183

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DEVELOPMENT OF A TUTORIAL TYPE SOFTWARE BASED ON SCANNED PHYSICAL SYNTHETIC FEMALE PELVIC FLOOR

Hypothesis / aims of study

The bone pelvis, the pelvic floor and pelvic fascias are one of the most complex structures of the human body. This relatively small space also contains many organ systems, and selected structures are observable only by special dissections that sacrifice other structures [1]. Inevitably, the study of the female pelvic floor anatomy comes up against the difficulty of learning. We hypothesized that a schematic synthetic physical model over-expressing those structures should be a useful and meaningful tool for visualization and manipulation of the anatomical elements being this model in the virtual environment. The goal of this study was to build a tutorial type software of the female pelvic floor anatomy utilizing data from the three-dimensional laser scanning of a synthetic physical model made of resin.

Study design, materials and methods

This is a descriptive correlational research, preceding experimental study. A physical synthetic model (named MARAP) was handmade of rigid and opaque resin, after literature review and also based on the previous research of a synthetic physical model [2]. The following anatomic elements were emphasized: the Anterior and Posterior fascia, the tendinous arch of Levator ani (Pubovisceralis) muscle, tendinous arch of the Anterior and Posterior fascias, Pericervical ring, Cardinals and Uterossacral ligaments.

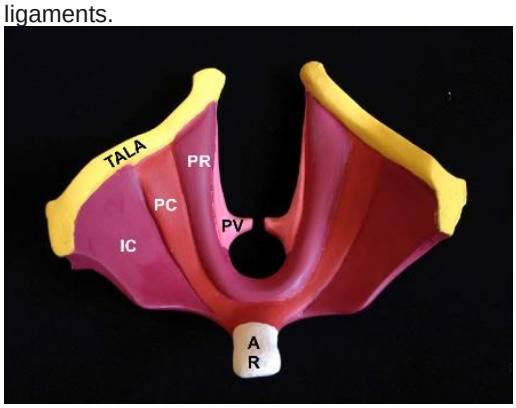

Fig 1. Segment of the MARAP synthetic physical model: a schematic model of the Levator ani (Pubovisceralis) muscle with emphasized beams: Pubovaginalis (PV), Puborectalis (PR), Pubococcygeus (PC) and Iliococcygeus (IC); Anococcygeal raphe (AR); tendinous arch of the Levator ani (TALA).

Twenty-five anatomical parts of the MARAP synthetic physical model were submitted to the SMARTSCAN 3D scanner – BREUCKMANN. The files generated by the laser scanner were compatible with the computer Computer-Aided Engineering - CAE and Computer-Aided Manufactoring - CAM systems. These systems enabled the manipulation of three-dimensional images and files with ".PLY" and ".STL" extensions, allowing corrections and improvements of the anatomical structures in the virtual environment. A three-dimensional viewer software was constructed based on the manipulative perspective that allowed a multi-angle view of all anatomical elements expressed in this virtual model.

Results

The software provided a multi-angle view of the model, presenting it in a consistent and comprehensible mode, which is difficult to do utilizing other means. It presented the possibility of manipulation and assembling of the anatomic elements in several axes, with optional transparences.

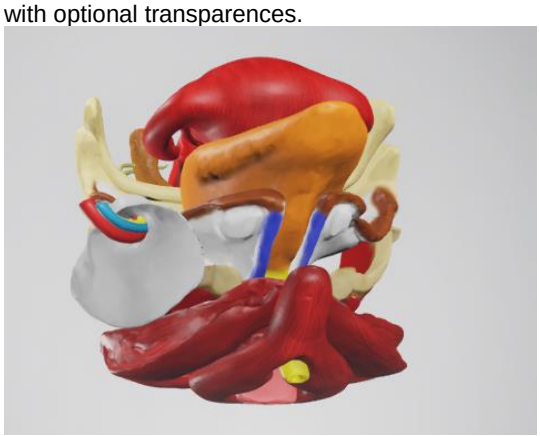

Fig 2. A right anterolateral perspective view of the virtual MARAP model, extracted from the software.

Interpretation of results

Anatomical models are important educational tools in institutions or settings that are unable to support the space, costs, or regulatory requirements required for cadaveric dissection or specimen storage. For these reasons, anatomy education will always benefit from a finely constructed three-dimensional model [3]. The fact that the base model MARAP was made schematically in resin, made it possible to transfer important anatomical characteristics to the virtual environment. Since the cloud of dots generated in the digital laser scanning could be translated into high quality three-dimensional image, we obtained the presentation of an expressive mesh, textured in a schematic mode. Emphasis was applied on the expression of anatomical structures which are often difficult to understand. Although these structures were thickened for better visualization in the base model, they were also presented as attenuated staining in the virtual model, compensating for the increased thickness.

Concluding message

We believe that this software will possibly be a useful tool to implement some alternative for the study of this complex anatomical segment of the human body. We intend to continue researching on this subject, submitting this software to a practical application, comparing it with other didactic tools, in order to estimate its didactic potential. New studies and approaches for anatomical structures recognition in the female pelvic floor should be developed and also encouraged.

References

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