BACKGROUND: Correction of enophthalmos in reconstruction of orbital wall fractures depends on intra-operative judgement by direction observation. Intra-operative navigation assistance could provide more precise guidance to “how enophthalmos of the orbit” after reconstruction of orbital wall, than observation only by raw eye. Pre-operative planning is a key procedure of this technique. Theoretically, 3-dimention planning is more precise, but may not be available for every institute due to limited facility. We performed navigation assisted surgery by pre-operative 2-dimention planning and evaluated the clinical outcome and benefit.

PATIENTS AND METHODS: From April 2015 to January 2018, six patients undergone navigation assisted surgery for reconstruction of orbital wall fracture, with pre-operative 2-dimention planning, including 4 for combined orbital floor and medial wall fractures, and 2 for orbital floor fracture alone. Four of them were cases of secondary reconstruction. We input unformatted DICOM images into Medtronic StealthStation® Surgical Navigation System, and made the planning by the built-in planning software. On axial view, we firstly identified and drew the vertical midline from nose tip to center of cervical spine. Then, we made horizontal lines at top of the normal side orbit, extended to the fractured side, perpendicular to the midline, at the middle of the whole orbit. Points of the predicted position of the top of orbit at the fractured side was marked, in same distance opposite to the normal side. In secondary reconstruction cases, this predicted point was marked 1mm higher than the top of the orbit of the normal side. Then we performed reduction and reconstruction of the orbital wall fracture. Titanium mesh was used for orbital wall reconstruction, and was adjusted under assistance of navigation system. Medpor® was used for further orbital content reconstruction and correction of enophthalmos in secondary cases, and was adjusted with guidance of the predicted point (to reach the predicted point after inserting the Medpor®). Clinical result was evaluated by photographing of facial appearance, post-operative CT scan, and measurement of exophthalmometer.

RESULTS: The 2-dimention planning of predicted reduction point was easy by drawing the vertical and horizontal lines. The predicted points of top of the orbit were compatible by intra-operative direct inspection in all cases. Post-operative exophthalmometer showed less than 1mm enophthalmos in injured eye in primary cases, and satisfied correction of enophthalmos in secondary cases (three cases less than 1mm post-op enophthalmos, and one case less than 2mm). Post-operative photographing showed satisfied appearance. CT scan revealed acceptable position of orbit and the titanium mesh.

CONCLUSION: For limited facility, navigation assisted surgery by 2-dimention planning for orbita wall reconstruction might be an alternative of 3-dimention planning. Optimal result could be reached with less cost and easier planning. However, it may not be as precise as 3-dimention planning and may have limitation in patients with more complicated fractures.

Pediatric Pedestrian Facial Fractures from Motor Vehicle Collisions: What Are the Patterns and Appropriate Management Strategies?

Presenter: Farrah C. Liu, BS
Co-Authors: Nicholas C. Oleck, BA; Jordan N. Halsey, MD; Andrew A. Dobitsch, BA; Thuy-my T. Le, BME; Edward S. Lee, MD; Mark S. Granick, MD
Affiliation: Rutgers-New Jersey Medical School, Newark, NJ

PURPOSE: Pediatric injury due to motor vehicle crashes can be especially destructive to the pediatric population as the facial skeleton has immature growth centers, leading to possible long-term defects in form and function. To our knowledge, there are few studies examining fractures patterns of this etiology, and thus a lack of literature for management strategies to optimize functional recovery in this specific population.

METHODS: A retrospective chart review was performed for all facial fractures resulting from motor vehicle collisions with pedestrians in the pediatric population at a level 1 trauma center in an urban environment (University Hospital in Newark, NJ) from 2002 to 2012. Patient demographics were collected, as well as location of fractures, concomitant injuries, and surgical management strategies.

