

Study	Design	Outcomes
Ho et al, 2024	Dose planning accuracy and postop CT image quality in CF-PEEK pedicle fixation systems compared to Ti. Dose profiles through the screw, tulip, longitudinal axis of the screw acquired with radiochromic films and compared to a collapsed cone algorithm simulation, to measure dose agreement. Image quality of postop CTs comparing 4 regions of interest around vertebrae and screws in water phantom models and previous planning CTs and comparing calculated artefact indexes.	CF-PEEK screws have non-inferior dosimetric prediction accuracy up to 50 mm beneath screw for collapsed-cone algorithm planning system. Statistically significant reduction in absolute difference between calculated and measured dose at a depth of 2 mm beneath the screw. Minimal attenuation with CF-PEEK relative to surrounding dose, extending to 50 mm beneath the screw. Statistically significant improvement in CT imaging quality with reduced artifact index values in CF-PEEK vs Ti fixation.
Nevelsky et al, 2017	Measured point dose differences between measured doses and Monte Carlo simulated doses for Ti vs CF-PEEK vs CF-PEEK with ultrathin Ti coated screws using 6 MV photon beam using a solid water phantom.	Max dose perturbation < 5% for CF-PEEK vs > 30% for Ti screws. Ultra Ti coating had negligible effect. Dose attenuation < 0.5% at depths of 1-6 mm when beam were passed across CF-PEEK screw vs 7.2-12.5% using Ti screw at same depths.
Poel et al, 2020	Phantom model study comparing Ti vs CF-PEEK using proton beam therapy.	CF-PEEK implant had 90% reduction of artifacts on CT images, significantly reducing time for artifact correction vs Ti-only implant. Up to 8% overdose with Ti construct vs ~ 5% with CF-PEEK.
Shi et al, 2022	Spinal phantom models with a) No instrumentation; b) Ti; c) CF-PEEK; and d) hybrid CF-PEEK with Ti tulip head. Measured CT iterative Metal Artifact Reduction. Representative spinal chordoma target and associated OARs were contoured with 50 Gy prescription dose to the initial target volume, followed by 24 Gy boost using multi-field optimization proton plans and photon VMAT plans were made.	Proton plans achieved similar normal target coverage and OAR sparing. For initial CTV, ensured 95% coverage and 90% OAR coverage for normal and CF-PEEK plans. Uncertainty analysis of spinal cord Dmax showed tighter distribution for normal and CF-PEEK plans. No difference in overall plan quality for photon vs proton when compared to normal spine regardless of type of implant. For proton plan, larger difference for normal spine insert vs Ti insert. For each insert scenario comparison between photon and proton plans, there was larger differences for OARs: heart and spinal cord.
Kalasauskas et al, 2022	Cadaveric imaging study of Ti-Ti vs C-Ti vs C-C pedicle screws using CT, 1.5T, and 3T MRI. Axial T1- and T2-weighted sequences of T and L regions assessed for artifacts. Artifacts classified as: 1) Not relevant; 2) Considerable; and 3) Severe.	92 screws and 178 artifact assessments made. Artifacts clearly visible on CT but did not influence visualization of intraspinal structures. Severe MRI artifacts hampering evaluation of the spinal cord found in 28% of Ti-Ti, 2% of C-Ti, and 0% of C-C screws. Considerable MRI artifacts found in 47% of Ti-Ti, 10% of C-Ti, and 0% of C-C screws.

Abbreviations: CF/PEEK = carbon fiber/polyetheretherketone; Ti = titanium; CT = computed tomography; MV = megavoltage; OAR = organs at risk; Gy = gray; VMAT = volumetric modulated arc therapy; C = carbon; T = tesla; MRI = magnetic resonance imaging; CTV = clinical target volume.