

# A Stepwise Guide to Freehand Bending of Orbital Floor Mesh

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**Summary:** Orbital fractures can often result in enophthalmos or diplopia. Orbital reconstruction with titanium meshes is the current treatment modality. Adapting the titanium orbital floor mesh is often challenging due to the complex anatomy of the orbital floor. Here, a stepwise free hand bending technique of a titanium orbital floor mesh is described. The bending can be done preoperatively, and mesh fit can be checked against a dry anatomical skull before sterilization. The methodical approach to free hand bending of titanium orbital floor mesh minimizes the intraoperative adjustments and permits quick orbital reconstruction. Trainees and less-experienced surgeons can benefit from the methodical approach to free hand bending of titanium orbital floor mesh. (*Plast Reconstr Surg Glob Open* 2022;10:e4159; doi: 10.1097/GOX.0000000000004159; Published online 7 March 2022.)

## INTRODUCTION

Orbital fractures constitute around 40% of facial fractures and commonly involve the floor and the medial wall of the orbit owing to their delicate anatomy.<sup>1</sup> Disruption of the orbital architecture may cause herniation or entrapment of orbital contents, resulting in enophthalmos or diplopia.<sup>2</sup> Reconstruction of the disrupted orbital walls and restoration to premorbid orbital volume and function is the goal of orbital reconstructive surgery. The complex geometry of the orbit makes precise repair challenging, with the medial bulge and “S” shaped curve of the posterior orbital floor being the key features to accurate orbital reconstruction.<sup>3</sup> Titanium orbital meshes are preferred by most surgeons for orbital reconstruction due to their biocompatibility, ease of handling, and ability to contour the mesh to adapt to the internal orbit.<sup>4</sup> However, the flat manufactured titanium orbital meshes require careful sculpting to allow them to passively rest in the orbit. Improper contouring of the orbital mesh may lead to unsatisfactory functional and esthetic outcomes. Intraoperative freehand bending of the orbital floor titanium mesh has been the conventional method employed. Nevertheless, less-experienced surgeons may not fully appreciate the nuances of orbital

mesh bending with the result that repeated corrections may be required to ensure the best shape and orientation. The repeated insertion and removal of the orbital mesh can frustrate the surgeon and cause iatrogenic injury to the orbital fat and extraocular muscles. We describe below a stepwise approach to freehand bending of titanium orbital meshes.

## TECHNIQUE

For explanation, a medium-sized titanium right orbital floor mesh is used (Stryker-Liebinger, USA; Fig. 1).

### Armamentarium

Titanium mesh, a curved hemostat, mesh cutting scissors, and a rasp to smooth the cut edge of the orbital mesh are used.

A small portion of the medial wing and the stabilization prong is trimmed off with mesh-cutting scissors to accommodate the lacrimal sac and prevent injury.

**Bend 1:** A medium-sized curved hemostat is used to clasp the orbital mesh mediolaterally 1–2 mm behind the stabilization prong. The curved hemostat serves as a surrogate marker of the infraorbital rim. Gentle pressure is then applied over the orbital mesh just posterior to the hemostat to mimic the dip of the orbital floor immediately posterior to the infraorbital rim (Fig. 2; Bend 1).

**Bend 2:** The lateral wing of the orbital floor mesh is free bent gently by 30 to 45 degrees to mimic the anatomy at the junction of the orbital floor and the lateral orbital wall (Fig. 2; Bend 2).

**Bend 3:** The body of the orbital floor mesh is free bent gently along the anteroposterior direction to mimic the gradual concave curve of the anterior orbital floor behind the rim (Fig. 2; Bend 3).

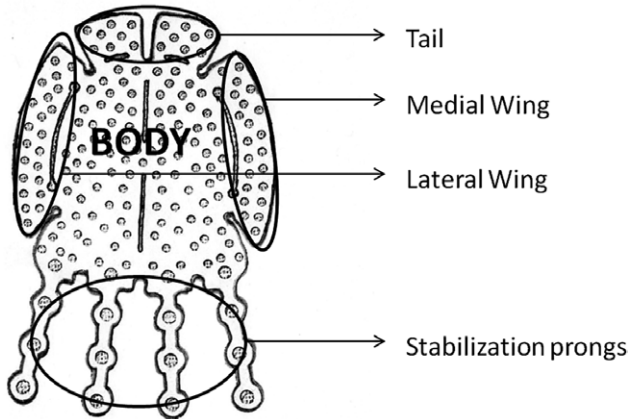
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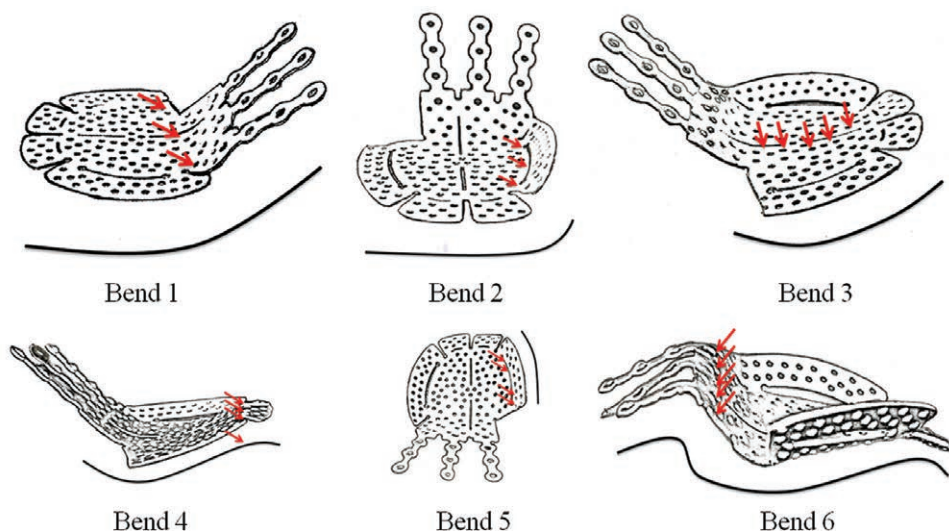


