

Original Article

## The Outcome of Autologous Bone Graft Versus Polyetheretherketone Cages in Anterior Cervical Discectomy and Fusion Surgery

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### ABSTRACT

**Objective:** To compare the outcome of autologous bone graft versus PEEK cages in ACDF surgery in terms of clinical performance and radiographic features.

**Methodology:** This study randomized controlled trial was conducted in the Department of Neurosurgery, Punjab Institute of Neurosciences, Lahore, Pakistan from April 2020 to December 2022. The patients were recruited by non-probability, Purposive Sampling followed by randomization by using the balloting method and stratified into two equal groups i.e. Group A (autologous bone graft) and Group B (PEEK cage).

**Results:** 98 patients were included in this study. The mean age of cases was  $49.88 \pm 17.83$  years. There were 58 (59.18%) male and 40 (40.82%) female cases. 25 (25.51%) cases had C3-C4 involved, 48 (48.98%) patients had C5-C6 and 25 (25.51%) cases had C5 region involved. The mean disc height at the 6<sup>th</sup> month in the PEEK group was  $6.71 \pm 0.46$  mm and in the bone graft group was  $6.33 \pm 0.47$  mm,  $p$ -value  $< 0.05$ . The mean operative time in the PEEK group ( $2.07 \pm 0.42$ ) was statistically less than the bone graft group ( $3.23 \pm 0.36$ ),  $p$ -value  $< 0.05$ . The average blood loss was also statistically less in the PEEK group as compared to the bone graft. The mean duration of hospital stay in the PEEK group was  $2.92 \pm 0.61$  days as compared to bone graft was  $5.48 \pm 1.90$  days,  $p$ -value  $< 0.05$ .

**Conclusion:** The outcome of ACDF surgery PEEK cages are better than autologous bone grafts in terms of clinical performance and radiological features. Hence PEEK cages can be opted in the future to have a better outcome and higher patient satisfaction.

**Keywords:** ACDF, PEEK cages, Autologous Bone, graft.

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Date of Acceptance: 15-09-2022  
Date of Online Publishing: 30-9-2022  
Date of Print: 30-9-2022

Date of Submission: 04-04-2022  
Date of Revision: 05-08-2022

DOI: 10.36552/pjns.v26i3.678

## INTRODUCTION

Cervical spondylotic myelopathy (CSM) results in various cervical spine pathologies. The degeneration of the cervical spine and the compression of the spinal cord cause CSM leading to pain in the neck and weakness of the arm or legs and limiting the daily routine activities. The anterior approaches for cervical spine surgery are highly successful. The basic approach of anterior cervical spine surgery was first cited by Smith and Robinson and they did anterior cervical discectomy and fusion (ACDF) procedure using an autologous bone graft.<sup>1,2</sup>

After the first use of autologous bone graft in ACDF surgery for cervical CSM, there has been a tremendous development of different graft options and instrumentations, through an anterior approach. In affected segments of the cervical spine, interbody fusion can be promoted by autologous bone grafts. Initially, autologous bone graft i.e. tricortical iliac crest bone graft was used in ACDF surgery.

However, various complications like donor site morbidity and higher failure rates caused by collapse, subsidence, displacement, infection, retropulsion, or resorption of the graft with subsequent pseudoarthrosis and extended healing time were observed.<sup>8,9,26</sup>

Hence, interbody fusion implants were developed to reduce the complications associated with bone grafts. These cages were developed to encase a bone graft which allows fusion of adjacent vertebrae.<sup>5</sup> PEEK (Polyethyleneetheretherketone) cages are one of the artificial synthetic cages used in ACDF surgery. Other synthetic cages used in ACDF surgery are made of ceramic, titanium, and carbon fiber reinforced polymer (CFRP, Bengal cages, 70% polyetheretherketone, 30% carbon fiber).<sup>3,4</sup>

PEEK materials were commercialized in 1980 and their industrial application was investigated as a biomaterial in prosthetic implants. In the late 1990s, PEEK was presented commercially as a biomaterial for spinal implants. During the past

decade, PEEK cages have been extensively utilized. The properties of low elastic modulus and radiolucency are appealing for spinal fusion.<sup>4,5,6,7</sup>

So rationale of our study was to compare the outcome of autologous bone graft versus PEEK cages in ACDF surgery both radiologically and clinically. In literature, a comparison of both surgical options is given but the results are not convincing that which graft material is superior. In this study, we wanted to confirm whether the clinical and surgical outcome of autologous bone graft is better than PEEK cage and vice versa in ACDF surgery.

