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Research-In-Progress

3D Printed Model Training to Facilitate Plate Contouring in Surgical Stabilization of Rib Fractures

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Introduction: Surgical stabilization of rib fractures has demonstrated benefit for flail chest and other severe chest wall injuries. Dependent on the institution, the procedure is performed by trauma, thoracic or orthopedic surgery. Dedicated training on exposure, ideally through a muscle-sparing technique, and appropriate reduction and internal fixation is variably obtained through residency and fellowship. Post-residency training is often via industry sponsored skills courses. Chest wall exposure, fracture reduction, and fixation techniques are key components to surgical outcome. Plate contouring prior to internal fixation can provide a challenge to those early in their operative experience, particularly along the posterior- and anterior-most aspects of the chest wall.

Methods: 3D printed ribs were developed and prepared for internal fixation using an anterior and posterior locking rib plating system. Variable lengths of the pre-contoured plates were used. Manipulation needed to recontour the plates to fit the presumed fracture location was noted based on location (posterior, lateral, anterior, costochondral).

Preliminary Results: For lateral fractures, minimal to no change in the pre-contoured shape was required. For posterior rib fractures and those fractures of the lower anterior ribs and costal cartilage, both in- and out-of-plane contouring was required for appropriate plate application.

Next Steps: Additional 3D printed rib and chest wall models will be generated. Variable length plates will be applied, and specific contour changes noted based on anatomical location of the fracture line. Contouring details will be collected and reviewed. Recommendations can then be provided for direction, location, and degree of in- and out-plane bending needed for adequate internal fixation. This will serve to educate new trainees in hopes to speed the learning curve for plate application in rib fixation.