Journal of Cranio-Maxillo-Facial Surgery 45 (2017) 271–274

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

# Orbital fracture repair outcomes with preformed titanium mesh implants and comparison to porous polyethylene coated titanium sheets

Michelle Y. Peng [a], Shannath L. Merbs [b], Michael P. Grant [b], Nicholas R. Mahoney [b, *]

[a] Department of Ophthalmology, University of California, San Francisco, San Francisco, CA, USA
[b] Wilmer Eye Institute, Johns Hopkins University, Baltimore, MD, USA

ARTICLE INFO

*Article history:*
Paper received 11 October 2016
Accepted 29 November 2016
Available online 3 December 2016

*Keywords:*
Orbital fracture
Orbital implants
Preformed orbital implants
Custom implants
Custom orbital implants
Orbital fracture repair

ABSTRACT

*Background:* Restoration of orbital volume after internal orbital fractures can prevent enophthalmos. A variety of allografts are commonly used including titanium mesh with and without porous polyethylene coating. Some controversy exists over the use of uncoated titanium mesh in the orbit. Newer products contoured to the three dimensional orbital anatomy aim to improve reestablishment of the complex orbital shape though studies of outcomes with their use are limited.
*Methods:* A retrospective chart review was performed to evaluate surgical outcomes in all patients who underwent orbital fracture repair with DePuy/Synthes titanium MatrixMIDFACE prefabricated implants (PFTi) as compared with porous polyethylene/titanium hybrid implants (PPETi) including Stryker Medpor Titan, MTB, and BTB implants. Incidence of reoperation, diplopia, and movement restriction between PFTi and PPETi groups and the risk ratio of the above outcomes between implant types were compared.
*Results:* A total of 464 orbital implants were reviewed. Patients were divided by implant type with 195 patients receiving a PFTi implant and 269 patients receiving PPETi implant. (PFTi) and 269 had placement of a porous polyethylene/titanium hybrid implant. Despite statistically significant increased probability of utilization in more complex and delayed fractures, the PFTi implant showed no significant difference in complication profile or reoperation rate compared to the more commonly used PPETi.
*Conclusions:* PFTi implants, designed to replicate the native orbital shape, have similar surgical outcomes and no difference in complication profile compared to standard porous polyethylene/titanium implants hybrid plates.


## 1. Introduction

Disruption of the internal orbital bony architecture can lead to both functional and aesthetic complications. The thin bones of the orbital floor and medial wall typically are displaced into the adjacent sinus cavities during blunt orbital trauma as a result of outward forces from the pressurization of the retrobulbar orbital contents (Smith and Regan, 1957). The expanded orbital cavity volume and displacement of the orbital tissue results in increased orbital volume and enophthalmos. Diplopia can also occur in displaced fractures as the extraocular muscles and perimuscular connective tissue herniate into the defect and become either mechanically restricted or altered in vector of action.

The fractured bone elements typically are unable to be reduced and so must be replaced to restore the normal internal orbital volume. In addition to volume, the complex contours of the orbital walls and variations in patient anatomy must be considered to accurately reconstruct the orbital shape which, in turn, determines the globe's position. The process of manually forming, fitting, and aligning orbital implants for anatomically accurate reconstruction can be challenging (Metzger et al., 2006a,b). Prefabricated titanium anatomic orbital implants have been developed to increase the speed and accuracy of plate shaping (Strong et al., 2013). Thus far, clinical outcomes in small groups of patients receiving these prefabricated implants show that they can provide reliable anatomic orbital correction (Kozakiewicz et al., 2011; Strong et al., 2013; Lee et al., 2014).

* Corresponding author. Wilmer Eye Institute, 600 N Wolfe Street, Maumenee 505, Baltimore, 21287, MD, USA.
*E-mail address:* nick.mahoney@jhmi.edu (N.R. Mahoney).

http://dx.doi.org/10.1016/j.jcms.2016.11.020
1010-5182/

We reviewed our usage of one such commercially available implant, the MatrixMIDFACE Titanium Preformed Orbital Plate (PFTi) (Depuy Synthes, West Chester, PA, USA). We compare this with outcomes of our use of porous polyethylene coated titanium sheet (PPETi) (Medpor Titan Barrier, Stryker, Kalamazoo, MI, USA) implants during the same time period.

## 2. Materials and methods

We performed an IRB-approved retrospective chart review of all patients who underwent orbital fracture repair at the Wilmer Eye Institute from January 2008 through October 2014. Patients for review were generated from an implant log that specifically tracked usage of preformed anatomic plates and from a CPT code list generated from all patients who underwent orbital fracture repair with implant placement. Charts were reviewed for patient demographics, mechanism of injury, orbital fracture description, timing of surgery, past ocular history, and all clinical examinations. Surgical history was reviewed, including the implant type, size, and fixation information as well as surgical complications and revisions.

