

PEDIATRIC CIRCUMCISION SIMULATION MODELA Simulation Model for Teaching Obstetrics Residents

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Abstract

Having a surgical simulation model allows residents to learn the steps and tissue dynamics involved with a procedure in a risk-free environment. The previous circumcision practice model used within the Augusta University Obstetrics Department did not realistically simulate the procedure. 3D modeling and printing were utilized to create molds which were then injected with

silicone. The resulting silicone circumcision model was found to have highly realistic tissue dynamics. Future residents within the obstetrics department will use the completed silicone model to practice circumcisions (Figure 1).



Figure 1

Introduction

Most obstetrics residents do not learn how to perform a circumcision ². One explanation for the 119% increase in revision circumcisions from 2004 –2009 is a drop in the quality of pediatric circumcisions ³. Surgical residents must have a way to practice circumcisions without doing so on live patients. Research has shown that practicing on cadavers has proved helpful in surgical situations ⁴. Cadavers, however, are expensive and the overall educational value can be equivalent to that of a simulation model ¹.

The purpose of this project was to create a newborn circumcision model that is easy to reproduce and use, and most importantly, has high fidelity tissue dynamics. The current model on the market does not have accurate tissue dynamics and is cost prohibitive for regular use in a training program.

Prior to the creation of this circumcision model, the obstetrics residents at Augusta University were practicing circumcision procedures on a low-fidelity model made from a Styrofoam cup covered with a balloon.

Materials & Methods

Penis Base

The first step to producing the simulator was the creation of a vector mockup, which included the correct dimensions of the penis and depth of the silicone base (Figure 2).

From the dimensions provided, the positive of the model was made in Cinema 4D then used with a boole to create the mold. Outflow channels were incorporated to allow air and extra silicone to escape. The lid to the mold was created in the same way and both pieces were equipped with registration marks so they would fit together precisely (Figure 3).

The mold was sprayed with mold release then filled with Smooth-On Dragon Skin FX Pro Silicone and allowed to cure for several hours. The cured silicone was gently pulled out of the mold and any extra silicone pieces were trimmed off. The silicone penis was then covered with a light dusting of cornstarch baby powder for a skin-like texture.

Foreskin

The mold for the foreskin was created in two parts. The 'canister' portion is slightly larger than the 'plug' portion, so when the cured silicone is pulled out, the foreskin has just the right amount of thickness (Figure 4).

The plug portion of the mold includes a tube-shaped recess along the bottom, which gives the silicone foreskin an inner band at the bottom. This helps to keep the foreskin adhered to the base of the penis.

After the cured silicone is removed from the mold, it is dusted with a light coating of cornstarch baby powder to allow the Gomco clamp to be applied without sticking to the silicone.



Figure 2



Figure 3



Figure 4

Results and Testing

The model was tested by an experienced obstetrics physician at Augusta University Health and was found to very closely represent the tissue dynamics of a newborn penis (Figure 5 - 7).

After using the model, the obstetrics physician felt that residents should be required to utilize the simulator and should be tested on how well they perform.







iaure 5

Figure 6

Figure 7

Future Considerations

The model will be utilized in the Augusta University
Obstetrics Department curriculum starting in June 2018.
A group of five students will be trained using traditional methods with the model and the rest of the class will be trained using just the traditional methods. Results of the experiment will be used to make any necessary changes to the model.

*Patent Pending

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