

# Traumatic Migration of the Bryan Cervical Disc Arthroplasty

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## Abstract

**Study Design** Case study.

**Objective** To describe a case of dislodgment and migration of the Bryan Cervical Disc (Medtronic Sofamor Danek, Memphis, Tennessee, United States) arthroplasty more than 6 months after implantation secondary to low-energy trauma.

**Methods** The inpatient, outpatient, and radiographic medical records of a patient with traumatic migration of the Bryan Cervical Disc arthroplasty were reviewed. The authors have no relevant disclosures to report.

**Results** A 36-year-old man with chronic left upper extremity radiculopathy underwent uncomplicated Bryan Cervical Disc arthroplasty at C5–C6, with complete resolution of his symptoms. Approximately 6 months after his index procedure, he sustained low-energy trauma to the posterior cervical spine, after being struck by a book falling from a shelf. The injury forced his neck into flexion, and though he did not have recurrence of his radiculopathy symptoms, radiographs demonstrated anterior migration of the arthroplasty device. He underwent revision to anterior cervical discectomy and fusion.

**Conclusions** Although extremely rare, it is imperative that surgeons consider the potential for failure of osseous integration in patients undergoing cervical disk arthroplasty, even beyond 3 to 6 months postoperatively. This concern is especially relevant to press-fit or milled devices like the Bryan Cervical Disc arthroplasty, which lack direct fixation into adjacent vertebral bodies. We are considering modification of our postoperative protocol to improve protection of the device after implantation, even beyond 3 months postoperatively.

## Keywords

- ▶ cervical disk arthroplasty
- ▶ cervical trauma
- ▶ traumatic migration
- ▶ device failure

## Introduction

The last decade has witnessed significant advances in the surgical management of cervical radiculopathy and myelopathy, to include development of motion-sparing alternatives to traditional anterior cervical discectomy and fusion (ACDF). The theoretical benefits of these alternatives, primarily cervical disk arthroplasty (CDA), include diminished contiguous

level strain, preservation of motion at the affected vertebral segment, and a hypothetical decrease in the development or progression of degenerative disease processes at immediately adjacent levels.<sup>1–3</sup> Several small randomized controlled trials have suggested that CDA may be associated with better neurologic outcomes, fewer revisions, and better overall success when compared with ACDF.<sup>4–8</sup> Previous studies have found that CDA provides up to an 89% rate of complete

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**Fig. 1** Anteroposterior (A) and lateral (B) preoperative radiographs demonstrating spondylosis and anterior osteophyte formation at C5–C6.

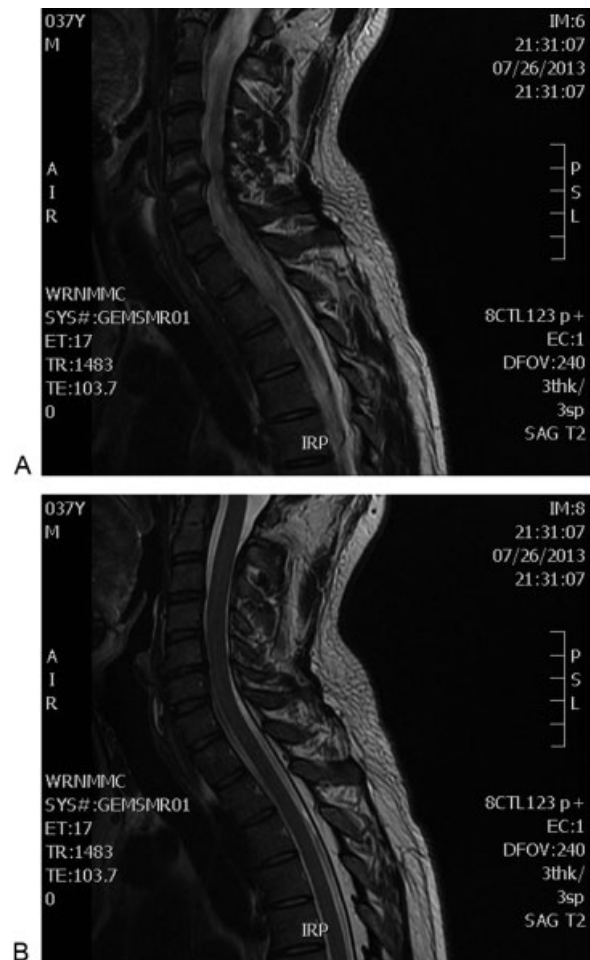
preoperative symptom relief, with greater than 90% of patients returning to their preoperative level of activity; notably, these outcomes were better than for patients undergoing ACDF.<sup>9,10</sup>

