Design and fabrication of synthetic, silicone-based tissue and organ models for surgical simulations

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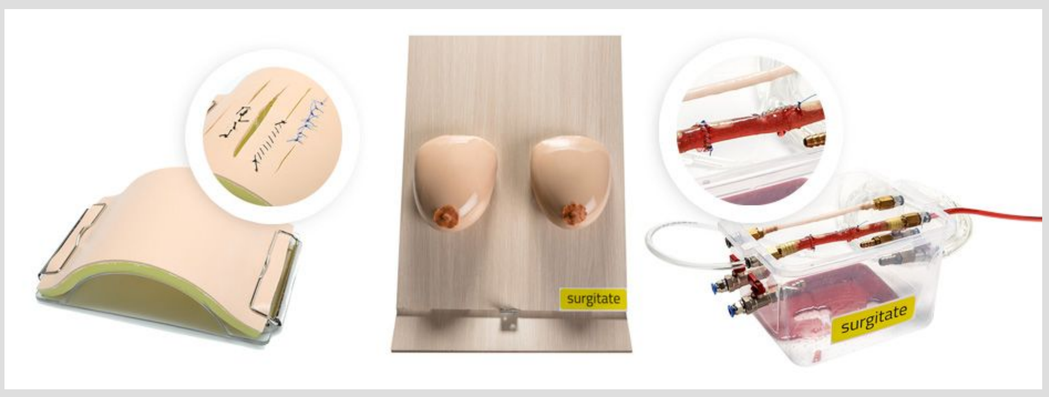
Abstract

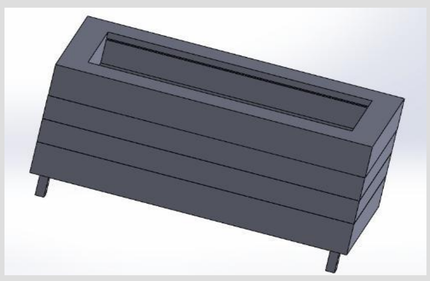


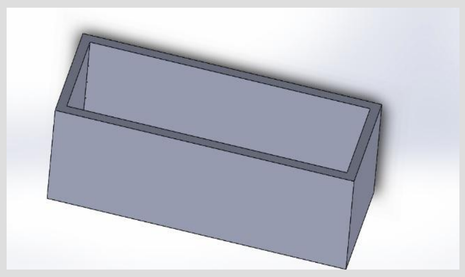
SKIN MODELS BREAST MODELS VASCULAR MODELS

Due to the lack of cadavers and fresh tissue/organ models, there is a need for a sustainable, reliable, and cost-effective platform for surgical simulations.

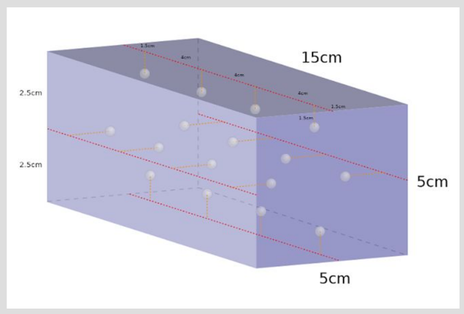
This project is doing in collaboration with National Center for Tumor Diseases (NTC). They use pre-operative organ models to find the target in surgical navigation. If the tissue is a soft tissue, models need to be adapted and deformed to the current situation. Therefore, collaboration starts at that point; creating a liver phantom as a biomechanical model so experiments can easily conduct. Model is comprised of silicone and ceramic balls. This model will be exposed to some deformations and it will be looked in Computed Tomography.

Design Objectives



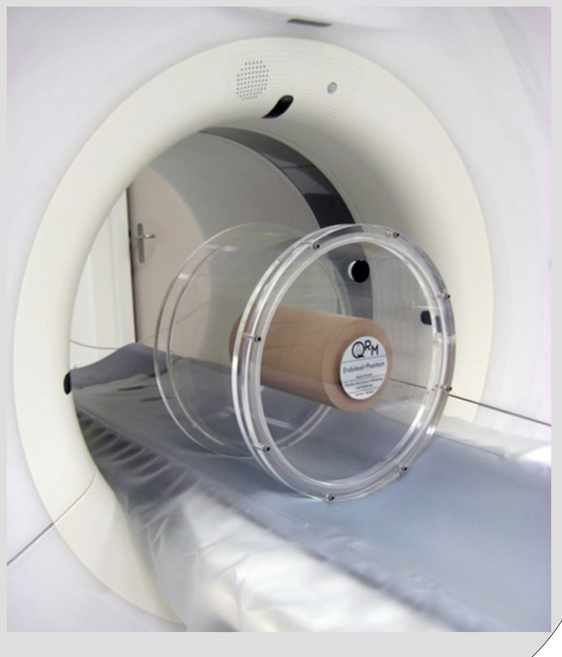


Silicone-based liver model
Five different sets of elasticity



Project Details

The silicone model will be subjected to mechanical testing and after that, deformations occur in model then will be looked at in CT scanner. Distance from the ceramic balls will be measured and used for liver tumor studies.



Experiment Details

-Silicone and silicone oil ratio for elasticity: 1-1-2/1-1-5
-Using tool for reach same dimension and pattern
-Our model's dimensions are 5x5x15 cm
-Tool comprise of 4 pieces- first and last one are 1.5 cm other ones 1 cm
-These pieces for different concentrations of silicones
-Pour silicone layer by layer
-Using ovens for speed up the process
-14G injector
-Injector for replacing ceramic balls to the right place

CONCLUSIONS

Benefits of using simulation in medicine:
-Referring artificial representation of real world process
-Aiding to replicate clinical scenarios
-Learning and appling high risk situations in surgery
-Allowing acquisition of clinical skills
-Allowing learn without fear of harming the patient because people can make mistakes
-Enhancing clinical competence
-Improving patient safety and reducing health care costs

This project allows to prove computer predictions in physically. This model will imitate the liver with tumors. Predictions of NTC will be tested with this liver model and afterwards it will use as a verification method.

REFERENCES

Al-Elq, A. (2010). Simulation-based medical teaching and learning. Journal of Family and Community Medicine,17(1), 35.
Pfeiffer, M., Riediger, C., Weitz, J., & Speidel, S. (2019). Learning soft tissue behavior of organs for surgical navigation with convolutional neural networks. International journal of computer assisted radiology and surgery, 14(7), 1147-1155.

NCT NATIONAL CENTER FOR TUMOR DISEASES PARTNER SITE DRESDEN UNIVERSITY CANCER CENTER UCC

surgitate
First Grade 'Imitated' Surgery