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Anchored Spacers Versus Standalone Cages in Two Levels Anterior Cervical Discectomy for Treatment of Degenerative Cervical Disc Disease; A Comparative Study

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ABSTRACT

Background Data: Anterior cervical discectomy and fusion (ACDF) has been standard procedure in treatment of degenerative cervical disc disease. In order to reduce risks associated with traditional methods of anterior cervical discectomy with fusion a new zero profile cage with screws has been introduced and widely used.

Purpose: To compare the clinical and radiological outcomes of two levels ACDF using stand-alone peek cage and zero profile anchored cage with screws.

Study Design: Two groups of patients were enrolled in this study; Group A involving 30 consecutive patients that underwent two levels ACDF using standalone peek cages, and Group B including 30 patients that underwent two levels ACDF with zero-profile anchored cage with screws.

Patients and Methods: Both surgical groups were assessed clinically involving neck and arm pain Visual Analogue Score (VAS), neck disability index and Nurick score. Radiological evaluation involved the changes in vertebral heights (VH), both segmental (Cobb-s) and global (Cobb-c) Cobb angle and fusion rates via plain X-ray cervical spine that was done pre-operative, immediate post-operative and at 24 months post-operative.

Results: The neck disability index and the Nurick score together with both VAS for neck and arm pain were significantly improved after surgery with no statistical difference between both groups. All patients in both groups showed satisfactory fusion rates except two patients in Group A. Both groups showed early marked increase in the VH followed later by cage subsidence that was significantly higher in Group A patients. In both groups; Cobb-c, and Cobb-s angles were significantly increased in the immediate postoperative compared to the preoperative measures. Terminal measures for both Cobb-c and Cobb-s, at 24 months follow up images, in both groups worsened but to a statistically significant lesser extent in Group B compared to Group A.

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Conclusion: The zero-profile anchored cage with screws compared to stand-alone peek cage was effective treatment for cervical disc disorders in two levels cervical discectomy and fusion and their results showed better result regarding the incidence of cage subsidence and maintaining cervical lordosis. (2018ESJ169)

Keywords: Anchored spacer; cervical cage; degenerative spine; cervical discectomy

INTRODUCTION

Anterior cervical discectomy and fusion (ACDF) has been considered the gold-standard technique in the treatment of degenerative cervical spondylosis.[25,26] Previously, simple discectomy and fusion with iliac bone graft was performed and then intervertebral cages with or without an additional anterior cervical plate were widely used in ACDF procedures. Anterior cervical plate can significantly increase interbody fusion rates.[11,29] and increase cervical stability and maintain cervical sagittal alignment.[14,17] However, previous studies have also reported that anterior cervical plating may carry some risks like increased dysphagia rates, perforation of esophagus, plate malposition, tracheoesophageal lesions and accelerated adjacent disc degeneration.[6,20,33]

In order to reduce these complications associated with traditional anterior cervical plate, a new zero-profile anchored cage with screws devices had been introduced and had been widely used.[8,9,22,23,31] Previous studies based on small sample sizes have reported the application of the zero-profile anchored cage with screws in single ACDF surgery with excellent clinical and radiographic outcomes.[4,8,18,31,32] However, two levels ACDF with zero-profile anchored cage with screws compared with stand-alone peek cage has been little reported in the literature.

The efficacy of two levels ACDF with zero-profile anchored cage with screws compared with stand-alone peek cage is important to the practice of spine surgery. Spine surgeons commonly use the stand-alone cage to avoid the discomfort of the anterior plate and autologous bone graft. However, if the zero-profile anchored cage with screws shows a superior outcome over the standalone cage and a similar outcome to the anterior plate system, this technique could be a suitable alternative.

In this study we aimed at comparing the clinical and radiological outcomes of two-level ACDF using stand-alone peek cage on one hand and zero profile anchored cage with screws on the other hand.

PATIENTS AND METHODS

This is a retrospective study which included a total of 30 consecutive patients who underwent two levels ACDF using conventional stand-alone peek cage (Group A) and 30 consecutive patients who underwent two levels ACDF using zero-profile anchored cage with screws (Group B). All cages were filled with synthetic bone graft. The study was conducted in the department of Neurosurgery, faculty of medicine, Ain Shams University, Cairo through the period extended from January 2013 to January 2018.

All patients operated for two levels ACDF during this period were included if they meet the following inclusion criteria: (1) symptomatic cervical disc compression causing either radiculopathy or myelopathy or both with failed medical treatment for at least 6 months; (2) two levels degenerative cervical spondylosis confirmed by magnetic resonance imaging (MRI); and (3) complete and continuous clinical and imaging data. Exclusion criteria constituted severe osteoporosis of the cervical spine, presence of active infections, pathologic fractures of the vertebrae, patients with spinal deformity, ankylosing spondylitis or rheumatoid arthritis, and continuous or combined ossification of the posterior longitudinal ligament (OPLL).