RESULTS: During the time period examined, 55 patients were identified as 18 years of age or younger and having sustained a facial fracture as the result of being struck by a motor vehicle. The mean age was 11.3 (range 1 – 18) years, with a male predominance of 69.0%. There were a total of 107 fractures identified on radiologic imaging via
CT or X-ray. The most common fractures were those of the orbit (23.4%), mandible (22.4%), and nasal bone (17.8%). The mean Glasgow Coma Scale on arrival was 12.1 (range 3 – 15). Twenty-one patients were intubated on, or prior to, arrival to the trauma bay. The most common concomitant injuries were skull fractures (25.3%), intracranial hemorrhage (22.2%), long bone fractures (15.2%), and intrathoracic injuries (15.2%). Of the 55 patients, 72.7% suffered from traumatic brain injury. The mean operative time was 216.9 (range 63 – 515) minutes. Surgery was required in 20 patients, with most undergoing open reduction and internal fixation with titanium plates and screws. Two patients required resorbable plates, and one required Medpor implants. The mean hospital length of stay was 9.3 (range 1 – 59) days. Three patients expired.

CONCLUSION/SIGNIFICANCE: There is currently a dearth of literature regarding the management and patterns of injury for pediatric pedestrian injuries due to motor vehicle collisions. The impact of these injuries can be devastating with concomitant life-threatening complications, and may influence the future development of the facial skeleton after healing of the bone and soft tissue. The authors hope this study can provide insight and further investigation regarding prevention and management.

HAND AND UPPER EXTREMITY SESSION 1

Urinary Bladder Matrix-Extracellular Matrix (UBM-ECM) for Management of Complex Upper Extremity Wounds

Presenter: Joseph R. Behrens, BS
Co-Author: Bruce Kraemer, MD
Affiliation: Saint Louis University, St. Louis, MO

INTRODUCTION: Open degloving injuries of the upper extremity can be devastating injuries that historically have poor outcomes. While initially, there are tissues present which appear viable, they are often destined to progress on to variable degrees of necrosis with standard wound care. Despite advances in flap transfers, patients often struggle with pain, scarring and limited use with the need for multiple revisions. Other non-operative reported treatments included a variety of topical dressing devices, growth factors, and prostaglandin E-1. Common to all of these treatments is the M1-macrophage directed healing and the attendant scarring that ensues at the site of the traumatic injury with those treatments. A Urinary Bladder Matrix-Extracellular Matrix wound device (UBM-ECM) preferentially promotes wound healing via an M2-macrophage constructive remodeling response and offers a new topical treatment modality for these frequently encountered wounds.

METHODS: The authors reviewed 17 wounds in 9 patients treated with serial placement of a UBM-ECM wound device (MicroMatrix® Powder and Cytal® Burn Matrix and Surgical Sheets- ACell®, Columbia, MD.). There were 6 males and 3 females patients with ages ranging from 20 to 82 years. The individual wound sizes ranged from 1cm² to 170cm². The upper extremity wounds were classified as to the type of injury, orientation of the tissue and original size of the wounds. The time to initial UBM-ECM device varied but in all cases was less than 2 days. The UBM-ECM powder and sheets were initially applied to the wounds in a standardized fashion with patients with larger wounds and exposed bone having initial larger volume of powder placed. Serial placement of the wound device was applied to wounds as indicated with the amount decreasing as the wound became smaller. The wound device was held in place with a petroleum impregnated gauze dressing which helped contain and retain the powder as well as moisture on the open wound bed. Serial hydrogel was topically applied. NPWT was used in 3 cases while the wounds drained 30cc or more per day. All wounds were treated to closure.

RESULTS: UBM-ECM wound treatment produced a durable, well healed wound in all patients. Three patients had secondary skin grafting to hasten the time to total healing. The ratio of skin graft to original wound area ranged from .28 (136.5cm²/481cm²) to .92 (44cm²/48cm²). The time to healing was based on the individual’s response to the UBM-ECM and ranged from 41 to 151 days. All patients regained sensation ranging from deeper pressure appreciation to discriminating sensation in the healed wound site. Clinical photographs of the outcomes of various severity stages are presented.

CONCLUSION: Complex upper extremity wounds managed with the UBM-ECM wound device reliably produced well healed, cosmetically acceptable healed wounds. Based on our results we strongly advocate all patients with complex and degloving injuries have early placement of UBM-ECM in their wounds to minimize the scarring and promote a constructive remodeling healing response. Further studies of these ECM wound devices are warranted.