CASE REPORT

Zero-Profile Implant System for Treatment of Dysphagia Caused by Noncontiguous Anterior Cervical Osteophytes—A Case Report with Literature Review

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Background: Esophageal cervical spondylosis is a rare type of cervical spondylosis which causes dysphagia. Surgical osteophyte resection is taken when conservative treatment does not respond. However, few reports on its operation and postoperative follow-up. We first present a case showing how the Zero-Profile implant system is utilized to treat dysphagia caused by noncontiguous anterior cervical osteophytes.

Case Presentation: A patient with progressive dysphagia was referred to our department. Imaging examinations revealed a large diffuse idiopathic skeletal hyperostosis (DISH) related anterior osteophyte in C3/4, C6/7 and ossification of the anterior and posterior longitudinal ligaments. Anterior cervical osteophytectomy, discectomy, and fusion were performed on C3/4, C6/7. Two Zero-Profile implants were implanted. Postoperative dysphagia was significantly improved, and the patient was free to swallow large pills or solid foods at nine-years follow-up.

Conclusion: Osteophyte excision can effectively treat esophageal cervical spondylosis, This case shows that fusion using the Zero-Profile implant system is a viable option for patients with potential cervical instability following osteophyte resection.

Key words: Anterior cervical discectomy and fusion; Diffuse idiopathic skeletal hyperostosis; Dysphagia; noncontiguous anterior cervical osteophytes; Zero-profile implant

Introduction

Esophageal cervical spondylosis caused by anterior cervical osteophytes (ACOs) is a rare cause of dysphagia and is commonly identified in elderly people with cervical degenerative disease and diffuse idiopathic skeletal hyperostosis (DISH). Although more than 75% of people over 65 years old have age-related anterior cervical osteophytes,[1] less than 1% of cervical osteophytes result in dysphagia, and only 1.7% of dysphagia cases are caused by cervical osteophytes.[2–4] These patients are initially given conservative treatment, such as diet modification, muscle relaxants, anti-inflammatories, postural modifications while eating, phonophoresis, and swallowing rehabilitation programs.[5,6] Those who do not respond to conservative treatment, are treated through surgical osteophyte resection. In the present case, a 65-year-old male presented with a large anterior osteophyte in C3/4,C6/7 causing severe dysphagia. He underwent osteophyte removal combined with anterior cervical discectomy and fusion using the Zero-Profile implant system which resolved the symptoms.

Case Presentation

A 65-year-old man presented with symptoms of progressive dysphagia for more than 9 months which seemed to become aggravated in the last 2 months. The patient was referred to our department. Initially, dysphagia symptoms

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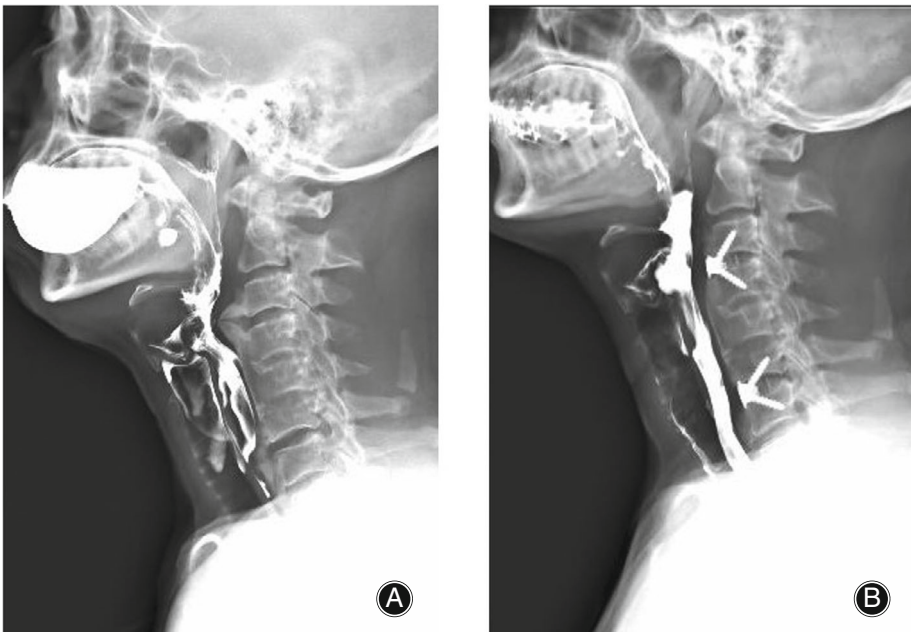

