



Preliminary results of EuroSOMT Erasmus+ Higher Education Partnership project :

Comparison of the 3D printing data of male and female pelvic models

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# ABSTRACT

A lack of standardized training curriculum and appropriate simulators in functional urological and uro-gynecological surgery is a fact. Possible reasons of this limitation are increasing complexity in surgeries with complex pelvic anatomy, high cost in simulators on market, lack of standardized training curriculum neither during residency and fellowship period, simulationbased standard fundamental functional urological surgery training modules. EuroSOMT ERASMUS+ project aimed to create simulators which are produced with using 3D printing and virtual reality technology via consensus of project outcomes and experts' view from EuroSOMT Working Group of ICS Institute School of Modern Technology, ICS Standardization Committee. In this study, we presented the first preliminary results of male / female 3Dprinted physical simulators in terms of technical properties, we compared the details of the printing processes of 3D physical simulators to be used in the training of sling surgeries in female and male.

## RESULTS

Production time, resin type and quantities of 3D printed male and female physical simulators are shown in Figure 1. Anterior, posterior and inferior(perineal) aspect of the male (upper row) and female(lower row) pelvic models can be seen respectively in Figure2.

Approximately the same time (300 hours) was spent for models of both male and female. Since the skeleton of the male model was larger, approximately 1.5 times more white resin was used. It is more difficult to segment and model the soft tissues and organs (eg. vagina) of the female model from radiological images and also print it successfully. However, before 3D printing, for each model, we determined exact anatomic structures which were important for male and female functional urologic surgeries. With this regard, we decided to make 3D modeling and segmentation in terms of bone, muscle, ligaments and organs. Following the separate production of the structures, post-process period was achieved to implement the anatomic models to physical surgical simulators. However, the models were prepared as a useful properties to do endoscopic examination and surgery as well.

**Figure1:** Production time, resin type and quantities of 3D printed male and female physical simulators.

					T OUT D			D	
1	Name Of The Part		Production Tim	ne in Printer	Type Of The Resin	A	mount Of Resin(mL)	Print Status	
2	female pelvic bone ri	ight 1		18 hours	White V4		150	Failure	
3	female pelvic bone ri	ight 1	17 hours	s and 56 minutes	White V4		142	Success	
4	female pelvic bone ri	ight 2	14 hours	s and 44 minutes	White V4		93	Success	
5	female pelvic bone ri	ight 3	13 hours	s and 18 minutes	White V4		89	Success	
6	female pelvic bone ri	ight 4	14 hours	s and 11 minutes	White V4		108	Success	
7	female pelvic bone I	eft 1	21 hours	s and 38 minutes	White V4		179	Success	
8	female pelvic bone I	eft 2	17 hours	s and 36 minutes	White V4		119	Success	
9	female pelvic bone I	eft 3	12 hours	s and 50 minutes	White V4		96	Success	
10	female pelvic bone I	eft 4	11 hours	and 32 minutes	White V4		87	Success	
11	Female Bladder		21 hours and 8 minutes		Elastic 50A V1		143	Success	
12	Female Rectum		14 hours and 46 minutes		Elastic 50A V1		51	Success	
13	Uterus		23 hours and 14 minutes		Elastic 50A V1		137	Failure	
14	Literus		20 hours and 56 minutes		Elastic 50A V1		123	Failure	
15	Vacina		20 nours and 56 minutes		Elastic 50A V1		101	Success	
16	Vagina		13 nours and 35 minutes		Elastic 50A V1		110	Success	
10	Uterus		47.5.	send 04 minutes	Elastic SUA V	4	110	Success	
1/	Female Rectum-rep	print	17 hours	s and 21 minutes	Elastic 50A V	1	51	Success	
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24 25 26 A1 1 2	Male Pelvic Mo	odel - e Part Production	Female Pel B Time in Printer 18 hours	C Type Of The Resin White V4	D Amount Of Resin(mL) 170	E Print Status Failure	F	G Muscles Anal Sphincter	
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## METHODS

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The steps of preparation of simulation-based training modules and curriculum in the scope of EuroSOMT project are; production of patient-specific CT-reconstructed 3D printed models with using patient/cadaver radiologic data, creation of VR/AR models with using the same 3D modeling scans, establishment appropriate syllabus and preparation evaluation documents, assessment of skills (technical and cognitive) in learning-training and teaching activities (3 times in a year), preparation of e-learning videos. We determined totally 17 surgical procedures (10 female, 7 male), enrolled to the curriculum for preparation procedure-based simulators. For each procedure, standard steps were determined in the curriculum. 3D printing technology was used for physical, virtual reality technology was used for non-physical simulators. All anatomical models will be provided by real-patient CT or MRI radiologic images, 3D reconstructed with using Mimics software and 3-matic.

We used following steps for the reconstruction and 3D printing of the customized anatomical models. First the extraction of CT or MRI data, from patients or cadavers, with a medical imaging device and generating the DICOM files from them with MIMICS software, secondly masking the area of interest and extracting the .STL files of the 3D models with MIMICS and 3D surface rendering, and texturing for the realistic human and surgery tool model with 3DS MAX and Z-Brush and finally printing them with FormLabs2 3D printer. We used white and elastic resin for skeleton and soft tissue and organs respectively (1,2). For 3D printing process, we used streolithography method in which laser printing modality used. The 3D printer brand was FormLabs 2 Bio.

**Figure2:** Anterior, posterior and inferior(perineal) aspect of the male (upper row) and female(lower row) pelvic models respectively



## CONCLUSIONS

If a personalized model is to be produced in functional urology, the beginning processes should be made in this way and the type and amount of material should be determined by considering the anatomical differences between male and female.

3D printhed models are useful and promiding modality for teaching process for residents and young urologists in terms of complexity of functional urologic surgeries.

Anatomic comparison shoud be take into account between male and female 3D printed models before start creation the physical simulator.



## REFERENCES

Tatar I, Huri E, Selçuk I, Moon YL, Paoluzzi A, Skolarikos A. Review of the effect of 3D medical printing and virtual reality on urology training with 'MedTRain3DModsim' Erasmus + European Union Project. Turk J Med Sci. 2019 Oct 24;49(5):1257-1270. doi: 10.3906/sag-1905-73. PMID: 31648427; PMCID: PMC7018298.

Tatar I, Selçuk I, Huri E. Evaluation of a 3d printed female anatomical model for the hands on training of trans-obturator tape (TOT) and tension free vaginal tape (TVT) sling procedures. Int J Morphol. 2020 38(2): 292-298 doi: 10.4067/S0717-95022020000200292

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