

# Computer-designed PEEK Implants Versus Titanium Mesh in Alloplastic Cranioplasty: A Retrospective Single-Surgeon Study

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## Introduction

Polyetheretherketone (PEEK) has emerged as one of the most promising alloplastic materials for calvarial reconstruction due to a number of desirable qualities including:

- resistance to heat and ionizing radiation
- biocompatibility
- biomechanically similar to native bone
- non-ferromagnetic for post-operative monitoring [1]

We aimed to evaluate and compare the outcomes of alloplastic cranioplasty performed with PEEK and titanium mesh ( $\pm$  reinforcement with acrylic cement (AC)) which has previously recorded many successes with low complication rates [2].

## Methods

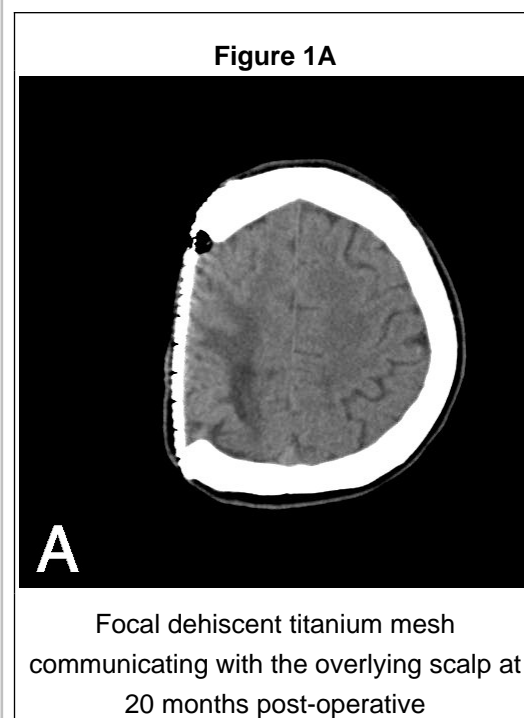
- Retrospective, single-surgeon, single-center study
- January 2008 to December 2012
- 24 patients (75% male) had initial decompressive craniectomy for intra- and extra-axial hemorrhage
- Titanium meshes ( $n=12$ ) were fashioned intra-operatively (reinforced with AC,  $n=7$ ); PEEK implants ( $n=12$ ) were pre-fabricated from high resolution CT scans
- On-going outpatient follow-up

## Results

Means:

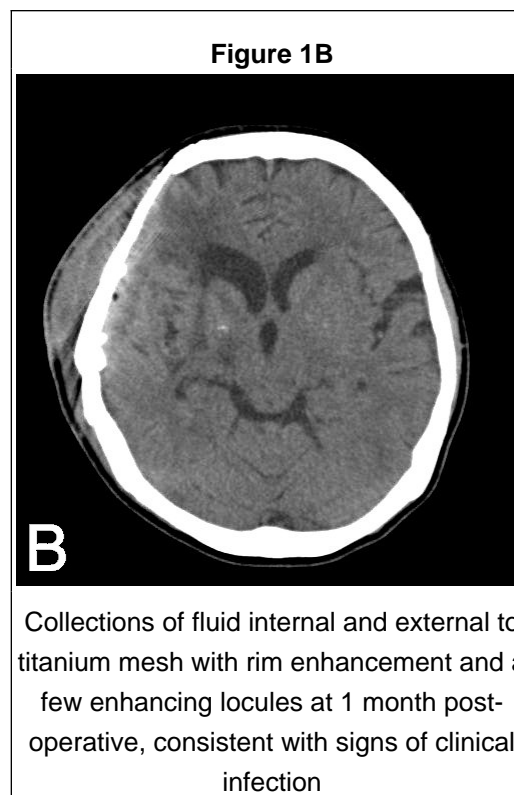
- age = 42 years (16 – 67)
- interval to surgery = 10 months (3 – 40)
- defect size = 12 x 9 cm (7 x 6 – 15 x 10)
- duration of surgery = 181 minutes (100 – 275)
- hospital stay = 13 days (4 – 80)
- follow-up = 11 months (1 – 32)

Cranial defects were located bi-frontally ( $n=3$ , 13%) and over the temporo-parietal region; the scalp was closed primarily in all cases



## Results (cont'd)

7 patients with titanium mesh cranioplasties (3 of which were titanium-AC) had post-operative complications including wound breakdown (Figure 1) and implant exposure. This culminated in implant removal in 6 (3 each of titanium only and titanium-AC), 4 of which required further plastics flap coverage. PEEK cranioplasty patients had an otherwise uneventful post-operative recovery for a similar follow-up period. Sub-group analysis showed no significant difference between the three cranioplasty groups.



## Conclusions

Early results suggest that PEEK may be a superior alloplastic cranioplasty material because:

- it does not migrate through the overlying skin flap like titanium meshes and
- avoids the highly exothermic reaction associated with the use of acrylic cement and this may compromise tissue viability

Longer-term follow-up and greater patient numbers are required for statistical significance.

## Learning Objectives

By the conclusion of this session, participants should be able to:

- recognize and appreciate the properties of PEEK implants
- identify the different materials used in alloplastic cranioplasty (PEEK, titanium, acrylic)
- suggest why PEEK may be superior to titanium for cranioplasty

## References

- [1] Hanasono MM, Goel N, DeMonte F. Calvarial reconstruction with polyetheretherketone implants. *Ann Plast Surg.* 2009; 62(6): 653-655.
- [2] Janecka IP. New reconstructive technologies in skull base surgery: role of titanium mesh and porous polyethylene. *Arch Otolaryngol Head Neck Surg.* 2000; 126(3):396-401.