Fig. 1 (A) Preoperative barium swallow lateral X-ray of esophagus showed a narrowed esophageal lumen at both C3–C4 and C6-C7 levels. And (B) 1-month postoperatively showed there were unobstructed in esophageal lumen

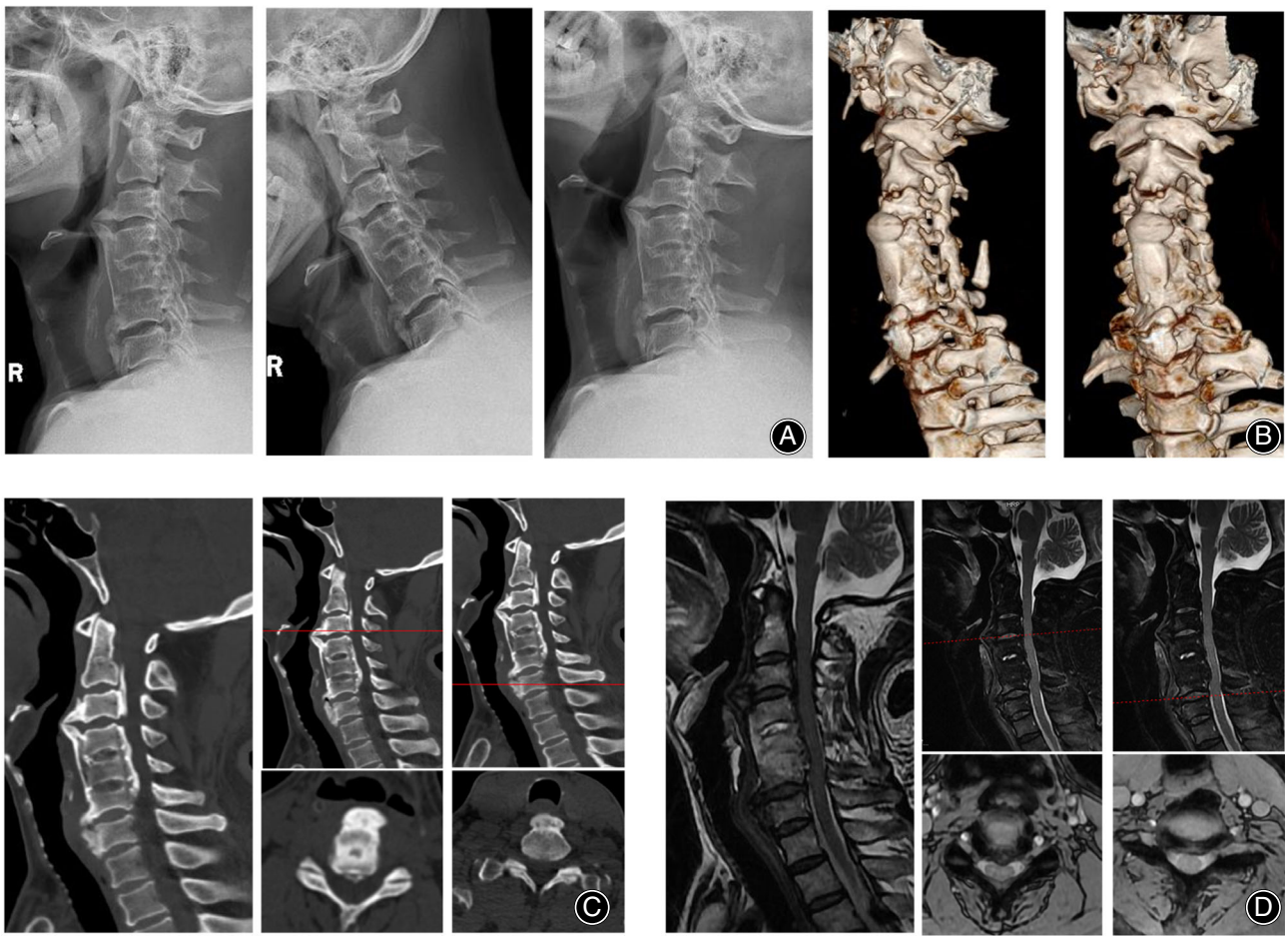

Fig. 2 Preoperative lateral, flexion, extension X-ray of cervical spine (A), anterior cervical hyperostosis on CT scan (C), three-dimensional reconstruction (B) and Sagittal showed there were two giant anterior multilevel osteophytic formation in C3–C4 and C6-C7 levels, Horizontal T2-weighted magnetic resonance image of the cervical spine (D) also showed that and mild compression on spinal