Surgical Technique:

All surgeries were performed via a classic right Smith-Robinson approach after induction of general anesthesia in a supine position.[2] A horizontal right-side skin incision was performed in the neck anteriorly followed by dissection of the subcutaneous tissue and cutting of the platysma. Dissection anterior to sternocleidomastoid and lateral retraction of the carotid sheath and medial retraction of the esophagus and the trachea follows, then opening of the prevertebral fascia and localization of targeted level using spinal needle under fluoroscopy was performed. Application of Cloward retractor and Casper distractor on targeted levels then the intervertebral disc and herniated nucleus pulposus were extirpated and then the posterior longitudinal ligament and along with osteophytes were resected microscopically. The subchondral endplate of each vertebral body was prepared with a high-speed drill and curette while the bony endplate was preserved as much as possible to prevent implant subsidence. After complete decompression and preparation of the endplate, the disc space was distracted, and a trial implant of appropriate size was inserted under image control. Then appropriate zero-profile anchored cage with screws or stand-alone peek cage (DePuySynthes, Paoli, CA, USA) filled with composite synthetic bone graft (β-tricalcium-phosphate) (DePuySynthes, Paoli, CA, USA) was implanted into intervertebral space. Lateral and antero-posterior fluoroscopic images were performed, and the correct position of the implant was adjusted. In zero-profile anchored cage with screws group, the locking screws were inserted using torque limitation after preparing the pilot hole oriented through the aiming device with the help of fluoroscopic images. Hemostasis is rechecked, and then closure of the wound was performed. All patients were asked to wear a hard-cervical collar postoperatively for two weeks followed by soft neck collar for another two weeks.

<u>Radiographic and Clinical Evaluation:</u>

All patients were routinely examined with preoperative cervical spine MRI and cervical spine plain X-ray images including; an antero-posterior and lateral views. Additionally, all patients were followed with cervical spine plain X-ray images including; an antero-posterior and lateral views at the outpatient clinic. The follow up were done immediately post-operative and at 24 months (last follow up). We measured the Cobb angle of segmental area (Cobb-s) and Cobb angle of global cervical spine (Cobb-c) in the cervical spine plain X-ray lateral view to evaluate the aggravation of kyphosis. Cobb-c indicates the angle (°) between the lower endplate of C2 and C7 vertebral bodies, and Cobb-s indicates the angle (°) between upper endplate of cranial vertebral body and the lower endplate of caudal vertebral body of operated levels. Bony fusion was evaluated through X-ray lateral view and confirmed by 1) less than 10-degree movement on lateral flexion/extension views, 2) presence of bridging trabecular bone between the endplates on anteroposterior and lateral views, 3) less than 50% radiolucency in the perimeter surrounding the cage, and 4) no evidence of pull out of the device. Also, we compared pre- and post-operative vertebral height (VH) in the plain X-ray images to evaluate the degree of subsidence to estimate the spinal alignment state indirectly. VH indicates the length (mm) between the midline of upper endplate of cranial vertebral body and the lower endplate of caudal vertebral body of operated level (Figure 1).

Clinical outcomes were evaluated with the neck disability index (NDI), Nurick score and Visual Analogue Scale of the patients' neck pain (VAS neck) and arms (VAS arm). These indices were checked pre-operatively, postoperative and at 24 months. The operation time, blood loss and hospital stay were also checked.

<u>Cost Effectiveness:</u>

The cost analysis was based on operating time, hospital stay, and prosthesis cost. We relied on the cost data, in Egyptian pounds (EGP), used in the Egyptian Ministry of Health Hospitals. The inpatient and outpatient medical treatment and physical therapy costs were excluded as all the patients received similar treatments. Because none of our patients needed reoperation during the follow-up period, any possible hardware complication was not assigned to the cost.

<u>Statistical Analysis:</u>

Statistical analysis was performed using the Student t test, Mann-Whitney test and Pearson chi-Square test on the Statistical program of social signs (SPSS) (software package, version 21.0). A $P<0.05$ was considered statistically significant.

RESULTS

The study included two groups of patients; the stand-alone peek cage (Group A) that included 30 consecutive patients with a mean age of 47.83±9.85 years, and the zero-profile anchored cage with screws (Group B) that included 30 consecutive patients with a mean age of 46.40±8.86. Group A included 16 females and 14 males, whereas Group B included 13 females and 17 males (Table 1). All reported patients complete the follow up period of 24 months.

There was no statistically significant difference between the two groups concerning age, gender, VAS for neck, VAS for arm, neck disability index and Nurick score before surgery (all, $P>0.05$).

The standalone peek cage (Group A) had a mean intraoperative blood loss of 77.50±57.62 ml, a mean operative time of 148.67±22.05 minutes and mean hospital stay duration of 3.03±0.93 days. The zero-profile anchored cage with screws (Group B) had mean intraoperative blood loss of 72.83±53.04 ml, a mean operative time of 157.67±22.69 minutes and mean hospital stay duration of 2.97±0.81 days. Regarding the cost analysis, in Group A; the average total cost incurred was 3720±325 EGP, while in Group B, the average total cost was 5480±360 EGP (Table 2). There was no significant difference regarding the intraoperative blood loss, the operative time and the hospital stay duration between the two patients groups.

