

Hydroxyapatite-Integrated PEEK vs Titanium-Coated PEEK Interbody Cages in Cervical and Lumbar Fusions: A Single-Surgeon Retrospective Fusion Assessment

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INTRODUCTION: Hydroxyapatite-integrated polyetheretherketone (HA-PEEK) interbody cages couple PEEK’s radiolucency and bone-matched modulus with the osteoconductivity of hydroxyapatite, while titanium-coated PEEK (Ti-PEEK) remains widely used. Head-to-head clinical data across cervical and lumbar regions are limited. We compared radiographic fusion and subsidence between HA-PEEK and Ti-PEEK devices in routine cervical and lumbar arthrodesis.

METHODS: Operative logs from a single fellowship-trained spine surgeon (January 2019–December 2022) were retrospectively reviewed. Adults (≥18 years) who received an HA-PEEK or Ti-PEEK interbody cage and had flexion–extension radiographs ≥10 months post-operation were included. Demographics/comorbidities and surgical variables were abstracted from charts. Fusion (bridging bone and no motion on lateral flexion–extension views) and cage subsidence were independently assessed on radiographs obtained 10–14 months post-op. Group comparisons used Wilcoxon rank-sum or Fisher’s exact tests (α=0.05). Cervical and lumbar procedures were analyzed separately.

RESULTS: One hundred eight procedures met inclusion (HA-PEEK n=52; Ti-PEEK n=56). HA-PEEK recipients were older than Ti-PEEK recipients (67.9 ± 1.7 vs 57.2 ± 1.4 years, p<0.001); BMI, sex, diabetes, osteoporosis, smoking, depression, and cervical-versus-lumbar distribution were comparable (all p≥0.27). At 10–12 months, every HA-PEEK case fused (100%), whereas 55/56 Ti-PEEK cases fused (98.2%) (p>0.999). Subsidence was absent with HA-PEEK and occurred in 2 Ti-PEEK cases (3.6%) (p=0.496). In lumbar sub-analysis, fusion (p=0.215) and subsidence (p=0.468) did not differ by material; all cervical constructs fused without subsidence regardless of cage type.

DISCUSSION: In this single-surgeon cohort, HA-PEEK achieved fusion and subsidence rates that were at least comparable to Ti-PEEK despite an older patient profile. Although HA’s osteoconductive surface could plausibly support early bone bridging, between-group differences were small and not statistically significant. The analysis was likely underpowered to detect rare events such as nonunion or clinically meaningful subsidence. Findings should be interpreted in light of selection bias (surgeon/implant choice), limited radiographic follow-up (10–14 months), and the absence of CT confirmation or patient-reported outcomes. Future multicenter prospective studies with longer follow-up and stratification by bone quality, smoking, and construct type are needed to clarify any material-specific advantages and their clinical impact.

SIGNIFICANCE/CLINICAL RELEVANCE: Both HA-PEEK and Ti-PEEK supported excellent early fusion with very low subsidence across cervical and lumbar applications. The absence of subsidence and 100% fusion in the older HA-PEEK cohort suggest potential advantages for patients with lower bone quality; larger prospective, multicenter studies with longer follow-up are warranted to define long-term comparative effectiveness.

IMAGES AND TABLES:

| | Overall (n = 108) | Titanium (n=56) | HA PEEK (n=52) | p-Value |
|--------------------------|----------------------|--------------------|-------------------|---------|
| Age ± SD | 62.4 ± 1.2 | *57.2 ± 1.4 | *67.9 ± 1.7 | *<0.001 |
| BMI ± SD | 28.7 ± 0.5 | 28.3 ± 0.7 | 29.2 ± 0.8 | 0.225 |
| Sex | | | | 0.843 |
| Male | 49 (45%) | 25 (45%) | 24 (46%) | |
| Female | 53 (49%) | 25 (45%) | 28 (54%) | |
| Osteoporosis | 9 (8%) | 5 (9%) | 4 (8%) | 0.739 |
| Diabetes | 12 (11%) | 5 (9%) | 7 (13%) | 0.761 |
| Smoking Status | | | | 0.756 |
| Never | 58 (54%) | 27 (48%) | 31 (60%) | |
| Former | 35 (32%) | 19 (34%) | 16 (31%) | |
| Current | 9 (8%) | 4 (7%) | 5 (10%) | |
| Depression | 47 (44%) | 25 (45%) | 22 (42%) | 0.848 |
| Number of Segments Fused | | | | 0.686 |
| 1 Level Fusion | 57 (53%) | 29 (52%) | 28 (56%) | 0.097 |
| 2 Level Fusion | 38 (35%) | 24 (43%) | 14 (27%) | |
| 3 Level Fusion | 10 (9%) | 3 (5%) | 7 (13%) | |
| >3 Level Fusion | 2 (2%) | 0 (0%) | 2 (4%) | |
| Average Levels Fused | 1.7 ± 0.2 | 1.5 ± 0.1 | 1.8 ± 0.2 | |
| Spinal Fusion Region | | | | 0.686 |
| Lumbar | 62 (57%) | 29 (52%) | 33 (63%) | |
| Cervical | 46 (43%) | 21 (38%) | 19 (37%) | |

Values represent means ± standard deviations and means (proportions)
*Indicates statistical significance at an a priori significance level of 0.05.

Abbreviations:
BMI- Body Mass Index
SD- Standard Deviation