## METHODOLOGY

### Study Design

Randomized Controlled Trial (RCT).

This study was conducted according to the CONSORT guidelines.<sup>25</sup>

### Setting

Department of Neurosurgery, Punjab Institute of Neurosciences, Lahore.

### Study Duration

12 months from the date of approval of synopsis.

### Sampling Technique & Randomization

Non-probability, Purposive Sampling followed by randomization by using the balloting method.

### Sample Size

The sample size was calculated by the following formula keeping the power of study equal to 80% and the level of significance equal to 5%.

$$n = \frac{\left( Z_{1-\alpha} \sqrt{2p(1-p)} + Z_{1-\beta} \sqrt{p_1(1-p_1)p_2(1-p_2)} \right)^2}{(p_1 - p_2)^2}$$

(Sample Size determination in health studies version 2.0.21 WHO).

$Z_{1-\beta}$  is the desired power of study = 80%

$Z_{1-\alpha/2}$  is the desired level of significance = 5%  
 $P_1$  is the anticipated proportion of complications in the autologous bone graft group = 17.5%<sup>24</sup>  
 $P_2$  is the anticipated proportion of complications in the PEEK cages group = 2.5%<sup>24</sup>  
 $p_1 - p_2$  is the difference between proportions = 15%  
 $n$  is the calculated sample size in each group = 49

## SAMPLE COLLECTION

### Inclusion Criteria

1. Patients with Cervical spondylotic myelopathies of age 16 – 90 years.
2. Both genders.
3. No previous ACDF surgery.
4. Traumatic cervical spine injury patients.

### Exclusion Criteria

1. Who refused to give informed consent.
2. Patients having multiple co-morbid conditions and unfit for surgery.

### Data Collection Procedure

Patients fulfilling the inclusion criteria were enrolled in the Department of Neurosurgery Lahore. Informed consent was obtained. Detailed history and physical examination followed by routine investigations i.e. CBC, LFTs, RFTs, Viral markers, X-ray chest along with MRI cervical spine and X-ray cervical spine. The lottery method was used to divide the patients randomly into two groups. Group A patients underwent ACDF surgery with an autologous bone graft while in group B, patients underwent ACDF surgery with a PEEK cage. The same surgical team did all the operations.

The level of disease and involvement of segments was noted. During the whole surgical process, per-operative time and blood loss were noted. Anesthesia complications were not included in the study. Post-operative hospital stay was also noted.

Post-operative follow-up at the 6<sup>th</sup> week, 3<sup>rd</sup> month, and 6<sup>th</sup> month was done and all outcomes are:

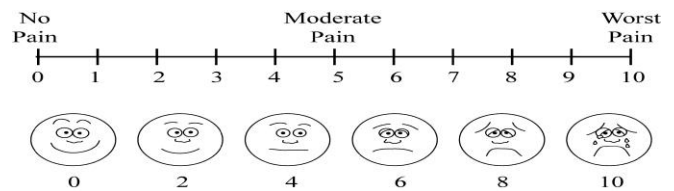
1. Clinical Performance (VAS and Odom's criteria).  
 ODOM'S CRITERIA<sup>3</sup>

**Excellent:** All preoperative symptoms were relieved, and abnormal findings improved.

**Good:** Minimal persistence of preoperative symptoms, abnormal findings unchanged or improved.

**Fair:** Definite relief of some preoperative symptoms, other symptoms unchanged or slightly improved.

**Poor:** Symptoms and signs unchanged or worse  
 Visual analog scale.



2. Radiographic features on X-ray cervical spine (Fusion, disc height) was noted) and was compared and analyzed in both groups.