The neck disability index and the Nurick score together with both VAS for neck and arm pain were significantly improved after surgery with no statistical difference comparing the two groups as shown in (Table 3).

Radiological Outcome:

Regarding bony fusion, both groups showed satisfactory results in radiological assessment according to our criteria mentioned before. Only two patients showed mild pseudarthrosis in the stand-alone peek cage (Group A), which did not affect final clinical outcome.

In the stand-alone peek cage (Group A), the immediate postoperative VH was significantly increased compared with preoperative time and then markedly decreased in the last follow up time compared to the immediate post but still slightly higher than the preoperative height ($P=0.000$, $P=0.00$ and $P=0.222$), respectively.

On the other hand, the zero-profile anchored cage with screws (Group B) showed an immediate postoperative significant increase in VH compared with preoperative condition followed by a slight decrease in the last follow up time compared to the immediate postoperative. The comparison between the last postoperative follow up vertebral height and the preoperative one was increased showed highly significant differences. ($P=0.000$, $P=0.915$ and $P=0.000$), respectively.

Comparing between the final VH values in both groups, there was a statistically highly significant difference. The mean VH in Group B was decreased but to a limit that is much less than in Group A (61.60, 56.92 respectively). This means that the decrease in vertebral height and cage subsidence was more in the stand-alone peek cage (Group A) than in the zero-profile anchored cage with screws (Group B) (Figure 2) (Table 4).

In Group A patients, Cobb-c, and Cobb-s angles were significantly increased in the immediate postoperative compared to the preoperative measures, and then markedly decreased at the time of the last follow up compared to the preoperative results (Cobb-c, $P=0.00$, $P=0.869$) and (Cobb-s, $P=0.00$, $P=0.915$) (Table 4).

In Group B patients on the other hand, Cobb-c, and Cobb-s angles were significantly increased in the immediate postoperative compared to the preoperative measures, and then slightly decreased at the time of the last follow up compared to the preoperative results (Cobb-c, $P=0.00$, $P=0.00$) and (Cobb-s, $P=0.00$, $P=0.00$) (Table 4).

The Cobb-c scores at the immediate postoperative time point were 17.92±2.07 degrees for the stand-alone peek cage (Group A) and 18.09±2.26 degrees for the zero-profile anchored cage with screws (Group B) (P=0.771). Both groups showed loss of lordosis in the last follow up that was to a lesser extent in Group B patients. There was a highly statistically significant difference between the two groups regarding the terminal Cobb-c scores (P=0.00) (Table 4).

The Cobb-s immediately after the surgery was 3.49±0.73 degrees for the stand-alone peek cage (Group A) and 3.19±0.72 degrees for the stand-alone peek cage (Group A) (*P*=0.114). These values worsened gradually and the last follow up values were 2.79±0.86 degrees and 1.73±1.39 degrees respectively (P=0.013). The difference in the changes in Cobb-s angle values between pre and early postoperative images was non-significant in the two groups, whereas there was a significant difference between the last follow up images and the preoperative ones in both groups (Table 4).

Postoperative Complications:

There were no reported patients of wound infection, esophageal perforation or instrumentation failure. One patient had a recurrent laryngeal nerve injury and two patients had pseudarthrosis in the stand-alone peek cage group (Group A). One patient had a collection of cerebrospinal fluid which was treated with aspiration and a lumbar drain in the stand-alone peek cage group (Group A).

Table 1. Reported Epidemiological Data in both Patients Groups.

Parameters		Standalone PEEK Cage (N=30)	ACDF with Screws (N=30)	Test Value	P-value	Sig
Age		47.83±9.85 (32–67)	46.40±8.86 (32–66)	0.593•	0.556	NS
Gender	Females	16 (53.3%)	13 (43.3%)	0.601	0.438	NS
	Males	14 (46.7%)	17 (56.7%)			

Table 2. Reported Operative Parameters in Both Patients Groups.

Parameters	Standalone PEEK Cage (N=30)	ACDF with Screws (N=30)	t•	P-value
Blood Loss (ML)	77.50±57.62 (20–205)	72.83±53.04 (20–200)	0.326	0.745
Operation Time (MIN)	148.67±22.05 (115–195)	157.67±22.69 (120–195)	-1.558	0.125
Hospital Stay (days)	3.03±0.93 (2-5)	2.97±0.81 (2-5)	0.297	0.768
Cost without implants	1390±250	1420±130	0.34	0.45
Total cost	3720±325	5480±360	0.54	0.86

Table 3. Reported Clinical Outcome Parameters in both Patients Groups.