However, CDA procedures are not without associated operative risks, and the short- and long-term complications of CDA have begun to emerge in the literature: as with ACDF, postoperative dysphagia, recurrent laryngeal nerve injury, and posterior neck pain are concerning.<sup>11–14</sup> Peridevice vertebral bone loss and osteolysis, heterotopic ossification, and migration of the device have been reported, as has progression of adjacent segment disease despite motion preservation.<sup>15–17</sup> The Bryan Cervical Disc (Medtronic Sofamor Danek, Memphis, Tennessee, United States) is unique among CDA devices in that it consists of two titanium shells encompassing a polyurethane nucleus; the device is implanted into a space milled out of the cleared cervical disk space and the adjacent vertebral bodies. Two wings extend along the anterior edges of the titanium shells to prevent posterior displacement of the device,<sup>18</sup> but there is no direct fixation into the superior or inferior end plates. Posterior migration of the device has been reported infrequently,<sup>17,19,20</sup> but can be associated with symptom recurrence and neurologic compromise.<sup>15</sup> Here we present the case of a patient with anterior extrusion of this implant after a low-energy trauma to the posterior neck.

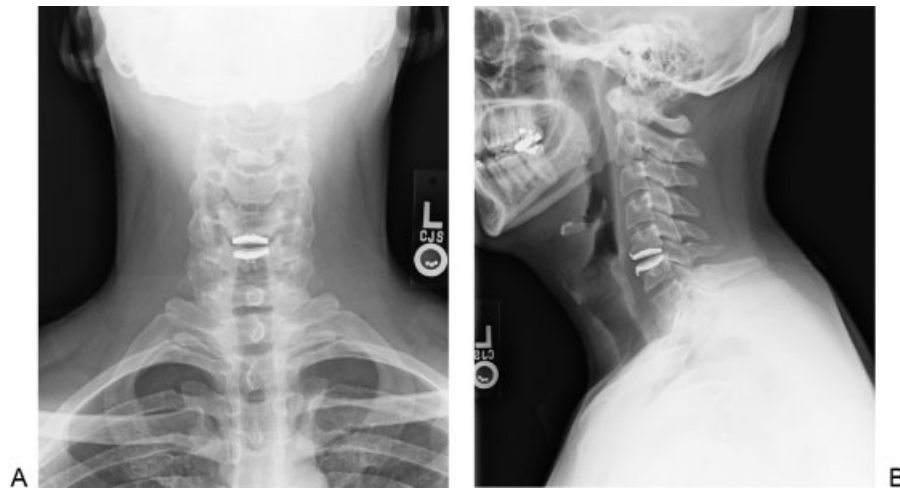
## Case Report

A 36-year-old man presented with left upper extremity radicular symptoms and intermittent numbness. He denied any gait disturbance or difficulty with fine motor activities. Physical exam demonstrated 4/5 strength of the left biceps and triceps. Preoperative radiographs are shown in **Fig. 1**. Magnetic resonance imaging (MRI) showed a disk osteophyte complex resulting in moderate central canal narrowing with moderate left and mild right neural foraminal stenosis at C5–C6 (**Fig. 2**). The patient underwent uncomplicated Bryan Cervical Disc arthroplasty at C5–C6 (**Fig. 3**) and had complete resolution of his

preoperative symptoms with return of the strength in his left upper extremity. After brief immobilization in a soft collar, the radiographs at 6 weeks were not concerning for implant failure



**Fig. 2** Sequential sagittal magnetic resonance image slices (A, B) demonstrating disk–osteophyte complex resulting in moderate central canal narrowing with moderate left and mild right neural foraminal stenosis at C5–C6.