were limited to difficulty swallowing large pills or solid foods. For nearly 2 months, both solids and liquids were causing dysphagia. Additionally, the patient experienced mild neck and shoulder pain radiating to the left arm. Other symptoms such as weight loss, sweating, hematochesia, or arm numbness were absent. His past medical history included hypertension for 15 years and nearly 9 months of diabetes. The patient was using angiotensin II receptor blockers, beta-blockers, and diuretics. There was no history of trauma or surgery in his neck.

His muscle strength was normal in all limbs. Additionally, there were no symptoms of myelopathy. Physical examination showed unremarkable general condition. Routine blood tests including biochemical parameters, thyroid function tests, and bone metabolism were normal. The pre-surgery Japanese Orthopedic Association (JOA) score was 17. The barium swallowing test revealed a narrowed esophageal lumen at both the C3–C4 and C6-C7 levels (Fig. 1A and Video S1). Moreover, cervical spine X-ray (Fig. 2A), three-dimensional reconstruction (Fig. 2B), computed tomography (CT) (Fig. 2C), and magnetic resonance imaging (MRI) (Fig. 2D) revealed giant anterior multilevel osteophytes around the C3–C4 and C6-C7 regions which compressed the esophagus. Additionally, ossification was observed in the anterior longitudinal ligament in C3-C7. There was also intermittent ossification of the posterior longitudinal ligament in the C2-C3 and C4-C6. Because C3/4 and C6/7 of the neck were