Parameters	Standalone PEEK Cage (N=30)	ACDF with Screws (N=30)	Test Value	P-value
VAS Neck Pre	8.50±1.20(6–10)	8.27±1.05(7–10)	-0.939	0.348
VAS Neck Post	3.47±0.73(2–4)	3.23±0.77(1–4)	-1.303	0.193
VAS Neck Post Last	2.27±0.91(1–4)	1.47±0.73(0–3)	-3.330	0.001
VAS Arm Pre	8.87±1.14(7–10)	9.40±0.72(8–10)	-1.759	0.079
VAS Arm Post	0.63±0.72(0–2)	0.67±0.71(0–2)	-0.211	0.833
VAS Arm Post Last	0.37±0.49(0–1)	0.40±0.62(0–2)	-0.071	0.943
Neck Disability Index Pre	53.80±16.27(24–92)	53.13±18.20(22–92)	0.150	0.882
Neck Disability Index Post	15.27±8.73(6–48)	16.13±10.58(6–48)	-0.346	0.731
Nurick Pre	1.63±1.27(0–5)	1.60±1.45(0–5)	-0.427	0.669
Nurick Post	0.57±0.73	0.60±0.89	-0.234	0.815

Table 4. Reported Radiological outcome Parameters in both Patients Groups.

Parameters		Standalone PEEK Cage (N=30)	ACDF with Screws (N=30)	T	P-value
VH (mm)	Pre-Op	56.76±1.57(54–59.5)	57.46±1.48(54.4–59.6)	3.230	0.078
	Post-Op	61.08±1.92(57.8–65.1)	61.73±1.24(59.1–64)	2.399	0.127
	Post-Op final	56.92±1.61(54.1–60.2)	61.60±1.29(59–63.9)	155.345	0.000
Cobb-C (degrees)	Pre-Op	14.47±2.35(11.5–18.9)	14.61±2.64(11.1–19.9)	-0.211•	0.833
	Post-Op	17.92±2.07(14.6–21.5)	18.09±2.26(13.6–220	-0.292•	0.771
	Post-Op last (24M)	14.55±2.48(11.1–19.3)	16.99±2.36(13–21.1)	15.272•	0.000
Cobb-S (degrees)	Pre-Op-Op	1.65±1.44(-0.69–3.9)	1.39±1.42(-0.99–3.6)	0.704•	0.484
	Post-Op	3.49±0.73(2.1–4.6)	3.19±0.72(1.8–4.3)	1.605•	0.114
	Post-Op last (24M)	2.79±0.86(1.1–4.2)	1.73±1.39-0.56–4.0)	2.554•	0.013

(VH: Vertebral Height; Cobb-S: angle of segmental area; Cobb-C: angle of global cervical spine)

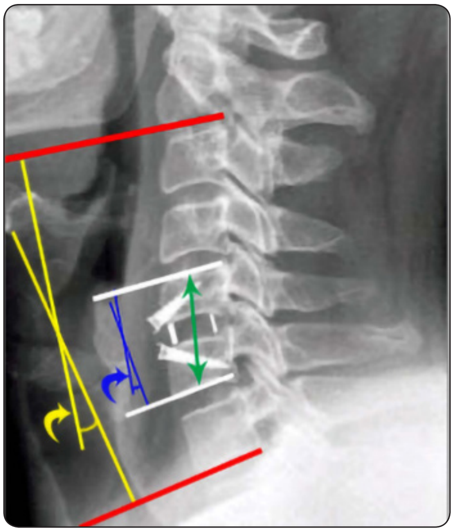

Figure 1. Demonstration of the measurements of the Cobb-C angle: yellowish arrow, Cobb-S angle: bluish arrow, and segmental height demonstrated by the double headed green arrow.

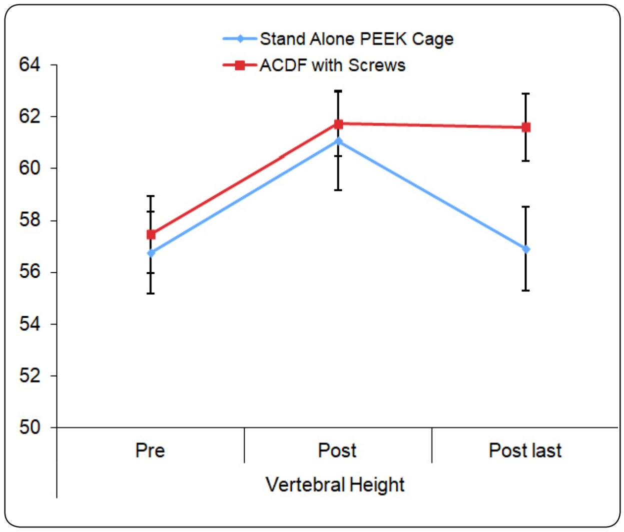

Figure 2. A chart comparing the serial VHs measured in both study groups.

