Carbon Fiber Fixation In Oncologic Bone Surgery

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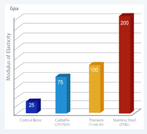
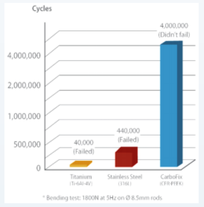
Introduction

Numerous previous studies describe carbon fiber as a safe, biocompatible material amenable for use in problem fractures[1-5]. Little study exists in the recent literature regarding the use of carbon fiber in the modern treatment of destructive bone conditions.

Compared with conventional metal bone fixation devices, carbon fiber provides improved fatigue strength, complete imaging compatibility, and a modulus of elasticity closer to that of cortical bone[2,6]. These characteristics make carbon fiber a potentially ideal fixation choice for bone and joint sparing oncologic procedures.





Questions / Purposes:

We ask if carbon fiber represents a safe and effective alternative to current metallic long bone fixation devices used in the treatment of tumor and tumor-like conditions of the long bones.

Methods

Study Design:

Retrospective case series, Level IV

Retrospective review of all orthopedic tumor / tumor-like conditions treated with carbon fiber internal fixation
- 18 month period
- Two academic institutions:
  - Cedars-Sinai Medical Center
  - University of Southern California

8 cases met the inclusion criteria:
- 1 myeloma proximal femur pathologic mal/non-union
- 1 metastatic carcinoma impending fx of the tibia
- 2 infected tibial non-unions
- 2 distal femoral non-unions with bone loss
- 2 high energy open tibia fractures

- Mean follow up 9.5 months (range 1 – 24)

Results

Case 1

56 year old homeless male with myeloma pathologic malreduced non-union

S/P revision to Carbon Fiber intramedullary nail:
- At 1 month postop
  - Callus on x-ray, walking w/o pain (lost to F/U)

Results (cont.)

Case 3

23 year old male S/P high energy MVA

S/P I&D, Carbon Fiber IMN, and local wound management (no flap or graft procedure)
- Soft tissues healed at 4 weeks
- Bone healed at 8 weeks
- No evidence of infection

Case 4

42 year old male with aseptic non-union

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S/P revision to carbon fiber IMN

At 1 month postop:
- No pain
- Ambulating with cane
- Early evidence of callus

Case 6

64 year old male with metastatic lung ca

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S/P Prophylactic Carbon Fiber IMN

Case 7

47 year old male with infected tibial non-union

Antibiotic cement coated carbon fiber nail

S/P free flap and antibiotic cement coated Carbon Fiber IMN

- Immediate weight-bearing
- No secondary bone graft or fixation procedure
- Ambulating without assistive devices by 6 mos
- Evidence of bone healing & back to full activity / golf at 1 year

Results (cont.)

Case 8

28 year old obese male with femoral nonunion

S/P revision to retrograde Carbon Fiber IMN

Results Summary:

- No adverse tissue reactions or complications were seen in any case.
- All patients bore full weight immediately.
- Radiographic fracture and bone lesion imaging remained optimal in all cases.
- All patients with non-unions resumed ambulation by one month without pain.
- No cases of subsequent fracture or hardware failure occurred.

Discussion & Conclusion

Because of its material and imaging properties, carbon fiber provides an ideal solution for long bone fixation in tumor and tumor-like conditions.

At short term follow-up, carbon fiber is a safe and effective alternative, and well tolerated without increased rate of complications when compared to conventional metal fixation devices.

References

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