Transforming the Healthcare Simulation Spectrum:
Now, Next and Beyond

19 - 21 October 2022 | Academia, Singapore

SingHealth DukeNUS ACADEMIC MEDICAL CENTRE
Institute of Medical Simulation

SESAM

SIMGHOSTS

Functional Role of Simulation Operations Specialist in Applying Innovative Simulated Skin to Training: An Evaluation of Return on Expectation

MDSSC Multi-Disciplinary Simulation and Skills Centre 綜合模擬及技能培訓中心
Safe and quality healthcare through simulation

WONG TKY, CHEUNG VKL, SO EHK, LEUNG ASH, SO SS, NG GWY, CHIA NH

Multi-Disciplinary Simulation & Skills Centre (MDSSC), Queen Elizabeth Hospital, Hospital Authority, HKSAR

Introduction

Innovation in simulation may be a little thing that makes a big difference in procedural training experiences for healthcare professionals. While simulation educators pay greater emphasis on educational design of simulation training curriculum and scenario, simulation operations specialists illustrate expertise in designing training models and manipulating simulation activities to optimize technological capacity for course-specific training objectives as well as realism. Conventionally, our center uses hand-made silicone layers alone to simulate human skin for psychomotor training in suture and surgical airway procedures. Several fragilities were identified by subject matter experts in general surgery: Existing simulated skin was too thin, easy to hit the board or cut through sutured wound site, and lose balance between elasticity and toughness as real human skin. This study aims to:

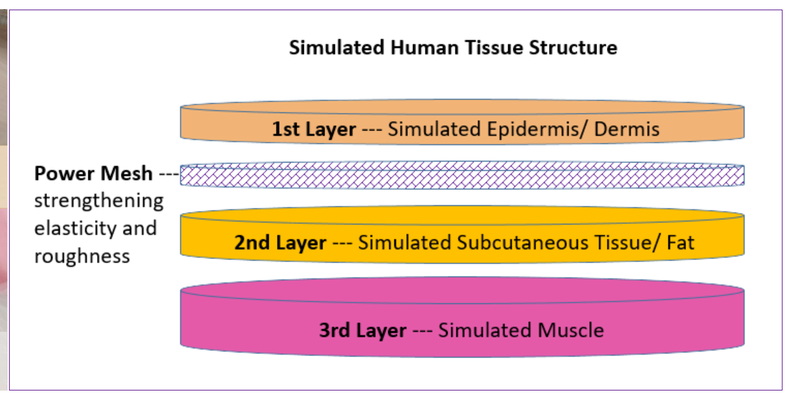
- showcase how simulation operations specialist makes use of innovative mind and technique for simulation training tool development in the preparation phase
- evaluate training effectiveness in cost benefits based on stakeholder feedback and comparative advantage of innovative approach and its application in surgical skills training

Methods

The entire fabrication procedures of simulated skin, either in simple slice or in thigh shape, require approximately 10 hours. Simulation operations specialist starts with mixing two-component silicone gels (Part A & B) on 1:1 ratio. Before casting mold, degassing process with stainless steel vacuum chamber which minimizes bubbles could ensure smooth suturing practice and good visualization of ultra-sound imagines. Then, pouring all thoroughly mixed and degassed silicone materials with a piece of power mesh fabric into a molding container results in elapse of 4-hour curing time under normal temperature and pressure. Two extra layers of silicone materials will be molded in addition to “the epidermis/ dermis layer” (in pale orange) to produce the underlying layer of subcutaneous fat (in yellow) and muscle (in pink) in 6 more hours. It is ready for training once the simulated skin has been fixated on a wood board or part-task trainer.


Power mesh for molding within silicone materials

3-layered simulated skin piece




Pouring mixture of silicone materials into container


Stainless steel vacuum chamber for degassing


Thigh part
+ 2 Simulated skin pieces (1 sutured)

Results & Discussion

The new simulated skin was implemented in 3 training courses attended by 82 frontline healthcare professionals (60 doctors and 22 nurses) in Hospital Authority from 15 Jun 2020 to 29 Jun 2021. Except 1 scenario-based simulation of critical care cardiology, no on-site technical support is needed for suturing and Cricothyroidotomy training. Through naturalistic observation and course review, we acknowledged comparative advantages in applying new simulated skin proven by positive feedback from participants, instructors, and administrators.

Training Course Applies Newly Invented Stimulated Skin (Jun 2020 – Jun 2021)

Department/ Specialty	Doctor	Nurse	Total
A&E	5	10	15
Anaes/ ICU	9	6	15
CTS	2	3	5
MED/ CCU	2	3	5
O&T	4	/	4
SURG/ NS	38	/	38
Total	60	22	82

1) Advanced Surgical Trauma Course
2) Orientation Education Program: Surgical Skill, Tube and Drain
3) Critical Care Cardiology Course

Participants and instructors felt satisfied with haptic sensation of the new skin and procedural fidelity in steps of wound closure and knot tying. Simulation operations specialist explained that this new invention set apart from market available products by its: i) compatibility, applicable on any 3D-printed model, part-task trainer or manikin without any stains on removal, ii) flexibility, producible in whatever shape, contour, size, or thickness to fit for different training objectives, and iii) safety, non-hazardous to human health (skin safe) and environment (biodegradable).

Detailed Material Costing

Materials	Specifications	Unit Cost (HKD)	Remarks
Liquid Silicone Rubber (for Molding)	1.2 Liters/ Can (A&B Parts)	$4,000	Production amount of 1 unit - produce 10 thigh parts (non-reusable) - or produce 30 pieces of skin (wear-and-tear in theory; probably reusable for few times repaired by technicians)
Power Mesh Fabric	Lightweight, soft in texture with a four-way stretch; 5 yards x 60 inches	$400	- for 20 thigh parts - or for 40 pieces of skin

Simulated Skin
- Cost of each pieces of skin for suturing/ surgical airway training = 4000/30 + 400/40 = HKD 143
- Market available simulated suture set = HKD 200 (suture pad alone, or HKD 750 + practice kits)
- Absolute cost saved per participant = (200 – 143) = HKD 57

Simulated Thigh Part
- Cost of each thigh part for critical care cardiology = 4000/10 + 400/20 = HKD 420
- Market available simulated silicone thigh part = HKD 500
- Absolute cost saved per participants = 500 – 420 = HKD 80

In addition, center management found it superior than commercial product as to monetary cost: Training material cost has decreased up to 30%. Stepping forward to expand use of stimulated skin on curved surface (e.g., pasted on skull during trauma scenario) or in hybrid mode (e.g., combined with standardized patients for both psychomotor and affective domains) would be the next move for sustainable quality enhancement in simulation training.