device has not been established in patients with the following conditions: axial neck pain as solitary symptom; not skeletally mature; prior cervical spine surgery, including prior surgery at the index level; fused level adjacent to the level to be treated; facet joint pathology of involved vertebral bodies; spinal metastases; Paget's disease, osteopenia, osteomalacia, or other metabolic bone disease; overt or active bacterial infection, either local or systemic; chronic or acute renal failure or history of renal disease; taking medications known to potentially interfere with bone/soft tissue healing (e.g., steroids); pregnant; diabetes mellitus requiring daily insulin management; extreme obesity as defined by the NIH Clinical Guidelines Body Mass Index (i.e., BMI ≥40); and have not undergone at least six weeks of non-operative treatment or had signs of progression or spinal cord/nerve root compression with continued non-operative care.

Implanted metal alloys release metallic ions into the body (especially those devices with metal-on-metal articulating surfaces). The long term effect of these ions on the body is not known. Patients in the clinical study were instructed to use non-steroidal anti-inflammatory drugs (NSAIDs) for two weeks postoperatively. It has been reported in the literature that short-term postoperative use of NSAIDs may reduce the instance of heterotopic ossification (HO). To reduce the instance of HO, it is recommended that the Prestige LP device be implanted in subjects able to tolerate the use of NSAIDs for two weeks post-operatively.

Caution: Federal law (USA) restricts this device to sale by or on the order of a physician.

Please see the package insert for the complete list of indications, warnings, precautions, adverse events, clinical results, and other important medical information.

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Consult instructions for use at this website www.medtronic.com/manuals.

Note: Manuals can be viewed using a current version of any major internet browser. For best results, use Adobe Acrobat™ Reader with the browser.

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