**Fig. 3** Anteroposterior (A) and lateral (B) immediate postoperative radiographs demonstrating well-positioned and appropriately sized single-level Bryan Cervical Disc arthroplasty device at C5-C6.

or migration (►Fig. 4). Radiographs obtained at 3 months' follow-up demonstrated maintenance of the implant position without evidence of loosening (►Fig. 5), and the activity restrictions were lifted. The patient continued to do well and returned to his normal activities of daily living.

At ~6 months postoperatively, the patient reported that while he was seated at his desk, a book fell off the shelf behind him and struck the posterior aspect of his neck at the occipital-cervical junction, forcing his neck into flexion. He denied any recurrence of his radicular symptoms but did note mild posterior neck pain after the incident. Radiographs obtained at the time demonstrated ~2 mm of anterior implant migration without apparent movement on dynamic imaging (►Fig. 6). The patient was counseled regarding the potential for further migration, and he elected to proceed with revision ACDF. Postrevision radiographs are shown in ►Fig. 7. The patient is currently doing well postoperatively without any worsening of his symptoms.

## Discussion

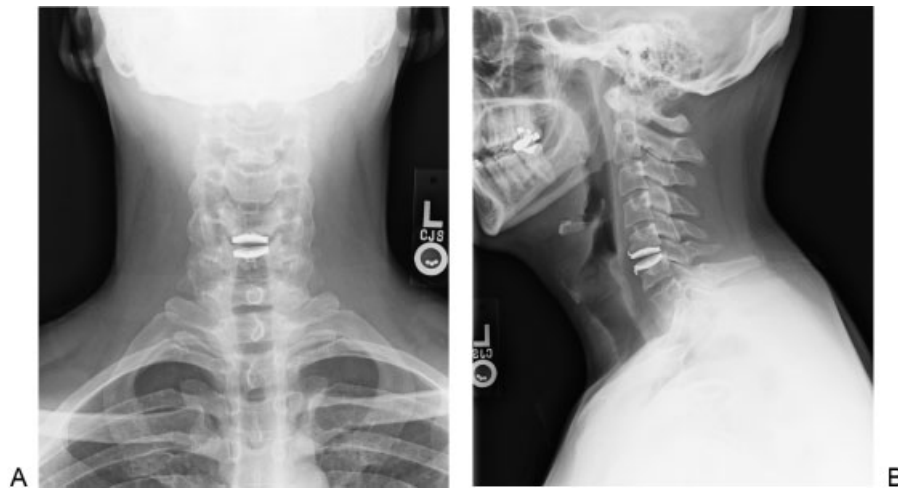
There are very few reports in the literature describing anterior migration of the Bryan Cervical Disc after implanta-

tion,<sup>17,19,20</sup> and none of these reports describes migration of the implant after low-energy trauma. Posterior migration of the Bryan Cervical Disc has been reported more commonly, but it also occurs infrequently and is not always associated with neurologic findings or symptom recurrence.<sup>21-23</sup> These articles are summarized in ►Table 1. Analysis of U.S. Food and Drug Administration IDE trials of the Bryan Cervical Disc noted only one case of posterior migration of the device with resulting myelopathy more than 4 years postoperatively.<sup>15</sup>

Importantly, this case illustrates that the potential exists for a failure of bony ingrowth into these implants, even 6 months postoperatively. We hypothesize that the low-energy trauma to the upper cervical spine in this patient caused immediate neck flexion without internal bracing, because the patient was not aware of or expecting the trauma. Although device migration is rare, the potential does exist for this complication to occur in a delayed fashion, and the physician must not only be aware of this potential but also appropriately counsel patients that it is possible. Currently, our postoperative protocol for patients undergoing single-level CDA is to immobilize for 1 to 2 weeks in a soft cervical collar as tolerated, followed by gradual resumption of normal activities. In asymptomatic patients, the device is considered