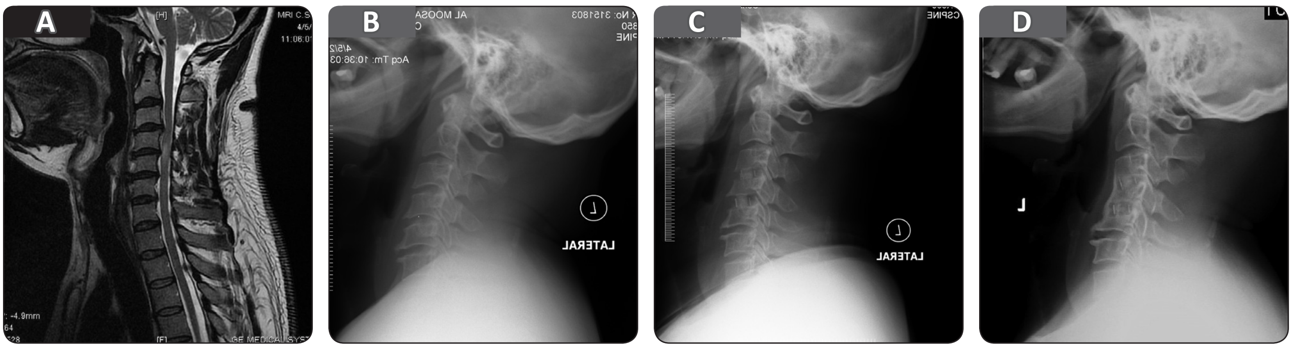

Figure 3. A 45 years old male patient presented with neck pain and left brachialgia unresponsive to medical treatment for one year. Patient was subjected for C3-4 and C4-5 ACDF using standalone peek cages. (A,B) Images show preoperative MRI and PXR cervical spine. (C) Shows early postoperative PCR cervical spine and (D) Shows late postoperative PXR cervical spine.

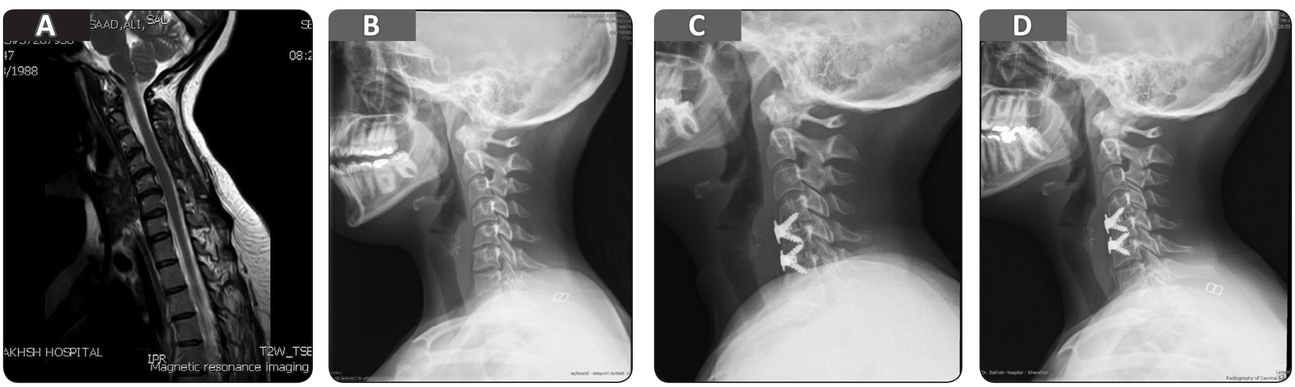

Figure 4. A 28 years old female patient presented with left brachialgia that didn't respond to medical treatment for 6 months. Patient was subjected for C4-5 and C5-6 ACDF using zero profile anchoring cages with screws. (A,B) Images show preoperative MRI and PXR cervical spine. (C) Shows early postoperative PCR cervical spine and (D) Shows late postoperative PXR cervical spine.

DISCUSSION

Degenerative cervical disc disease is most commonly treated by anterior cervical discectomy and interbody fusion (ACDF), which is considered as the gold standard for the surgical management at present. Although the cervical total disc arthroplasty is a possible option,[16,21,30] still its inclusion criteria are somewhat limited.[3] Cervical standalone peek cage gained the popularity due to its superior biomechanical properties and a similar elastic coefficient to human bone, which enriches the fusion rate. Cage extrusion was relatively reported together with subsidence, that's why still anterior cervical plating using various interbody grafts is being used to enhance stabilization property and increase fusion rate.[1,10,15,19,34] However anterior cervical plating still carries some risks like chronic dysphagia and donor site bone graft complications.[5,27,28] Zero-profile anchored cage with screws was introduced to decrease the incidence of plate complications including the dysphagia and maintain the fixation needed for the fusion to occur.[8,9,22,23,31]

In this study, there was no significant difference between the two surgical groups regarding the postoperative bony fusion. Evaluation of occurrence of cage subsidence by measuring serial vertebral heights of the fused levels revealed that it's more evident in standalone cage group than in anchored spacers group, giving the later a privilege regarding the biomechanical alignment. On measuring the Cobb-s for the segmental fused levels and the Cobb-c for the overall lordotic angle, both of them increased in the immediate postoperative images of both groups indicating an early improvement in the lordotic posture postoperatively. Later, in the last follow up both angles showed a decrease in both groups but the decrease in the angle was to a lesser extent in the zero-profile anchored cage with screws (Group B) compared to that in the stand-alone cage (Group A) with a statistically significant difference.