## 3. Results

A total of 475 patient charts were reviewed. Of these patients, 195 had placement of a MatrixMIDFACE preformed orbital plate (PFTi) and 269 had placement of a porous polyethylene/titanium hybrid implant (PPETi) (Medpor Titan "MTB" or "BTB" implants, Stryker, Kalamazoo, MI) (Fig. 1). The 11 remaining patients were excluded from further review (resorbable [1], manually bent flat titanium plates [3], porous polyethylene sheets [4] or other preformed titanium plates [3]). Of the patients receiving a PFTi plate, 24 of 195 (12.3%) had had previous orbital fracture repair compared to 15 of 269 (5.6%) in the PPETi group.

After dividing the patients into subgroups based on implant type and number of repairs, each cohort was further subdivided for analysis based on patient demographics, fracture description and timing of repair (Table 1). The cohort of patients receiving a PFTi implant and those receiving PPETi implant were similar in most ways with no significant difference in gender or mechanism of injury. The most common mechanism of injury was violent assault and most patients were men. A z-score was calculated comparing the independent proportions of patients in each category in both subgroups. There was a statistically significant increased probability that fractures involving two internal orbital walls or those repaired 30 days after injury received a PFTi implant while those repaired in less than 14 days were more likely to have received a PPETi implant.

The vast majority (444) had a retroseptal transconjunctival approach with or without retrocaruncular extension (Shen et al., 2015). Of these, seven had an additional lateral canthotomy. Eight patients underwent an isolated transcaruncular approach, seven had received conjunctival periotomy in the setting of simultaneous enucleation, and five were repaired transcutaneously through existing lacerations.

In the patients undergoing a first time repair with PFTi (n = 171), 3 (1.8%) patients underwent implant revision or removal and 3 (1.8%) patients had volume augmentation compared to 5 (2.0%) revisions and 1 (0.4%) augmentation in patients undergoing a first time repair with PPETi (n = 254) (Table 2). In the subgroup receiving PFTi after a previous repair (n = 24), 2 (8.3%) patients underwent a revision and 2 (8.3%) volume augmentation compared to 3 (20.0%) and 1 (6.6%) in the subgroup receiving PPETi after a previous repair (n = 15). There were no implant infections or orbital hematomas in the PFTi group but 1 retrobulbar hematoma and 2 late infections in the PPETi group, all of whom had no visual compromise and were treated with implant removal and with replacement performed only in the hematoma patient.

Among patients undergoing first time repair, 146 (85.4%) reported diplopia at presentation, which was reported as subjectively *better* or *resolved* at last follow up in 126 (86.3%). For the PFTi group, 202 (79.5%) reported diplopia on presentation, which was *better* in 166 (82.2%) at last follow up.

Only 47 PFTi and 56 PPETi patients followed up for more than 12 weeks. Of these, 29 (61.7%) PFTi patients had diplopia during their

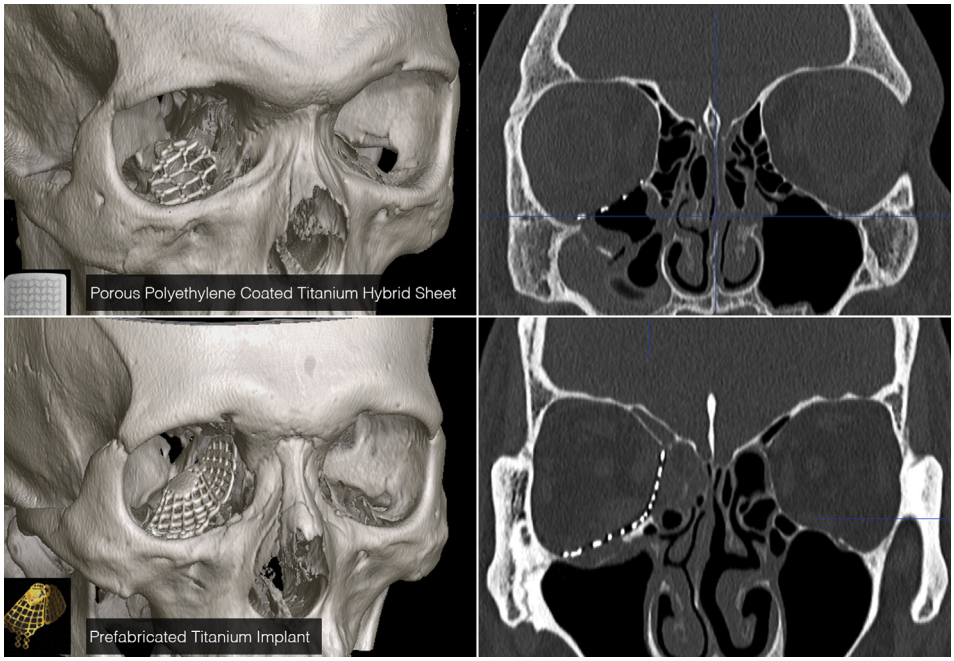


**Fig. 1.** Post-operative CT scans of two representative patients receiving orbital implants in this study. Top: porous polyethylene coated titanium hybrid sheet, Bottom: preformed titanium implant.