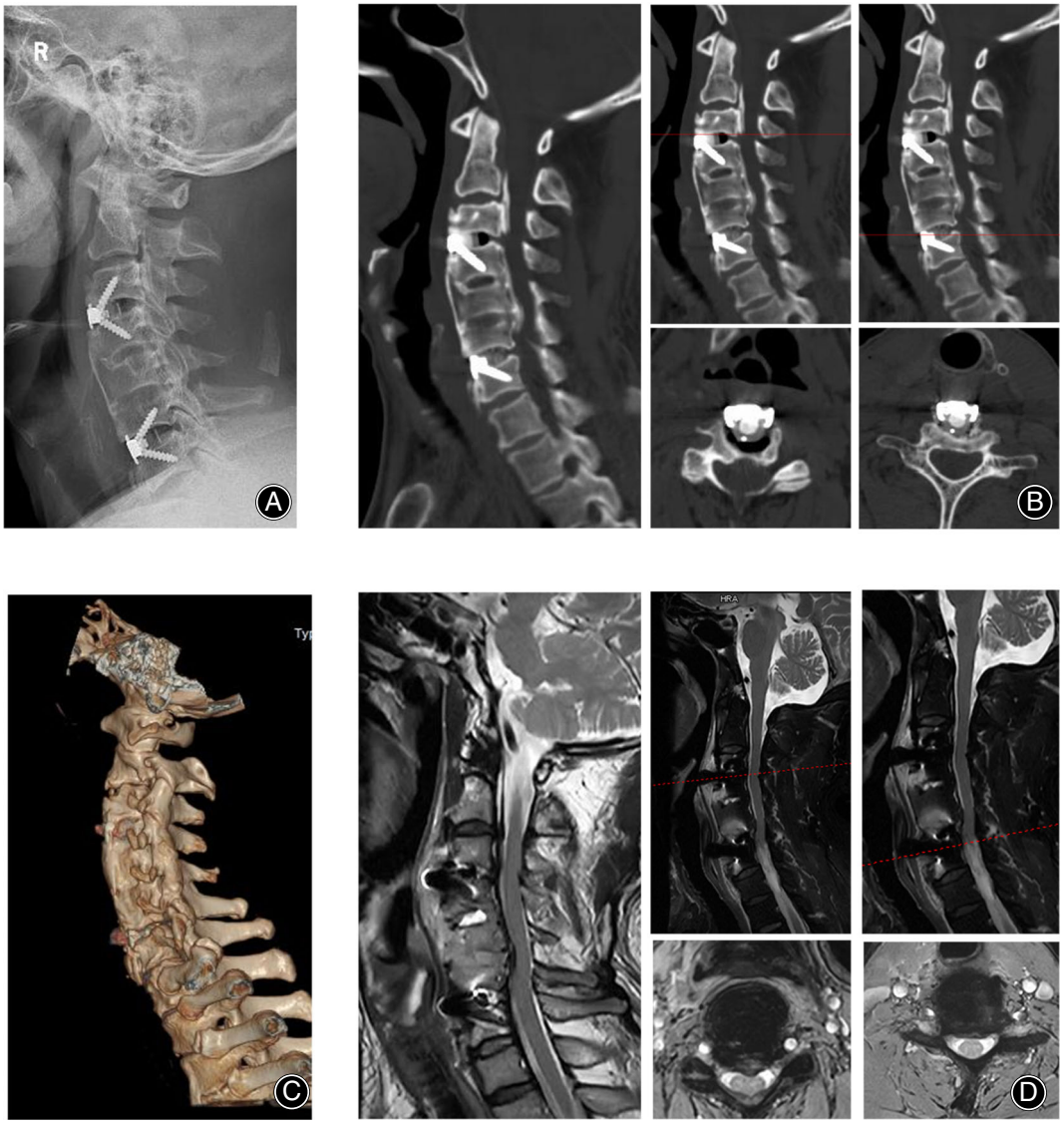

Fig. 3 Postoperative lateral X-ray of cervical spine (A), anterior cervical hyperostosis on CT scan (B), three-dimensional reconstruction (C) and Sagittal, Horizontal T2-weighted magnetic resonance image of the cervical spine (D) showed the giant anterior multilevel osteophytic formation in C3–C4 and C6-C7 levels were completely excised

not connected, the cervical spine retained some range of motion. Range of motion (ROM) in C2-C7 was 9.43°, whereas that of C3/4 and C6/7 were 1.37° and 3.52°, respectively.

Because the primary complaint of the patient was dysphagia. An anterolateral approach was used to perform anterior cervical osteophytectomy. An anterior curved incision was used to enter, and empty needles were used to mark the surgical levels. The osteophytes in the front were removed using the sharp-nosed bone forceps and an abrasion drill until the vertebral level returned to normal. The esophagus was pulled to one side to protect it from injury during the surgery. Given that the posterior longitudinal ligaments of the surgical segments were not connected and adjacent cervical vertebra segments were fused osseously. Moreover, because removal of osteophytes may invariably damage the annulus fibrosus of the corresponding segment, it is also likely to cause instability in the subsequent surgical segment. Therefore, the discs were completely removed and two zero profile (Zero-P VA; Zero Profle[Zero-P] Implant System, Synthes GmbH, Switzerland) implant systems were used to fuse C3/4 and C6/7. There were no complications following surgery. The patient reported significant alleviation of dysphagia. The Cervical spine X-ray (Fig. 3A), CT (Fig. 3B), three-dimensional reconstruction (Fig. 3C) and MRI (Fig. 3D) performed post-operatively revealed adequate osteophytes resection. Barium swallowing test (Fig. 1B and Video S2) performed 1 month later revealed no obstruction of the esophageal lumen. At the three-month follow-up, the dysphagia had completely resolved, and the patient was able to swallow large pills or solid foods. The X-ray (Fig. 4A), CT (Figure 4B), and three-dimensional reconstruction (Fig. 4C) revealed no recurrence of the osteophyte, and the ROM at C3/4 and C6/7 were 2.88°and 0.14°, respectively. The JOA score in the three-month follow-up was 17. Moreover, at the last follow-up performed at 9 months (Fig. S1), there was no recurrence of the osteophyte, and a continuous bone bridge was formed behind the prosthesis.