In a study conducted by Shin JS et al,[24] they measured the vertebral heights in their study and named it interbody height (IBH), comparing the zero-profile anchored cage with screws and stand-alone peek cage for single level, they found that IBH showed a significantly decreased value in patients with (stand-alone PEEK cage group) more than that in (zero-profile anchored cage with screws group) from the immediate postoperative to the last follow-up time and from the preoperative to the last follow-up time (P=0.025, P=0.000), respectively. Their results were congruent with our results indicating that zero-profile anchored cage with screws has a lesser subsidence rate compared to the stand-alone peek cage in two years follow up. In another study by Cho HJ et al,[7] they reported that the subsidence of the stand-alone peek cage patients' group was higher than that of zero-profile anchored cage with screws patients' group in a single level ACDF. Although these results were not directly related to the clinical outcomes, higher subsidence rate could worsen degenerative changes of the cervical spine, which might eventually affect cervical spondylotic symptoms.

In our study, both Cobb-s and Cobb-c angles showed significant increase in the immediate postoperative follow up in both groups, while in last follow up imaging the zero-profile anchored cage with screws showed less decrease in the angles than the stand-alone peek cage group. These results mean that the cervical lordosis is better maintained in the zero-profile anchored cage with screws than that in the stand-alone peek cage.

Cho HJ et al,[7] compared the Cobb angles of the whole cervical spine (Cobb-c) and the segmental area (Cobb-s) between the stand-alone cage group and the zero-profile anchored cage with screws group. The initial change in Cobb-c angle was not significantly different. The immediately post-operative Cobb-c angle was improved in both groups, showing no significant difference between the two groups. The lordotic curve of both groups was improved temporarily, but it worsened as time passed. At the 24 months post-operative follow up imaging the Cobb-c angle of the peek cage group was even worse than that of the pre-operative one, while the zero-profile anchored cage with screws group maintained a somewhat improved value compared to the pre-operative Cobb-c angle value. However, the changes in the two groups were not statistically significant. When they compared the tendency of the Cobb-s between the two groups, it showed similar results to the Cobb-c, lordosis was improved temporarily and then gradually worsened. The difference between the 24 months post-operative and the immediately post-operative time points were significant, representing that the zero-profile anchored cage with screws group displayed significantly less aggravation of the segmental Cobb-s angle than the peek cage group.[7] In some long-term studies, degenerative changes of adjacent levels were observed in 77% of the patients with kyphosis.[12,13] Taking this into consideration, the restoration of the lordotic angle may be beneficial to prevent the aggravation of degenerative changes. In this aspect, zero-profile anchored cage with screws seems to better maintain the normal curvature of the cervical spine than the stand-alone peek cage.

Although this study revealed higher average cost in the zero profile anchored cages than the stand-alone PEEK cage, there was no statistically significant difference between both groups if we exclude the cost of the implants. In our opinion, cost-effectiveness analysis is not a tool to determine the "best" treatment for any particular disease or pathologic entity. It is an analytical technique of combining many variables in a single model that does not allow systematic testing of the effect of each variable on the outcome. In the two groups, fusion factors, short-term risks, costs and hardware complications, outcome, and long-term reoperation rates must be considered in trying to determine the relative cost-effectiveness of the alternative procedures.

Study Limitations:

There are limitations in the current study that should be considered as small sample size, retrospective nature of the study and lack of randomization increasing the probability of selection bias. All these factors hinder development of general conclusion of superiority of anchored cages versus stand-alone PEEK cage in maintaining lordosis and sagittal balance. Also, the follow up period (24 months) is insufficient to provide the clinical impact of maintaining lordosis and sagittal balance with anchored cages justifying the relatively higher cost of using it versus stand -alone PEEK cages and hence more studies with longer follow up period are needed to generalize a conclusion as regard favoring its use. Moreover, long term follow up studies will allow clarifying the effect of improving the overall sagittal balance, prevention of adjacent level and hence reducing the cost of reoperation.

CONCLUSION

The zero-profile anchored cage with screws compared to stand-alone peek cage was effective treatment for cervical disc disorders in two levels cervical discectomy and fusion and their results showed better result regarding the incidence of cage subsidence and maintaining cervical lordosis. Large case serious and different modality of fusions should be compared with long follow up period to realize the difference between the two groups and other fusion modalities including the plate with bone graft or the plate with cage.