### Operative Technique

Under general anesthesia and proper positioning of the patient, the skin incision is made horizontally, centered on the sternocleidomastoid muscle. After the proper dissection, complete exposure of the cervical spine is done by the operating team. The level of disease is verified with help of a lateral C-spine x-ray with a lumbar puncture needle in the interspace.

The disc space is incised. The discectomy is performed. The posterior longitudinal ligament is incised the subligamentous space is probed with a blunt nerve hook. The posterior lip of the vertebral body above and below are removed, and decompression of the roots is verified with a blunt nerve hook. Fusion is performed at this time either by autologous bone graft or PEEK cage

material placed in the interspace.

After completion of the procedure, the wound was closed in layers. Post-operatively patient was shifted to HDU for the monitoring of complications i.e., airway obstruction, weakness of nerve root of level operated, long tract signs, and hoarseness. A cervical collar was applied for 04 weeks postoperatively.

### Data Analysis Procedure

- Data was entered and analyzed by using SPSS 22 version.
- Quantitative variables such as age and demographic variables were described as Mean ± S.D. for both groups.
- Qualitative variables such as gender and performance and complications were described as frequency and percentage for both groups.
- A comparison of both groups for surgical outcomes was done by using the chi-square test and t-test according to the nature of outcome variables.
- A P-value of ≤ 0.05 was considered significant.

## RESULTS

### Age Distribution

The mean age in the PEEK cage group was 48 years, and in the bone graft group was 51 years. See table 1 for details.

**Table 1:** Comparison of age (years) in both study groups.

Study Groups	Age (Years)			
	Mean	S.D	Minimum	Maximum
PEEK Cage	48.37	20.68	18	80
Bone graft	51.39	14.50	35	80
<b>Total</b>	49.88	17.83	18	80

### Gender Distribution

There were a total of 59% male and 41% female patients.

### Distribution of the Cervical Spine Level Involved

There were 25 (25.51%) cases that had C3 – C4 involved, 48 (48.98%) patients had C5 – C6 and 25 (25.51%) cases had C5 region involved.

**Table 2:** Descriptive statistics of cervical levels involved

Cervical Levels Involved	
C3 – C4	25 (25.51%)
C5 – C6	48 (48.98%)
C5	25 (25.51%)

### Improvement in Neck Pain

Before surgery, the mean pain (VAS) in the PEEK cage group was 8.86 ± 0.82 and in the bone graft group was 8.90 ± 0.82 with statistically no significant difference. In the 6th week, the mean pain in the PEEK cage group (3.57 ± 0.74) was also statistically the same (3.73 ± 0.67), p-value > 0.05. In 3rd month mean the pain was statistically lower in the PEEK cage group (2.65 ± 0.72) as compared to the bone graft group (3.12 ± 0.63), p-value < 0.05. In the 6th month the mean pain was also statistically lower in the PEEK cage group (2.12 ± 0.78) as compared to the bone graft group (2.71 ± 0.71), p-value < 0.05.

### Comparison of Disc Height

Before surgery, the mean disc height in the PEEK group was 1.14 ± 0.35 mm and in the bone graft group was 1.29 ± 0.46 with no statistical difference, p-value > 0.05. The mean disc height at the 6th week in the PEEK group was 7.35 ± 0.48 mm and in the bone graft group was 7.14 ± 0.65 mm with statistically no significant difference, p-value > 0.05. The mean disc height in the PEEK group was 7.06 ± 0.80 mm and 6.73 ± 0.70 in the bone graft group with statistically lower height in bone graft. The mean disc height at the 6th month in the PEEK group was 6.71 ± 0.46 mm and in the bone graft group was 6.33 ± 0.47 mm, p-value < 0.05.

**Table 3:** Comparison of mean pain (VAS) at baseline, 6<sup>th</sup> week, 6<sup>th</sup> week, and 3<sup>rd</sup> month in both Study groups.