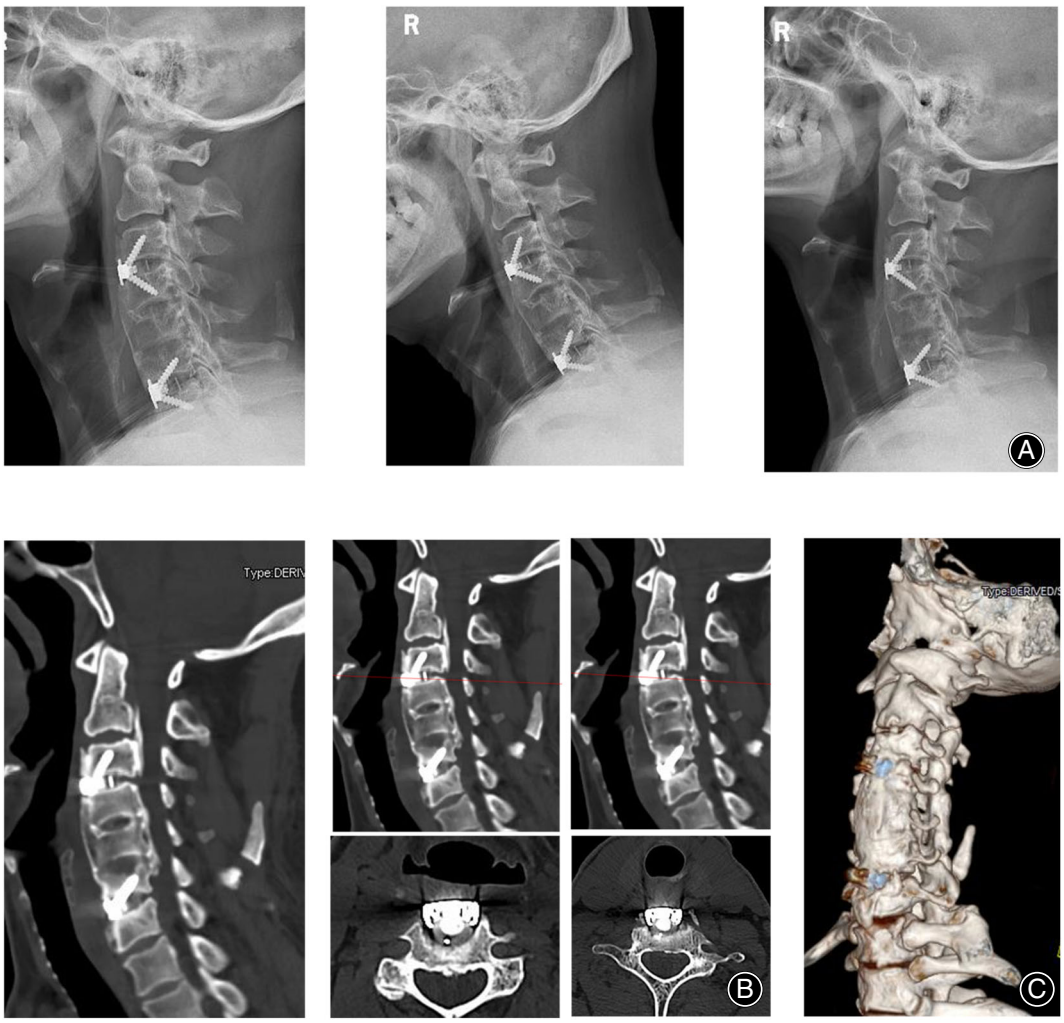

Fig. 4 3-monthes fellow-up lateral, flexion, extension X-ray of cervical spine (A), anterior cervical hyperostosis on CT scan (B), three-dimensional reconstruction (C) showed the osteophytic formation were completely excised and there were no new osteophyte formation and compression on spinal

Discussion

Since the discovery of dysphagia caused by cervical osteophytes in 1904 by Zahn[7] and the first surgical excision of an osteophyte in 1938 by Iglauer,[8] numerous researchers have reported that cervical osteophyte compression on the esophagus and throat may lead to dysphagia, foreign body sensation, and weight loss. According to Gamache and Voorhies,[9] the etiology of cervical anterior osteophytes can be classified as follows: (i) diffuse idiopathic skeletal hyperostosis (DISH), (ii) spondylosis deformans, (ii) ankylosing spondylitis, and (iv) intervertebral osteochondrosis. DISH is the most common cause of anterior cervical hyperosteophytosis. The major diagnostic criteria for DISH are the presence of more than four contiguous vertebral bodies with flowing calcification and ossifications in the anterior longitudinal ligament and the absence of apophyseal joint ankylosis or sacroiliac joint sclerosis. In the majority of cases, there were no radiographic signs of degenerative disc disease, but this may occur in some cases. In the present case, DISH, cervical degenerate disease and ossification of posterior longitudinal ligament (OPLL) were observed.