REFERENCES

1. Anderson DG, Albert TJ: Bone grafting, implants, and plating options for anterior cervical fusions. Orthop Clin North Am 33(2):317-28, 2002
2. Aronson N, Filtzer DL and Bagan M: Anterior cervical fusion by the smith-robinson approach. J Neurosurg 29:396-404, 1968
3. 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 8(5):711-6, 2008

4. Barbagallo GM, Romano D, Certo F, Milone P, Albanese V. Zero-P: A new zero-profile cage-plate device for single and multilevel ACDF. A single Institution series with four years maximum follow-up and review of the literature on zero-profile devices. Eur Spine J 22:S868-78, 2013
5. Bartels RH, Donk RD, Feuth T: Subsidence of stand-alone cervical carbon fiber cages. Neurosurgery 58(3):502-8, 2006
6. Bazaz R, Lee MJ, Yoo JU: Incidence of dysphagia after anterior cervical spine surgery-A prospective study. Spine 27:2453-8, 2002
7. Cho HJ, Hur JW, Lee JB, Han JS, Cho TH, Park JY: Cervical Stand-Alone Polyetheretherketone Cage versus Zero-Profile Anchored Spacer in Single-Level Anterior Cervical Discectomy and Fusion: Minimum 2-Year Assessment of Radiographic and Clinical Outcome. J Korean Neurosurg Soc 58 (2):119-24, 2015
8. Dawood OM, AbdelGhany WA, Desoky AE, Sabry H: Clinical Outcome Results of Stand Alone Anchored Spacer for Anterior Cervical Discectomy and Fusion. Egy Spine J 26:6-14, 2018
9. Dong J, Lu M, Lu T, Liang B, Xu J, Zhou J, et al: Meta-Analysis Comparing Zero-Profile Spacer and Anterior Plate in Anterior Cervical Fusion. PLOS One 10:e0130223, 2015
10. Fraser JF, Hartl R: Anterior approaches to fusion of the cervical spine: A met analysis of fusion rates. J Neurosurg Spine 6(4):298-303, 2007
11. Kaiser MG, Haid RW, Subach BR, Barnes B, Rodts GE: Anterior cervical plating enhances arthrodesis after discectomy and fusion with cortical allograft. Neurosurgery 50:229-36, 2002
12. Katsuura A, Hukuda S, Saruhashi Y, Mori K: Kyphotic malalignment after anterior cervical fusion is one of the factors promoting the degenerative process in adjacent intervertebral levels. Eur Spine J 10:320-24, 2001
13. Kim CH, Chung CK, Hahn S: Autologous iliac bone graft with anterior plating is advantageous over the stand-alone cage for segmental lordosis in single-level cervical disc disease. Neurosurgery 72:257-65, 2013
14. Kim SW, Limson MA, Kim SB, Arbatin JJ, Chang KY, Park MS, et al: Comparison of radiographic changes after ACDF versus Bryan disc arthroplasty in single and bi-level cases. Eur Spine J 18:218-31, 2009
15. Malloy KM, Hilibrand AS: Autograft versus allograft in degenerative cervical disease. Clin Orthop Relat Res (394):27-38, 2002
16. Nabhan A, Ahlhelm F, Pitzen T, Steudel WI, Jung J, Shariat K, et al: Disc replacement using pro-disc c versus fusion: A prospective randomised and controlled radiographic and clinical study. Eur Spine J 16(3):423-30, 2007
17. Pitzen TR, Chrobok J, Stulik J, Ruffing S, Drumm J, Sova L, et al: Implant Complications, Fusion, Loss of Lordosis, and Outcome After Anterior Cervical Plating With Dynamic or Rigid Plates Two-Year Results of a Multi-Centric, Randomized, Controlled Study. Spine 34:641-6, 2009
18. Qi M, Chen H, Liu Y, Zhang Y, Liang L, Yuan W: The use of a zero-profile device compared with an anterior plate and cage in the treatment of patients with symptomatic cervical spondylosis A preliminary clinical investigation. Bone Joint J 95B:543-7, 2013
19. Romner B, Due-Tonnessen BJ, Egge A, Anke IM, Trumpy JH: Modified robinson-smith procedure for the treatment of cervical radiculopathy. Acta Neurol Scand 90(3):197-200, 1994
20. Sahjpaul RL: Esophageal perforation from anterior cervical screw migration. Surg Neurol 68:205-9, 2007
21. 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 20(7):481-91, 2007

