Pseudarthrosis following single-level ACDF is five times more likely when a PEEK interbody device is used

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TABLE 2. Comparison of pseudarthrosis, need for revision surgery, and smoking status between the structural allograft and PEEK implant groups

Factor	Structural Allograft Group	PEEK Group	p Value
Pseudarthrosis on imaging studies	7 (10)	29 (52)	≤0.001
Revision surgery	1 (14)	7 (24)	0.01
Smokers w/ pseudarthrosis	4 (57)	11 (38)	0.59

Unless otherwise specified, values represent numbers of patients (%).

In spine surgery, "arthrodesis" is the term used to describe fusion of adjacent vertebrae following removal of an intervertebral disc. Arthrodesis is achieved by placing a bone graft or bone graft substitute between the vertebrae to bridge the empty space so that new bone can grow between. "Pseudarthrosis" is the term used to describe failure of this expected new bone growth.

Researchers at the Department of Neurological Surgery, Oregon Health & Science University, found pseudarthrosis to be five times more likely

after a polyetheretherketone (PEEK) interbody spacer device had been used to bridge the gap between vertebrae during cervical spine surgery than after a structural (bone) allograft had been used. The researchers' findings appear in a new article published today in the *Journal of Neurosurgery: Spine*: "Fivefold higher rate of pseudarthrosis with polyetheretherketone interbody device than with structural allograft used for 1-level anterior cervical discectomy and fusion," written by Katie L. Krause, MD, Ph.D., and colleagues.

Background

Anterior cervical discectomy and fusion (ACDF) is a common surgical procedure performed in patients experiencing pain or weakness due to a herniated or deteriorated intervertebral disc in the neck. During the operation, the surgeon approaches the cervical spine from the front of the body, thus avoiding the spinal cord, spinal nerves, and thick neck muscles. After reaching the spine, the surgeon removes the damaged disc, which lies between two adjacent vertebrae, and replaces it with a bone graft or an artificial graft packed with bone fragments or bone-inducing proteins that serves to "fuse" the two vertebrae together and stabilize the spine. ACDF can be performed at a single level (replacing one disc between two adjacent vertebrae with a graft) or at multiple levels (replacing multiple discs with grafts).

In this paper, the authors focus on two graft materials commonly used to bridge the gap between two vertebrae after disc removal: structural allograft and polyetheretherketone (PEEK). Structural allograft is a sterilized piece of bone obtained from a cadaver. It has no active bone cells or bone-inducing proteins itself, but acts as a natural scaffold over which bone can regrow. PEEK is a strong, biocompatible plastic. Although itself bioinert, this plastic scaffold is packed with bone shavings or proteins at the time of surgery to induce bone growth.

Present Study

In this retrospective study, the authors reviewed the cases of 127 patients who had undergone single-level ACDF and participated in at least 1 year of follow-up. Fifty-six (56) patients had received PEEK implants and 71 had received structural allografts. The goal of the study was to see which graft material was more effective at producing greater bone fusion following ACDF. This was done by reviewing follow-up radiographic images to identify which patients had pseudarthrosis, defined as a "lack of solid bone growth across the disc space at 1 or more years of radiographic follow-up," and by checking patient charts to see if repeated surgical intervention was required.

The authors found no significant differences in patient age, sex, or body mass index between the two patient groups (PEEK implant group and structural allograft group). There was also no significant difference in tobacco use between the two groups. Tobacco use was examined because there is substantial medical evidence that smoking has a negative effect on bone healing.

The authors found radiographic evidence of pseudarthrosis in 29 (52%) of the 56 patients with PEEK implants and in 7 (10%) of the 71 patients with structural allografts. They also found repeated surgery was warranted in 7 patients (24%) with PEEK implants and in only 1 patient (14%) with a structural allograft. These findings show that when used in a single-level ACDF, PEEK implants were associated with a significantly higher rate of bone nonunion (lack of new bone growth) and a significantly higher rate of the need for additional surgery than structural allografts.

Interestingly, the researchers cite literature on insurance reimbursement policies for ACDFs. The cost of an ACDF performed using a PEEK device can be reimbursed at a far greater amount than the cost of

performing the same surgery using a structural allograft.

In light of the results of this study, the authors suggest that surgeons consider the risks of bone nonunion and the need for repeated surgery when choosing which graft to select for an ACDF. They also advocate a change in the discrepancy between reimbursement costs for surgeries involving PEEK implants and structural allografts.

When asked about the paper, the study's senior author, Dr. Khoi Than, said, "Hundreds of thousands of PEEK implants are placed in patients' necks every year, and our work verifies my suspicion that many of them are not healing. I would encourage my fellow surgeons to consider using structural allograft instead of PEEK, despite the lower reimbursement, as the former is clearly the better option for our patients."

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