

Development of a 3D-Printed Testicular Cancer Model for Testicular Examination Education

Objective

To develop a set of 3D-printed models to facilitate teaching testicular examination and improving understanding of testicular malignancies amongst patients and medical learners.

Practice Points

1. Testicular cancer is the most commonly diagnosed malignancy in young males, it is highly amenable to treatment when caught at an early stage, with a five-year survival approaching 100% in patients diagnosed at stage I.
2. Testicular examination is a non-invasive and inexpensive means of detecting testicular cancer at an early stage.
3. 3D-printed technology allows for anatomically-accurate models to be made at a fraction of the cost of traditional models; thus, mitigating the financial barriers currently associated with testicular cancer education.

Methods

(PI: Drs. M. Organ, D. Harvey, R. Power)

1. A multidisciplinary team comprising urologists, engineers, and medical students used an iterative design process to develop a set of 3D-printed testicular cancer models.
2. Five models were developed, with each simulated scrotum containing either a) two healthy testicles, or b) one healthy testicle and one testicle with an endophytic lesion of varying size.
3. Once the set of testicular cancer models had been developed, two separate sessions were held to ascertain feedback from both clinicians and medical learners.

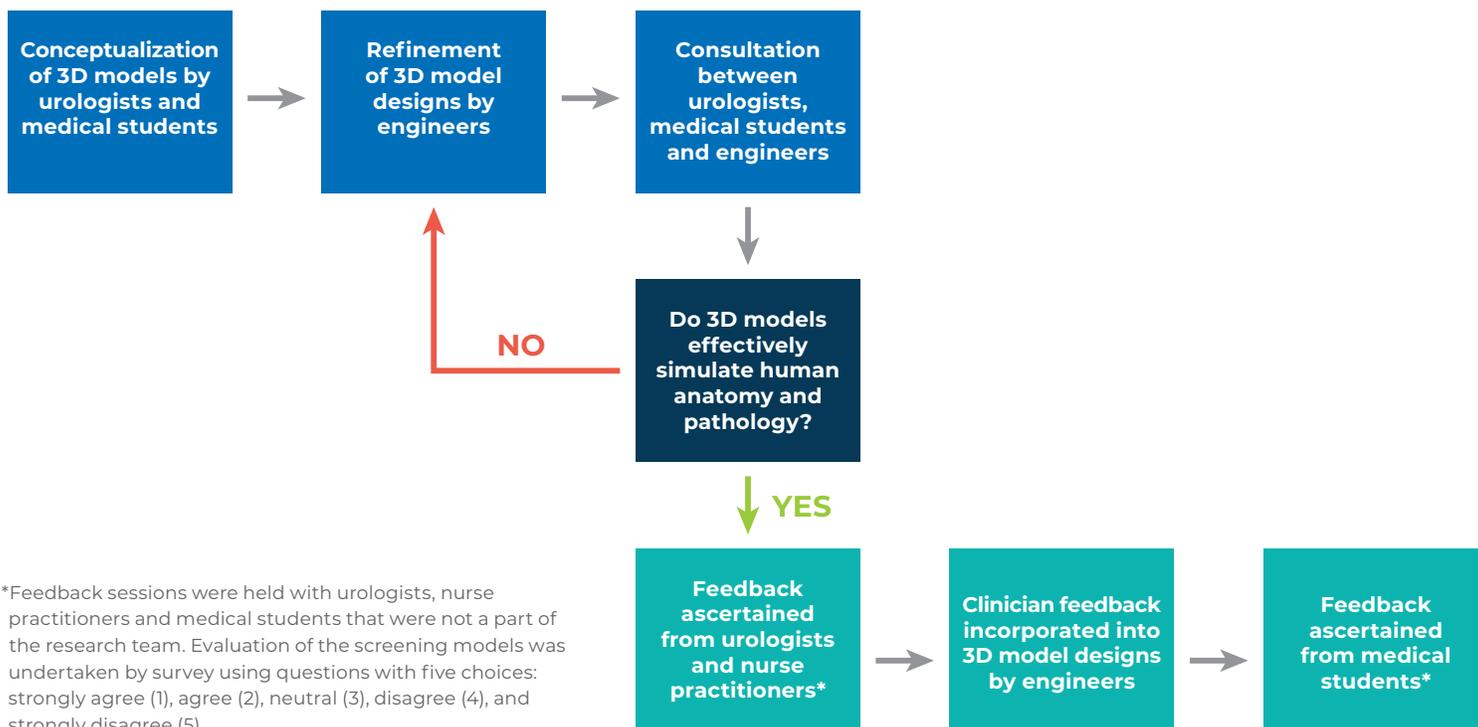


Figure 1. Iterative Design Process Used for the Design and Completion of the 3D-Printed Testicular Cancer Models

Results

- Clinicians reported that the models enabled accurate simulation of a testicular examination involving both healthy and pathologic testes (mean= 4.3 ± 1.0).
- Clinicians agreed that the models would be useful teaching tools for both medical learners (mean = 4.8 ± 0.5) and patients (mean = 4.8 ± 0.7).
- Following an educational session with the models, medical learners reported significant improvements in confidence and skill in performing a testicular examination.

Table 1. Results of Evaluation of Testicular Cancer Screening Models by Urologists (N=4) and Urology Nurse Practitioners (N=4)

Questions on model evaluation survey	Mean ± SD	% Agree	% Neutral
This model is anatomically accurate	4.5 ± 0.5	100	0
On palpation, the testical with no mass feels like an accurate representation of a healthy testicle	4.6 ± 0.5	100	0
On palpation, the simulated testicle pathology feels like an accurate representation of pathology required for further investigation	4.4 ± 0.5	100	0
This model allows for an accurate simulation of a testicular exam	4.3 ± 1.0	71.4	28.5
This model would be a useful teaching tool for patients who are learning testicular self-examination	4.8 ± 0.7	87.5	12.5
This model would be a useful teaching tool for medical learners who are learning testicular examination	4.8 ± 0.5	100	0
This model is an improvement over existing models for testicular cancer	4.6 ± 0.5	100	0

SD = Standard deviation.
7 of 8 answered questions 4 and 7

Table 2. Results of Evaluation of Testicular Cancer Screening Models by 32 First- and Second-Year Medical Students

Questions on model evaluation survey	Mean ± SD	% Agree	% Neutral	% Disagree
At the beginning of the session, I possessed the skills to perform a testicular examination	1.8 ± 0.9	6.3	12.5	81.3
At the end of the session, I possessed the skills to perform a testicular examination	4.2 ± 0.4	100	0	0
At the beginning of the session, I felt confident performing a testicular examination	1.6 ± 0.9	6.3	6.3	87.5
At the end of the session, I felt confident performing a testicular examination	3.9 ± 0.4	84.4	15.6	0
This model is anatomically accurate	4.4 ± 0.6	96.8	3.2	0
This model allows for an accurate simulation of a testicular exam	4.3 ± 0.5	96.7	3.3	0
This model would be a useful teaching tool for patients who are learning testicular self-examination	4.7 ± 0.5	100	0	0
This model would be a useful teaching tool for medical learners who are learning testicular examination	4.8 ± 0.4	100	0	0
This model would be a useful addition to existing urology curriculum	4.7 ± 0.4	100	0	0

31 answered questions 5, and 30 answered questions 6 and 9

Conclusions

1. 3D-printed models can effectively simulate palpation of both healthy and pathologic testes.
2. The developed models have the potential to be a useful adjunct in teaching testicular examination and in demonstrating abnormal findings that require further investigation.