3D-Printed Surgical Simulator for Kirschner Wire Placement in Hand Fractures

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INTRODUCTION: Surgical simulation provides resident physicians the opportunity to improve their operative skills in a safe environment. Placement of Kirschner wires for hand fractures is a deceptively difficult technique which requires significant experience to master. A simulator to aid in visualizing the anatomy would help trainees more rapidly advance their skills. We describe the design, creation, and preliminary validation of a 3D-printed hand simulator for Kirschner wire placement.

METHODS: Computer aided design (CAD) software was used to create a hand model based on anatomic measurements. 3D-printing was used to manufacture the separate components. Simulated bones were created from polyurethane, with imbedded graphite to render them radiopaque. The overlying soft tissues were made from silicone. Both a transparent and opaque soft tissue envelope were created. Resident physicians and staff both evaluated the model, and then a semi-structured questionnaire was used to assess their experiences.

RESULTS: An anatomically correct model was manufactured with multiple metacarpal and phalangeal fractures. Articulations at the interphalangeal joints were mobile within normal limits. Two variations of the model were created: one with transparent skin allowing visualization of the underlying bones, and one with opaque skin. This transparency allowed for a graded difficulty for novice surgeons, and correlation between tactile and visual feedback. Visualization under fluoroscopic C-arm demonstrated visible discernment of the bones.

Five residents and five staff evaluated the models. Experiences analyzed included: simulation realism, educational utility, and overall reaction. Responses in all domains were favorable, suggesting the positive utility of this model.

CONCLUSION: Using 3D-printing, we developed an anatomically correct and realistic simulator for Kirschner wire placement in hand fractures. Initial feedback has been favorable, suggesting its potential as an effective educational tool.

Octyl-2-Cyanoacrylate and Adhesive Mesh Closure System Versus Subcuticular Suture Closure in Reduction Mammoplasty: A Randomized, Controlled Trial

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INTRODUCTION: An ideal wound closure system is one that is effective, consistent, and efficient. The commonly-used subcuticular suture is time-consuming, operator-dependent, and inflammatory in nature. Recent studies have demonstrated the efficacy of octyl-2-cyanoacrylate and mesh system (Dermabond Prineo, Ethicon, Inc.) in the closure of surgical wounds. This study compared the use of Prineo to subcuticular suture closure in patients undergoing reduction mammoplasty.

METHODS: A prospective, randomized, controlled, single-blind study of patients undergoing bilateral reduction mammoplasty was performed. Power analysis was done to determine the minimum sample size of seven breasts per group. Each breast per patient was randomized to layered closure with Prineo or subcuticular sutures for the final layer. The incision length and time to closure were measured and recorded for each breast. Incisions were assessed at 2 weeks, 6 weeks, 6 months, and 1 year for scar quality and complications. Subjects completed the Patient Observer Scar Assessment Scale (POSAS) for each breast and two blinded plastic surgeons evaluated scar quality using the Vancouver Scar Scale (VSS) at each time point.
RESULTS: Twenty-one patients participated in the study. On average, Prineo closure took 58.38 seconds (2.50 s/cm) while subcuticular closure took 444.76 seconds (18.94 s/cm). Prineo closure was approximately 6.8 times faster (p=0.000) than subcuticular closure, saving an average of 6.4 minutes per incision. VSS scores were significantly better in patients with Prineo closure at 2 weeks (p=0.026), although there was no difference in POSAS and VSS scores at all other time points. No differences were found in wound complication or infection rates between the two groups and no adverse reactions were observed in either group. Cost analysis of our results estimated an average cost saving of approximately $127.75 per surgery when Prineo was used instead of subcuticular suture.

CONCLUSION: In reduction mammoplasty, Prineo closure results in equivalent scar quality and lower operative cost without increased complications when compared to subcuticular closure. The Prineo system is significantly faster than subcuticular closure and represents an effective, consistent, and efficient alternative to standard suture techniques.

Therapeutic Mammoplasty and Dermal Flap, a Novel Hybrid Approach for Chest Wall Reconstruction

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INTRODUCTION: Breast reduction techniques in management of breast cancer have been described since 1980 mainly to resect large tumour in large breasts. This oncoplastic approach has emerged due to the demand for more aesthetically acceptable results without compromising oncological safety. In addition, the redundant lower pole breast skin envelope is used as a de-epithelialized dermal flap. Recently published evidence has highlighted the importance of multidisciplinary thoracic oncoplastic approach in management of chest wall tumours providing a safe versatile long term outcome. We advocate a hybrid technique utilising both therapeutic mammoplasty and inferiorly based de-epithelialized dermal flap to provide coverage for anterior chest wall defects post resection of chest wall tumour which to the author’s best knowledge would be the first time to be described in this context

METHODS: Retrospective data analysis of 115 patients between 2009–2017 whom underwent chest wall resection and reconstruction revealed the utilization of therapeutic mammoplasty and dermal flap to provide soft tissue coverage post resection of chest wall sarcoma in 7 patients. Patient’s demographics, clinico-pathological, radiological, operative details, adjuvant therapy, postoperative morbidity and follow-up data were recorded in these seven patients

RESULTS: Chondrosarcoma was the pathology in all women with age range from 31–59 years (median 35). Defects were located anterior with size ranging from 100–150 cm² (mean 115). The post-operative follow-up ranged from 36–72 months (median 17). R0 resection was achieved in all patients. Rigid reconstruction with cement mesh was performed in four patients while in three non-rigid reconstructions with prolene mesh was performed. Supero-medial nipple areola complex pedicle was performed in 5 unilateral while supero-lateral in a bilateral case and a unilateral case was performed. In all patients the lower pole de-epithelialized dermal flap was used to provide soft tissue coverage. Three patients had contralateral symmetrisation. One patient experienced T junction necrosis which was managed conservatively while all other patients had excellent functional and aesthetic outcomes

CONCLUSION: Therapeutic mammoplasty and dermal flap as a hybrid technique would provide both an excellent exposure for resection and a versatile, easy and safe option for soft tissue coverage post chest wall resection with superior aesthetic outcomes. This technique should be added as a valuable tool in the armamentarium of thoracoplasty especially in young females with moderate to large breasts

Outcomes of Sternal Rigid Plate Fixation from 2005–2015 Using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP)