USE OF PEEK IN SPINE SURGERY

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Titanium

- Stress shielding: stress mismatch between titanium implant and adjacent bone
- Local inflammation: wear and corrosion from metal implant debris
- PEEK (poly(ether-ether-ketone) as alternative
PEEK Advantages

- Biocompatibility and biomechanical properties
- Radiolucent
- Elastic modulus close to cancellous bone

Fusion promotion with PEEK

- Bioinert
- Hydrophobic surface: not conducive to fast bone cell attachment, slow bone fusion
- Bulk modification: bioactive hydroxyapatite, tricalcium phosphate, and strontium-containing hydroxyapatite increases elastic modulus
- Surface modification: does not adversely change PEEK’s intrinsic properties

PEEK and TiO2/PEEK

- Protective oxide layer forms rapidly on Ti when exposed to air
- TiO2 binds calcium and phosphate ions, simulating bone-like apatite to induce osteoblast attachment and growth
- TiO2 film on PEEK: significant adhesion, proliferation, differentiation of osteoblast cells
Osseointegration

- TiO2/PEEK in C-spine
  - PIERCE-PEEK: large prospective, multi-center clinical trial, single-level empty PEEK ACDF cage → complete bony fusion of 83% at 18 months
  - Kotsias, 2017: prospective, multi-center, single-arm clinical study, single-level PEEK + Ti vs. PEEK only ACDF cage → complete bony fusion of 80% at 18 months but no lasting clinical benefit from Ti coating
  - Patients with solid bone fusion did better than patients with non-union

Review of PEEK cages in C-spine

- 2 randomized controlled trials
- 5 prospective comparative trials
- 3 retrospective comparative trials
- PEEK vs. bone graft: minimal evidence for better clinical and radiographic outcome with PEEK implant
- No differences among PEEK, titanium, carbon fiber cages
Titanium coated PEEK cages in ALIF: 42 of 44 (96%) exhibited solid arthrodesis at 7 months.

Improvement in low back pain and leg pain (using VAS).

Tobacco use, advanced age and DM yielded poorer fusion rates.

Time to fusion shorter than comparative ALIF studies.

PEEK vs. autologous cage with spinous processes and laminae: no significant difference in functional outcomes and fusion rates at 2 years in single-level PLIF.
PEEK rods

• Titanium rods: overstabilization, stress shielding, adjacent segment degeneration
• Systematic review: 8 clinical studies, 15 biomechanical studies
• PEEK rods in biomechanical studies: superior load-sharing distribution, larger adjacent segment range of motion, reduced stress at rod-screw/screw-bone interface
• PEEK rod construct: simple in assembly, reliable in vivo performance when compared to dynamic devices
• However, no evidence to confirm better outcomes with PEEK rods when compared to titanium rods

Conclusions/Future of PEEK

• PEEK has visualization and modulus of elasticity benefits
• Poor osseous integration unless surface treated
• Possible use in motion-preservation devices

THANK YOU
REFERENCES