Pain (VAS)	Study groups	Mean	S.D	Minimum	Maximum	t-test	p-value
Baseline	PEEK Cage	8.86	0.82	8	10	-2.46	0.806
	Bone graft	8.90	0.82	8	10		
	<b>Total</b>	<b>8.88</b>	<b>0.82</b>	<b>8</b>	<b>10</b>		
6 <sup>th</sup> week	PEEK Cage	3.57	0.74	2	4	-1.148	0.254
	Bone graft	3.73	0.67	2	5		
	<b>Total</b>	<b>3.65</b>	<b>0.70</b>	<b>2</b>	<b>5</b>		
3 <sup>rd</sup> month	PEEK Cage	2.65	0.72	2	4	-3.418	0.001*
	Bone graft	3.12	0.63	2	4		
	<b>Total</b>	<b>2.89</b>	<b>0.72</b>	<b>2</b>	<b>4</b>		
6 <sup>th</sup> month	PEEK Cage	2.12	0.78	1	3	-3.933	< 0.001**
	Bone graft	2.71	0.71	2	4		
	<b>Total</b>	<b>2.42</b>	<b>0.80</b>	<b>1</b>	<b>4</b>		

\*\*Highly Significant, \*Significant

**Table 4:** Comparison of Disc Height (mm) at baseline, 6<sup>th</sup> week, 3<sup>rd</sup> month, and 6<sup>th</sup> month in both study groups.

Disc Height (mm)		Mean	S.D	Minimum	Maximum	t-test	p-value
Baseline	PEEK Cage	1.14	0.35	1	2	-1.732	0.086
	Bone graft	1.29	0.46	1	2		
	<b>Total</b>	<b>1.21</b>	<b>0.41</b>	<b>1</b>	<b>2</b>		
6 <sup>th</sup> week	PEEK Cage	7.35	0.48	7	8	1.775	0.079
	Bone graft	7.14	0.65	6	8		
	<b>Total</b>	<b>7.24</b>	<b>0.58</b>	<b>6</b>	<b>8</b>		
3 <sup>rd</sup> month	PEEK Cage	7.06	0.80	6	8	2.148	0.034*
	Bone graft	6.73	0.70	6	8		
	<b>Total</b>	<b>6.90</b>	<b>0.77</b>	<b>6</b>	<b>8</b>		
6 <sup>th</sup> month	PEEK Cage	6.71	0.46	6	7	4.126	< 0.001**
	Bone graft	6.33	0.47	6	7		
	<b>Total</b>	<b>6.52</b>	<b>0.50</b>	<b>6</b>	<b>7</b>		

\*\*Highly Significant, \*Significant

### Odom's Criteria

In the 6th week in the PEEK cage group 42 (85.7%) cases had good and 7 (14.3%) cases had fair outcomes, while in the bone graft group, there were 43 (87.8%) cases had good and 6 (12.2%) cases had fair outcome, with significant difference between groups, p-value > 0.05. In 3rd month in the PEEK cage group, 11 (22.4%) cases had excellent, 31 (63.3%) had good and 7 (14.3%) cases had fair outcomes while in the bone graft group 2 (4.1%) cases had excellent, 35 (71.4%) had a good outcome and 12 (24.5%) cases had fair outcome, the good to the excellent outcome was statistically higher in PEEK group as compared to bone graft group, p-value < 0.05. In the 6th month, 32 (65.3%) cases had excellent and 17 (34.7%) cases had good outcomes while in the bone graft group 14 (28.6%) cases had excellent, 28 (57.1%) cases had good, and 7 (14.3%) cases had fair outcomes, the PEEK cage group had higher good to the excellent outcome than the bone graft group, p-value < 0.05.

### Fusion Rates

In the PEEK cage group, at the 6th week, 3rd months, and 6th months a total of 35 (71.4%), 29 (59.2%) and 16 (32.7%) cases had bony fusion respectively while in the bone graft group all cases had bony fusion throughout the follow up with statistically significant better results in PEEK cage group than bone graft

**Table 5:** Comparison of Odom's criteria (6th week, 3<sup>rd</sup> month, and 6<sup>th</sup> month) in both study groups.

