Titanium Mesh in Orbital Wall Reconstruction: A Short Review

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ABSTRACT

Orbital wall fractures are the more common fractures of the mid-face. Though surgical timing and approach are two important factors in management of orbital wall fracture, a third important factor is the choice of material used for reconstruction. There are numerous materials that are available for reconstruction of orbital wall defect. One among which is Titanium. Titanium is a metallic alloplast that has received much attention in the area of craniofacial reconstruction (Mok D et al).

Keywords: *Orbital Wall, Reconstruction, Titanium, Alloplast*

Introduction

Orbital wall fractures are quite common consequence of maxillofacial trauma¹. The consequences of an orbital injury are dramatic. They vary from loss of vision, diplopia, loss of an eye, epiphora, a disturbing loss of facial sensation to an unsightly and unacceptable appearance of the eye and the hard and soft tissues around it².

Damage to the walls themselves can cause disorders such as diplopia, enophthalmos, and much less frequently vertical dystopia. It is therefore mandatory to reconstruct the orbital walls with the same care one invests in repair of orbital rims³.

The ideal material for orbital reconstruction remains controversial. It should be cheap, biocompatible, readily available, easy to manipulate and insert in the operating room and it should allow fixation to the host bone by screws, wires, or sutures⁴.

Two main options for volume augmentation are autologous grafts and alloplastic implants. But autologous options are associated with potential donor site morbidity, difficult contouring, and graft resorption. Titanium, high – density porous polyethylene, and many other materials have been used as bone substitutes. They are relatively inert, provide reliable support without donor site morbidity, and are easily adapted to the contour of the orbit⁵.

Choice of Materials:

Autografts were the first major class of materials used in the reconstruction of orbital floor defects. Commonly used autologous materials are bone and cartilage⁶. Autologous bone grafts remain the “gold standard” for orbital floor

reconstruction⁷. But these grafts have the disadvantages of donor site morbidity related to surrounding anatomy⁶.

Lyophilized dura mater and banked demineralized bone are the most commonly used allografts for orbital floor fractures. But evidence from past reports has shown that allografts are associated with an increased risk of disease transmission from donor to patient⁶.

Webster proposed the use of lyophilized porcine dermis and found the material to be suitable for orbital floor repair⁸.

Alloplastic materials include polymers, porous polyethylene, titanium, bioactive glass, silicone, nylon, teflon, seprafilm. In many cases, the use of alloplastic materials is less expensive than the increased operative time required to harvest bone⁵.

Literature Supporting use of Titanium Mesh in Orbital Reconstruction

Gabrielli et al evaluated the efficacy and safety of traumatic orbital defect reconstruction with titanium mesh. After a minimum post – operative follow up of 12 months they documented that titanium mesh is a reliable option for orbital reconstruction⁹.

In the study conducted by Degala et al on 10 patients with symptomatic zygomatico-orbital fractures requiring orbital wall reconstruction, it was documented that titanium mesh could be considered to be the ideal orbital floor repair material. They also stated that their use leads to less morbidity as no donor site operation is needed. Also it provides favourable healing as it is biocompatible¹⁰.

Kozakiewicz et al compared the functional results of individual reconstructions of orbital wall using either

titanium mesh or ultra high molecular weight polyethylene. This study of 6 months functional result assessment of pre bent individual implants and CNC milled ultra-high molecular weight polyethylene of the orbital wall has shown it to be a predictable reconstruction method¹.

In the study conducted by Reich et al on 10 patients, the authors recommended the prefabricated titanium plate in the treatment of isolated orbital wall fractures or in combination with the medial wall despite the material costs¹¹.

Woo et al evaluated the use of titanium mesh plates in 17 patients with large medial orbital wall defects and they proposed that titanium mesh may be a valuable material for the reconstruction of severe medial orbital wall fractures¹².

Discussion

Studies validating titanium as an alloplastic material for orbital floor repair began in the early 1990s^{13,14}. It has been used for the repair of large orbital floor defects and correction of globe malposition by restoration of orbital structure and prevention of late complications. By closely reproducing the natural orbital volume and shape, titanium mesh can prevent traumatic enophthalmos from developing⁶.

Titanium is a metallic alloplast that has received much attention in the area of craniofacial reconstruction¹⁵. An attractive feature of titanium is its ability to osseointegrate¹⁶.¹⁷. Review of literature suggests that titanium may be an ideal material for orbital wall reconstruction^{1,9-12}.

Advantages of titanium mesh plates include availability, biocompatibility, ease of intra operative contouring, and rigid fixation¹⁸. Unfortunately, these implants are not easily positioned. Irregular edges of the mesh may catch prolapsed orbital fat¹⁹. Typically, titanium mesh plates should be placed 2 mm away from the orbital rim to avoid adherence syndrome²⁰.

Custom made titanium implants using computer assisted designs have enabled surgeons to achieve optimal reconstruction in areas of limited visibility and protection of vital structures²¹.

Conclusion

The various properties of titanium make it an ideal material for orbital wall reconstruction. Ultimately, the goal of reconstruction is to restore the form and function. As biotechnology advances, newer materials will emerge. But finally it is only the surgeon's decision to choose the best material.

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