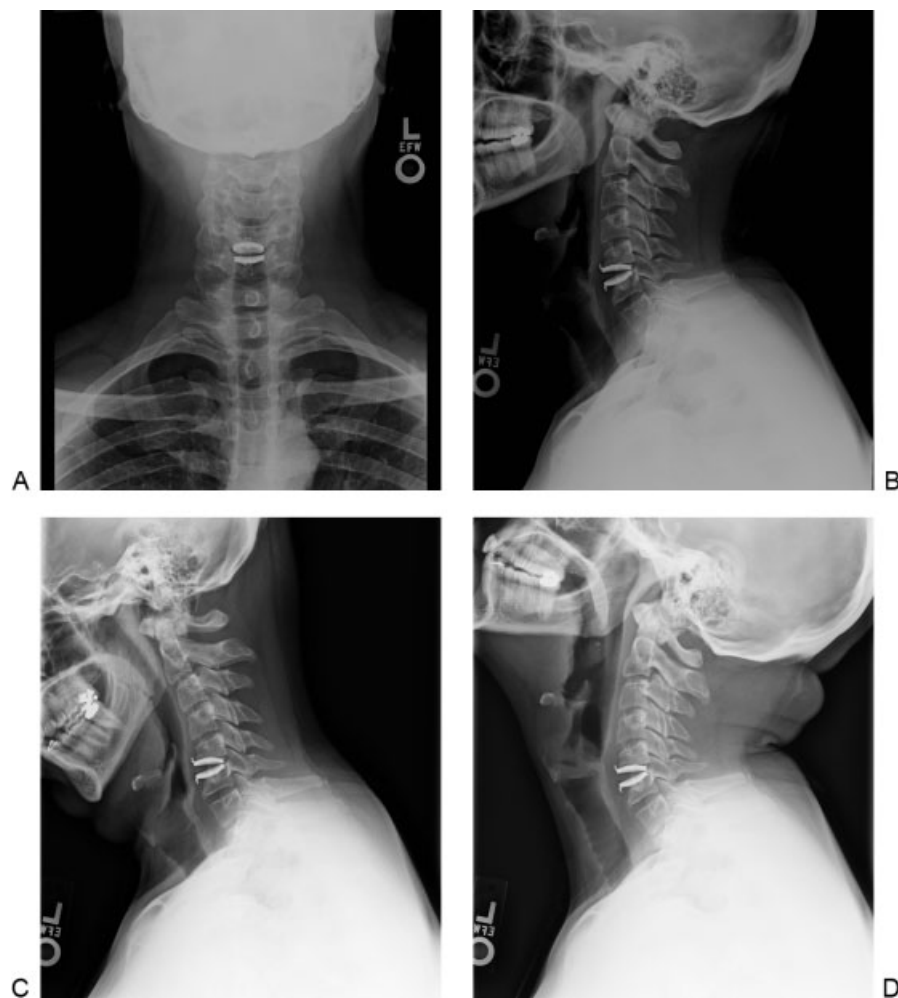
**Fig. 4** Lateral (A), flexion (B), and extension (C) radiographs at 6 weeks postoperatively demonstrating no change in the location or placement of the device, without evidence of migration or subsidence.



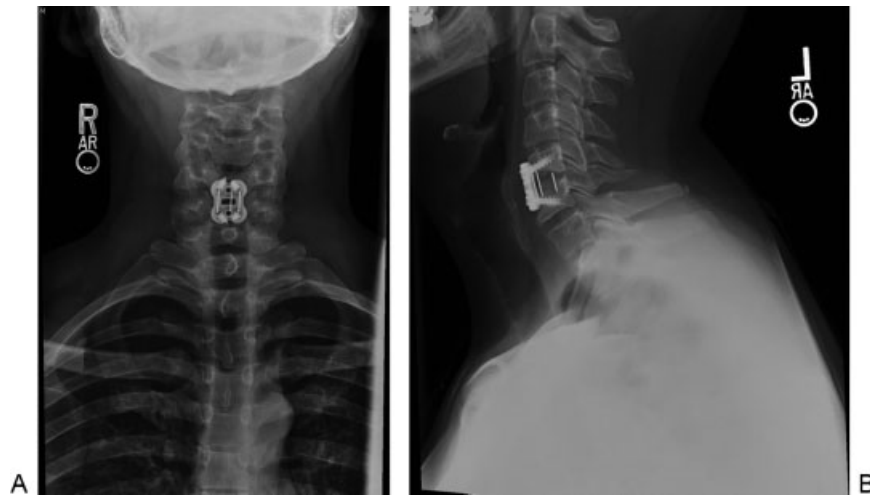
**Fig. 5** Anteroposterior (A) and lateral (B) radiographs at 3 months postoperation demonstrating no change in position of the implant.