Odom's Criteria		Study		Chi-square	p-value
		PEEK Cage	Bone Graft		
6 <sup>th</sup> week	Good	42 (85.7%)	43 (87.8%)	0.089	0.766
	Fair	7 (14.3%)	6 (12.2%)		
	Excellent	11 (22.4%)	2 (4.1%)		
3 <sup>rd</sup> month	Good	31 (63.3%)	35 (71.4%)	7.79	0.020
	Fair	7 (14.3%)	12 (24.5%)		
	Excellent	32 (65.3%)	14 (28.6%)		
6 <sup>th</sup> month	Good	17 (34.7%)	28 (57.1%)	16.73	< 0.001
	Fair	0 (0%)	7 (14.3%)		

\*\*Highly Significant, \*Significant

**Table 6:** Comparison of Fusion (6th week, 3<sup>rd</sup> month, and 6<sup>th</sup> month) in both study groups.

Fusion		Study		Chi-square	p-value
		PEEK Cage	Bone Graft		
6 <sup>th</sup> week	Yes	35 (71.4%)	49 (100%)	16.333	< 0.001**
	No	14 (28.6%)	0 (0%)		
3 <sup>rd</sup> month	Yes	29 (59.2%)	49 (100%)	25.128	< 0.001**
	No	20 (40.8%)	0 (0%)		
6 <sup>th</sup> month	Yes	16 (32.7%)	49 (100%)	49.754	< 0.001**
	No	33 (67.3%)	0 (0%)		

\*\*Highly Significant

**Table 7:** Comparison of Total blood loss (ml) in both study groups.

Study Groups	Total Blood Loss (ml)			
	Mean	S.D	Minimum	Maximum
PEEK Cage	273.37	52.34	200	400
Bone graft	345.71	50.40	240	400
<b>Total</b>	309.54	62.73	200	400

t-test = -6.969  
P-value ≤ 0.001 (Highly Significant)

group, p-value < 0.05.

### Comparison of Average Blood Loss

The average blood loss was also statistically less in the PEEK group as compared to bone grafts  $273.37 \pm 52.34$  ml and  $345.71 \pm 50.40$  ml,  $p$ -value  $< 0.05$ .

### Hospital-Stay Duration

The mean hospital stay in the PEEK group was  $2.92 \pm 0.61$  days as compared to bone graft was  $5.48 \pm 1.90$  days,  $p$ -value  $< 0.05$ .

### Operative Time

The mean operative time in the PEEK group ( $2.07 \pm 0.42$ ) was statistically less than that in the bone graft group ( $3.23 \pm 0.36$ ),  $p$ -value  $< 0.05$ .

**Table 8:** Comparison of Post-op Hospital stay (days) in both study groups.

Study Groups	Post-op Hospital Stay (Days)			
	Mean	S.D	Minimum	Maximum
PEEK Cage	2.92	0.61	2	4
Bone graft	5.84	1.90	3	12
<b>Total</b>	4.38	2.03	2	12

t-test = -10.258  
P-value  $\leq 0.001$  (Highly Significant)

**Table 9:** Comparison of operative time (Hours) in both study groups.

Study Groups	Pre-operative Time (Hours)			
	Mean	S.D	Minimum	Maximum
PEEK Cage	2.07	0.42	1.5	3.0
Bone graft	3.23	0.36	2.0	3.5
<b>Total</b>	2.65	0.70	1.5	3.5

t-test = -14.789  
P-value  $\leq 0.001$  (Highly Significant)

## DISCUSSION

The patients having degenerative or post-traumatic diseases affecting the cervical spine, such as spondylosis, stenosis, ruptured discs, and OPLL, ACDF surgery is a well-approved treatment for mentioned conditions. Patients often experience considerable decreases in quality of life along with functional incapacity as a result of the debilitating nature of such diseases.<sup>11</sup> As a result, the surgical intervention's goals are to decompress neuronal components by removing the diseased intervertebral disc and to restore spinal stability and alignment. An anterior approach has numerous advantages, having a minimum injury to nearby structures, clear visibility of the disease and decompression site, and better approachability, allowing for faster excision of the involved disc and total fusion.<sup>12</sup>