Esophageal cervical spondylosis is diagnosed based on the patient's symptoms and radiographs. Several treatments are used to treat this condition including diet modification, muscle relaxants, anti-inflammatories, postural changes during eating, phonophoresis, and swallowing rehabilitation programs. The surgery was performed when conservative treatment failed, progressive dysphagia developed or the patient had another type of cervical spondylosis.[5,10] Cervical osteophyte excision using the anterior approach is a common surgical method for the treatment of esophageal cervical spondylosis. However, whether internal fusion should be performed simultaneously is controversial. Removal of osteophytes may result in cervical instability, it is recommended to fuse the osteophyte segment.[11] Not only did this patient have large osteophytes in C3/4, C6/7, and ossification of the anterior longitudinal ligament, he also had significant ossification of the posterior longitudinal ligament, which fixed C4-6. However, there was no ossification of the posterior longitudinal ligament in C3/4, C6/7. Some range of motion was observed in C3/4, C6/7. This implies that excision of osteophytes in C3/4, C6/7 will result in excessive range in C3/4, C6/7, causing instability. Moreover, a long stage fixed C4-6 will increase the range in adjacent segments and lead to instability. In agreement with Miyamoto and Park[12,13] osteophytes in the front of the cervical were found to be closely related to the stability and range of motion of the cervical vertebra. In this patient, if osteophyte excision was performed without fusion, osteophytes reoccurrence or some other types of cervical spondylosis may occur postoperation. Notably, the osteophytes in C3/4 and C6/7 regions were close to the disc. During removal of osteophytes, the intervertebral disc may be damaged, accompanied by aggravation of the degeneration and instability of C3/4 and C6/7, leading to cervical spondylosis. Therefore, we recommend C3/4 and C6/7 osteophytes excision, followed by C3/4, C6/7 discectomy and fusion.

Regarding the choice of implants, Chung and Shriver[14–17] postulated that the traditional titanium plate and screw fusion system may exacerbate esophageal pressure and causing postoperative dysphagia, particularly in C3/4. To avoid this, the zero-profile implant, as a novel cervical fusion device, has been shown to result in lower risk of dysphagia when compared to the anterior plate and cage fusion, possibly because it does not induce significant esophageal disturbance.[18] Moreover, zero-profile implants require less exposure and are easier to install than conventional plate and cage implants. Therefore, we chose a zero-profile implant in this patient. According to Huang,[19] the incidence of dysphagia was significantly greater in patients undergoing two-level anterior cervical discectomy and fusion with zero-profile than those in the one-level group. Moreover, it has been shown that degeneration of the intermediate segment following noncontiguous anterior cervical fusion is faster than that of the supra- or infra-adjacent segments.[20–22] However, the two levels of Zero-p are rarely used for the treatment of esophageal cervical spondylosis. Therefore, the associated complications remained unknown.

In conclusion, we report a two-level noncontiguous (C3/4, C6/7) fusion using a Zero-p implant for the treatment of esophageal cervical spondylosis. Therefore, we make the following recommendations: (i) patients diagnosed with esophageal cervical spondylosis require a precise preoperative radiographic assessment to determine the location and extent of esophageal compression; (ii) preoperative evaluation should be performed to determine whether the removal of osteophytes will cause cervical stability. If removal will lead to instability, fusion surgery should be performed; (3) fusion using the Zero-p implant is recommended, because it can minimize esophageal and soft tissue disturbance; and (4) the Zero-P implant can achieve satisfactory fixation strength in the adjacent segments of a long fusion segment. A general treatment algorithm is summarized in the graphical abstract.

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Author Contributions

Yang Meng and Hao Liu contributed to the study design and supervision. Zihan Peng, Ying Hong and Yang

Meng contributed to study design, data extraction and statistical, and manuscript draft. All authors contributed to the review and revision of the manuscript. All authors read and approved the final manuscript.

Supporting Information

Additional Supporting Information may be found in the online version of this article on the publisher's web-site:

Video S1. Supporting information

Video S2. Supporting information

Figure S1. 9-monthes fellow-up lateral, flexion, extension X-ray of cervical spine (A), anterior cervical hyperostosis on CT scan (B), three-dimensional reconstruction (C) showed there was no recurrence of the osteophyte, and a continuous bone bridge was formed behind the prosthesis

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