fused to the adjacent end plates at 3 months, and all activity restrictions are lifted at that time. However, in light of this case and other findings of atraumatic migration at our institution,<sup>17</sup> we are considering modification of our postoperative protocol for similar CDA to delay the resumption of

normal activities, which may theoretically protect the device and improve osseous integration. However, no effective imaging modality is currently available to ascertain the bony ingrowth into these devices, as the bone-implant interface is often obscured from artifact interference on computed



**Fig. 6** Anteroposterior (A), lateral (B), flexion (C), and extension (D) radiographs at 6 months postoperatively showing migration of the Bryan Cervical Disc device ~2 mm anteriorly, without change in implant position on dynamic radiography.



**Fig. 7** Anteroposterior (A) and lateral (B) immediate postoperative revision radiographs demonstrating an anterior cervical discectomy and fusion at C5–C6.

**Table 1** Summary of cited articles discussing migration of cervical disk arthroplasty devices

Authors	Year	Article type	No. of CDA patients	No. of migration cases	Direction of migration	Implant
Wagner et al <sup>17</sup>	2014	Case report	1	1	Posterior	Bryan Cervical Disc (Medtronic Sofamor Danek, Memphis, Tennessee, United States)
Anderson et al <sup>19</sup>	2004	Prospective	136	2	Anterior and posterior	Bryan Cervical Disc
Tsermoulas and Bhattathiri <sup>20</sup>	2013	Case report	1	1	Anterior	Mobi-C Cervical Disc Prosthesis (LDR Spine USA, Inc., Austin, Texas, United States)
Pickett et al <sup>21</sup>	2006	Prospective	74	1	Posterior	Bryan Cervical Disc
Zhang et al <sup>22</sup>	2014	Prospective	58	2	Posterior	Bryan Cervical Disc
Quan et al <sup>23</sup>	2011	Prospective	21	1	Posterior	Bryan Cervical Disc
Hacker et al <sup>15</sup>	2013	Prospective	94	1	Posterior	Bryan Cervical Disc

Abbreviation: CDA, cervical disk arthroplasty.

tomography scan, which further complicates the postoperative algorithm in such patients. Despite these concerns, we do believe that CDA is a safe, viable treatment alternative to ACDF, as corroborated by recent literature.<sup>9,10,12,22,24–26</sup>

However, it is important to note that the device in this case is not perfectly placed in the interspace. Although ideal anatomic placement of the arthroplasty is centered between the uncovertebral joints, the Bryan Cervical Disc arthroplasty also requires milling of the end plate to provide press-fit stability. This particular case demonstrates that aggressive or nonuniform removal of the inferior end plate during the milling process may lead to asymmetrical seating of the implant. Whether the imperfect placement of the device is

related to the osseous ingrowth failure or ultimately to the traumatic migration of the implant is unclear; however, this possibility cannot be ignored.

In conclusion, it is imperative that surgeons consider the potential for the failure of osseous integration in patients receiving CDA, even beyond 3 to 6 months postoperatively. This concern is especially relevant to press-fit or milled devices like the Bryan Cervical Disc, which lack direct fixation into the adjacent vertebral bodies. In patients outside the acute postoperative period, a low-energy trauma to the cervical spine can yield potentially devastating consequences, and in light of these findings a review of many institutional postoperative protocols may be beneficial.



**Note**

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**Disclosures**

Scott C. Wagner, none

Daniel G. Kang, none

Melvin D. Helgeson, none

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