Furthermore, while some problems could be severe, the published rates are tremendously low, with the majority of cases being attributable to

surgical fault or graft retrieval. Autologous bone graft is considered the "gold standard" in anterior ACDF surgery for a complete fusion, as demonstrated by the Cochrane library, while competitive options are on the rise throughout the available research. Currently, graft harvesting can cause a variety of problems including donor-site pain, hematoma, nerve palsy (lateral cutaneous nerve), and infection.<sup>13</sup> In contrast, allograft, historically, was popular to avoid the need for autologous bone graft, has its own set of difficulties, comprising the danger of contagious, infection, and variances in biocompatibility. In autograft fusion without plating, graft failure and pseudoarthrosis have been observed. The goal of developing intervertebral implants using bone graft substitute technology was to lessen or abolish the requirement of autografts to improve recovery time and clinical results.<sup>14</sup>

Traditionally, iliac crest autologous bone implants were employed to gain spinal fusion.

Because retrieving the bone graft produces pain at the graft harvesting site in approximately 30% of individuals, surgeons have increasingly turned to prosthetic materials in the last two decades. However, some people have expressed concern about the high cost of synthetic implants, which could not be defensible regarding their efficacy and safe use. While the physical properties of PEEK cages make them more appealing for spinal fusion, they have been shown to cause pseudoarthrosis, subsidence, and migration.<sup>15</sup>

In comparison to allograft, metallic implants, PEEK cages, or other grafts, iliac crest autologous bone graft for solitary or multi-level ACDF surgery was reported to have greater fusion, fewer complication rates, and very cheaper costs.<sup>16</sup> There is a paucity of facts on clinical outcomes from other research, implying that there is minimal evidence for PEEK cages having a better clinical and radiologic outcome than bone grafts in the cervical spine.<sup>17</sup>

In the current study mean age of all cases was  $49.88 \pm 17.83$  years and there were 58 (59.18%) male and 40 (40.82%) female cases with a higher male-to-female ratio. Similar findings were reported i.e. there were 24 (60%) males and 16 (40%) females. The age of the patients ranged from 30 – 72 years with a mean  $\pm$  SD of  $45 \pm 8.34$ .<sup>18</sup>

Another study reported a higher male-to-female ratio in another study but the mean age was higher than that in the current study i.e. a study was done including 68 patients (28 females, 41.2%), and (40 males, 58.8%) with a mean age of 59.4 years.

In the 6th month the mean pain was statistically lower in the PEEK cage group ( $2.12 \pm 0.78$ ) as compared to the bone graft group ( $2.71 \pm 0.71$ ),  $p$ -value  $< 0.05$ . The mean surgical time in the PEEK group ( $2.07 \pm 0.42$ ) was statistically less than the bone graft group ( $3.23 \pm 0.36$ ),  $p$ -value  $< 0.05$ . The average blood loss was also statistically less in the PEEK group as compared to bone grafts  $273.37 \pm 52.34$  ml and  $345.71 \pm 50.40$

ml,  $p$ -value  $< 0.05$ . The mean hospital stay in the PEEK group was  $2.92 \pm 0.61$  days as compared to bone graft was  $5.48 \pm 1.90$  days,  $p$ -value  $< 0.05$ . Although there was no significant difference in the volume of blood loss between the two groups ( $p = 0.17$ ), the length of operation in the local bone group was considerably shorter than that in the iliac bone group ( $p = 0.01$ ). VAS scores in both groups reduced significantly after surgery, whereas JOA values improved. At the final follow-up, however, no statistically significant changes were identified among the two groups ( $p = 0.45$  and  $p = 0.93$ ).<sup>19</sup>