22. Scholz M, Schnake KJ, Pingel A, Hoffmann R, Kandziora F: A New Zero-profile Implant for Stand-alone Anterior Cervical Interbody Fusion. Clin Orthop Relat Res 469:666-73, 2011
23. Shao H, Chen J, Ru B, Yan F, Zhang J, Xu S, et al: Zero-profile implant versus conventional cage-plate implant in anterior cervical discectomy and fusion for the treatment of degenerative cervical spondylosis: a meta-analysis. J Orthop Surg Res 10:148, 2015
24. Shin JS, Oh SH, Cho PG: Surgical Outcome of a Zero-profile Device Comparing with Stand-alone Cage and Anterior Cervical Plate with Iliac Bone Graft in the Anterior Cervical Discectomy and Fusion. Korean J Spine 11(3):169-77, 2014
25. Simmons EH and Bhalla SK: Anterior cervical discectomy and fusion. A clinical and biomechanical study with eight-year follow-up. J Bone Joint Surg Br 51:225-37, 1969
26. Simmons EH: Anterior cervical discectomy and fusion. Proc R Soc Med 63:897-8, 1970
27. Song KJ, Lee KB: A preliminary study of the use of cage and plating for single-segment fusion in degenerative cervical spine disease. J Clin Neurosci 13(2):181-7, 2006
28. Summers BN, Eisenstein SM: Donor site pain from the ilium. A complication of lumbar spine fusion. J Bone Joint Surg Br 71(4):677-80, 1989
29. Wang JC, McDonough PW, Endow KK, Delamarter RB: Increased fusion rates with cervical plating for two-level anterior cervical discectomy and fusion. Spine 25:41-5, 2000
30. Wang Y, Cai B, Zhang XS, Xiao SH, Wang Z, Lu N, et al: Clinical outcomes of single level Bryan cervical disc arthroplasty: A prospective controlled study. Zhonghua Wai Ke Za Zhi 46(5):328-32, 2008
31. Wang Z, Jiang W, Li X, Wang H, Shi J, Chen J, et al: The application of zero-profile anchored spacer in anterior cervical discectomy and fusion. Eur Spine J 24:148-54, 2015
32. Yan B and Nie L: Clinical comparison of Zero-profile interbody fusion device and anterior cervical plate interbody fusion in treating cervical spondylosis. Int J Clin Exp Med 8:13854-8, 2015
33. Yang Y, Ma L, Liu H and Xu M: A Meta-Analysis of the Incidence of Patient-Reported Dysphagia After Anterior Cervical Decompression and Fusion with the Zero-Profile Implant System. Dysphagia 31:134-45, 2016
34. Zdeblick TA, Phillips FM: Interbody cage devices. Spine (Phila Pa 1976) 28 (15 Suppl):S2-7, 2003

الملخص العربى

النتائج الإكلينيكية للأقفاص العنقية ذاتية التثبيت بالمقارنة بالأقفاص العنقية متعددة ايثير الكيتون في علاج أمراض الغضروف العنقي: دراسة مقارنة

البيانات الخلفيه: من أجل تقليل المضاعفات التي يمكن أن تحدث أثناء جراحات الغضروف العنقي من الأمام، ظهرت الأقفاص العنقية ذاتية التثبيت من الأمام.

الغرض: في هذه الدراسة يتم تقييم نتائج وفائدة الجراحات الأمامية لإستئصال الغضاريف العنقية بإستخدام الأقفاص العنقية ذاتية التثبيت والأقفاص العنقية متعددة إيثير الكيتونات وذلك عن طريق النتائج الإكلينيكية والأشعة التشخيصية.

تصميم الدراسة: هذه الدراسة كانت بأثر رجعي أجريت على ستين مريضا يعانون من أمراض الغضاريف العنقية التنكسية. ولقد تم تقييم المرضى باستخدام المقاييس التالية: مؤشرات الألم البصرية، زوايا الإنحناء للعمود الفقري فى اتجاهات متعددة.

المرضى و الطرق: أجريت الدراسة على ستين مريضا خضعوا لإجراء جراحة إستئصال غضروفين عنقيين من الأمام، تم تقسيمهم لمجموعتين المجموعة الأولى تم فيها إستخدام الأقفاص العنقية الكيتونية والمجموعة الثانية تم فيها إستخدام الأقفاص ذاتية التثبيت. وتم تقييم المرضى كلهم فى خلال زيارات المتابعة التى امتدت لعامين.

النتائج: كان التحسن ملحوظا في مقاييس الألم بالنسبة للمجموعتين خلال فترة المتابعة بدون فارق إحصائي واضح. وكان التغير في إرتفاع جسم الفقرات واضحا في الفترة الأولى بعد الجراحة مع ظهور الفارق بين المجموعتين من حيث إمتصاص الأقفاص الكيتونية (المجموعة الأولى) داخل جسم الفقرات أكثر منها في المجموعة الثانية. وبالنسبة لزوايا الإنحناء للعمود الفقري كانت المحافظة عليها بصورة أفضل في المجموعة الثانية.

الإستنتاج: أثبتت الأقفاص العنقية ذاتية التثبيت أنها أفضل من الأقفاص الكيتونية للإستخدام أثناء إجراء جراحات إستئصال الغضاريف العنقية الأمامية لمستويين وتستطيع أن تحقق الإلتحام الفقاري المناسب مع حدوث نسبة أقل من إمتصاص الأقفاص والمحافظة على زوايا الإنحناء بالفقرات العنقية.