**Fig. 1.** Parts of a medium-sized right titanium orbital floor mesh.

*Bend 4:* The tail of the orbital floor mesh is free bent gently inferiorly to mimic the upward inclination of the posterior orbital floor. The tail end of the mesh must rest passively on the posteromedial portion of the orbital floor. When completed, bends 1, 3 and 4 will mimic the lazy “S” curve of the orbital floor visualized in a lateral view of the orbit (Fig. 2; Bend 4).

*Bend 5:* The medial wing of the orbital floor mesh is free bent in two locations, with the posterior end of the medial wing being bent more relative to the lacrimal end. This bend mimics the posteromedial bulge of the orbital floor (Fig. 2; Bend 5).

*Bend 6:* After confirming a satisfactory positioning of the orbital floor mesh intraoperatively, the stabilization prongs are sharply bent to adapt over the orbital rim and fixed with screws on the facial surface of the infraorbital rim (Fig. 2; Bend 6). All sharp edges are smoothed before fixation of the orbital mesh.



**Fig. 2.** Sequential cardinal bends. Bend 1: Free bend of the body of the orbital floor immediately posterior to the infraorbital rim. Bend 2: Free bend of the lateral wing of the orbital floor mesh. Bend 3: Free bend of the main body of the orbital floor mesh. Bend 4: Free bend of the tail of orbital floor mesh mimicking the lazy “S” curve. Bend 5: Free bend of the medial wing of the orbital floor mesh. Bend 6: Free bend of the stabilization prongs.

### Takeaways

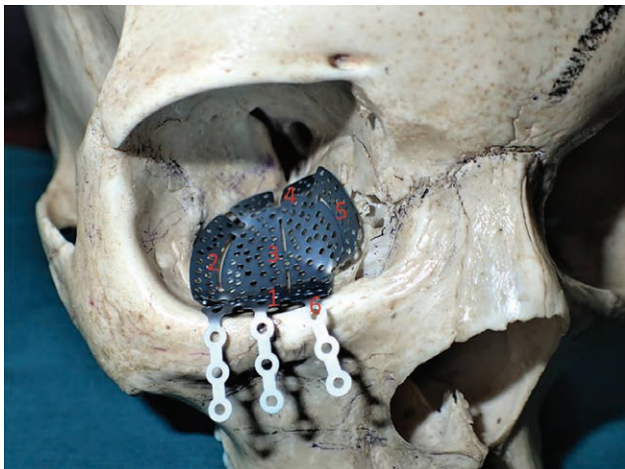
**Question:** How to freehand bend the orbital floor titanium mesh intraoperatively?

**Findings:** There are six cardinal steps in preadapting the orbital floor mesh to the orbital floor.

**Meaning:** Following the stepwise sequence of freehand bends, the surgeon will have a contoured titanium orbital mesh that may need only minimal adjustments before final positioning.

### DISCUSSION

3D prototypes of an orbital stereolithographic model can be obtained by mirroring the nonfractured orbit using medical software and a 3D printer. Orbital floor meshes can be trimmed and hand molded in this stepwise method to fit the size of the defect according to the 3D printed orbital model.<sup>5</sup> However, such 3D printed orbital models are best for secondary orbital reconstructive surgeries and may not always be available in acute trauma surgery settings. The use of preformed 3D orbital plates,<sup>6</sup> patient-specific implants,<sup>7</sup> and computer-assisted approaches<sup>8</sup> in orbital reconstruction allow for a more precise and safe orbital reconstruction but suffer from high costs, precluding them in resource-constrained maxillofacial surgical units. The above-described step-wise guide to orbital floor mesh bending can also be employed preoperatively. We have observed that surgical residents/less-experienced surgeons can precontour orbital floor meshes more easily when following the step-wise approach rather than free bending using one’s intuition and mental visualization of the orbital floor anatomy. The positioning of the orbital floor mesh is evaluated on a dry anatomical skull (Fig. 3), following which the mesh can



**Fig. 3.** Final bent mesh on the right orbital floor of a dry skull with the sequence of bends marked.



**Fig. 4.** Sagittal view of NCCT orbit showing orbital mesh resting on the posterior ledge and lazy "S" curve.

be sterilized. Our experience with this stepwise guide is that only minimal adjustments are needed on the orbital mesh intraoperatively, and the reconstruction is completed relatively quickly (Fig. 4).

## CONCLUSIONS

Unlike step-wise pictorial manuals describing the technical nuances of mandible and midface miniplate bending, to the best of our knowledge, similar manuals on freehand bending of orbital mesh are not available. We recommend that the above stepwise guide can be used for a quick freehand bending of the orbital mesh during orbital reconstructive surgeries.

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