In the 6th month, 32 (65.3%) cases had excellent and 17 (34.7%) cases had good outcomes while in the bone graft group 14 (28.6%) cases had excellent, 28 (57.1%) cases had good and 7 (14.3%) cases had fair outcome, the PEEK cage group had higher good to the excellent outcome than bone graft group,  $p$ -value  $< 0.05$ . similar results were reported by another study i.e. according to Odom's criteria, 18/20 patients (90%) were marked excellent-good in the cage group in comparison to 16/ 20 patients (85%) in the group with bone graft, but their difference was insignificant.<sup>18</sup>

In the current study in the PEEK cage group, at the 6th week, 3rd months, and 6th months a total of 35 (71.4%), 29 (59.2%) and 16 (32.7%) cases had bony fusion respectively while in bone graft group all cases had bony fusion throughout the follow up with statistically significant better results in PEEK cage group than bone graft group,  $p$ -value  $< 0.05$ . Another study reported favorable results for to PEEK cage in terms of fusion as we found i.e. fusion was achieved in 85% of patients in the PEEK cage group whereas it was 90% in the ICG group.<sup>18</sup>

A local study was conducted in Pakistan which included 151 patients having ACDF surgery in which PEEK cages were used and follow-up was of 6 months postoperatively, where they reported PEEK cages are safe, easy to use, and effective substitute to solid bone grafts, and results



showed that the fusion rate was 100%.<sup>9</sup>

Another study included 61 patients with PEEK cage and 107 patients with structural allograft. Pseudoarthrosis rate was 5.4 percent (PEEK) and 3.4 percent (allograft) ( $p > 0.05$ ); 7.1 percent (PEEK) and 8.1 percent (allograft) ( $p > 0.05$ ); and 10% (PEEK) and 11.1 percent (allograft) ( $p > 0.05$ ) for 1-level fusions. In 1-, 2-, and 3-levels ACDF, no substantial difference in subsidence magnitude among PEEK and allograft ( $p > 0.05$ )<sup>20</sup> was noted. According to Lied B, et al., the clinical outcomes of utilizing an iliac crest bone graft against a PEEK cage are equivalent, although PEEK cages are preferable in ACDF surgery because of the absence of donor site morbidity.<sup>23</sup> When compared to autograft, the patient satisfaction rate with bone graft alternatives is extremely soaring. The usual recommendation – autograft is the gold standard for ACDF surgery, was questioned by the author. The autologous bone graft should not be labeled "gold standard" in the present era of graft substitutes, but rather an index option for comparison with other options.<sup>10</sup> Additionally, a bone graft can be used to supplement the fusion achieved with these tools. Fusion, on the other hand, can be achieved purely with autologous bone graft or allograft without the need for any of the above-mentioned synthetic devices.<sup>21</sup>

In a study, it was determined that the high fusion rate, low subsidence, cage stability, and ease of radiological evaluation are due to the physical qualities of the PEEK material besides the design of the cage.<sup>22</sup>

## CONCLUSION

It is concluded that PEEK cages are better than autologous bone grafts in ACDF surgery in terms of less pain, higher good to excellent functional outcome using Odom's criteria, less operative time, less blood loss (ml) and less hospital stay (days) less fusion rate and shorter disc height (mm). Hence PEEK cage can be opted in the

future to have a better outcome and higher patient satisfaction.

## RECOMMENDATIONS

It is recommended that, because of the above study and its results, PEEK cages should be the first choice for ACDF surgeries in CSM patients due to their effectiveness. However, there should be more clinical trials to be done for the gold standardization of this cage material in such procedures.

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### Additional Information

**Disclosures:** Authors report no conflict of interest.

**Ethical Review Board Approval:** The study was conformed to the ethical review board requirements.

**Human Subjects:** Consent was obtained by all patients/participants in this study.

**Conflicts of Interest:**

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

### AUTHOR CONTRIBUTIONS

Sr. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1	Mubashir Malik	Study Design, Methodology, and Paper Writing.
2	Zubair Ahmed Khan, Mubashir Malik	Data Calculation and Data Analysis.
3	Amir Aziz, Muhammad Naveed Majeed	Interpretation of Results.
4	Shehzad Safdar	Statistical Analysis.
6	Rizwan Masood Butt	Literature Review and Paper Edit.