

Application method of the virtual dissection system for health-care related students

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Abstract— Human anatomy is a study that explores the form and structure of the human body and is the basic subject of health students. However, except for medical students, the practice of the medical students through the cadavers is very difficult in reality. In other words, the body for anatomy can not be practiced alone in the school by the law on the dissection and preservation of the body as well as the problem of very few donors. To overcome these limitations, various anatomy and human body information contents using digital technologies such as web-based or stand-alone software are being developed and utilized. The Anatomage table, a virtual anatomy system, provides an environment in which real-sized 3D human images are dissected by various touch interactions without anatomy bodies. In addition to the anatomy content provided in the textbooks, students can conduct virtual anatomy exercises on the characteristics of the human body that they are interested in through the Anatomy table. This paper introduces the important features of the anatomy practice of the health-care related students at the Anatomy table and also introduces the self-directed anatomy learning application cases.

Keywords— Health-care related students, Virtual dissection system, Gross anatomy, Anatomy Education, Digital human

I. INTRODUCTION

Human anatomy is an area of morphology that explores the normal shape and structure of the human body. In general, human anatomy can be divided into gross anatomy, which studies structures identified by the naked eye, and microscopic anatomy, which studies the distinct structure of the human body using a microscope. In particular, visual anatomy can be divided into systematic anatomy, which studies the human body by system according to the approach, and regional anatomy, which studies the composition of the human body according to the site [1]. Most of the medical students study human anatomy with a local anatomical approach, but most of the students in the Department of Radiology, Clinical Pathology, Physical Therapy, Occupational Therapy, Dental Hygiene, and Dental Engineering, which are nursing departments and medical technician training departments, learn most of human anatomy.

Human anatomy education can learn the exact structure and function of the human body by providing practical training opportunities through Cadaver, an anatomical body. Existing studies have shown that practical training through cadavers is helpful in learning anatomy [2]. However, with the difficulty of securing cadavers, the practice of human anatomy by the Act on the Dissection and Conservation of Cadavers is practically very difficult to carry out in health colleges except for most medical schools [3]. It takes a lot of money to build a professional laboratory and manage cadavers, and moreover, a lot of preliminary training time is

needed for pre-training to make the students of the health department who are new to anatomy perform the anatomy directly.

Anatomage table, a virtual dissection system, provides an environment in which a real-life 3D human image is dissected by interaction through various touch methods without a body for dissection [4-6]. Currently, it is deployed in about 500 healthcare universities around the world, and the human body can be freely dissected, and the actual internal form can be seen. In addition to the anatomical contents provided in the textbooks, students can also perform virtual anatomy exercises on the human characteristics of their interest through the Anatomage Table. In this paper, we introduce the important features necessary for the anatomy practice of Anatomage Table, a virtual anatomy system, and introduce the self-directed anatomical learning applications of health students.

II. SUBJECTS AND METHODS

A. Virtual dissection system

The virtual dissection system introduced in this paper is Anatomage Table of Anatomage Co., Ltd. The anatomy table in Figure 1 is a digitized 3D human anatomy system that enables visualization of the same anatomical form as Cadaver. A table in the form of an operating table and a life-size touch screen are provided to enable a virtual experience of performing actual anatomy through interaction. The Anatomage Table provides a full body model and a high-resolution partial model of a male and a female as shown in figure 1. The full body model displayed on the touch screen can variously change a display method using a keyboard, a mouse, and a finger. The anatomy table has various functions such as digital anatomy projection library, more than 20 high-resolution partial cases, and animal cases. However, many functions such as clinical pathology cases and individual vascular structure tracking are functions for medical school student practice. In this paper, we will introduce only important functions for undergraduate students in the health department.

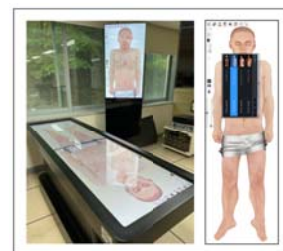


Fig. 1. Virtual dissection system

B. Specific cross-section (mesbutton) settings

As shown in Figure 2, you can set a specific cross-section by pressing a button in the form of a scalpel. If the line is drawn across the human model image with keeping this after touching the arbitrary spot within the human model of the image display window after the shape button being pressed and activating, the specific section is instituted. Especially, if you touch the human body model located on one side based on the selected cross section, you can observe the visual anatomical image that the cross-section setting is completed.

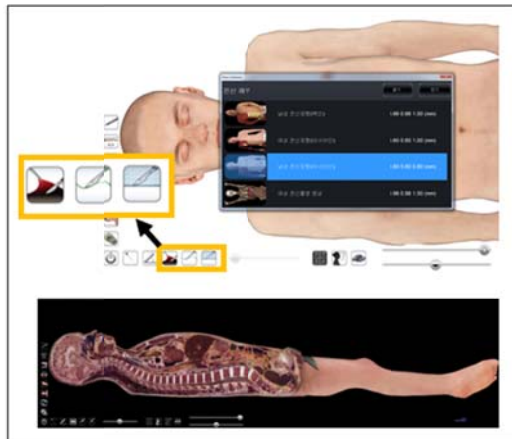


Fig. 2. Custom Clipping Plane Mode

C. Search tool and image adjustment button

It uses to confirm the fixed human body image through the specific section etc. The structure name of the part which is touched by using the search tool like Figure 3 can be confirmed. In particular, the selected structure is highlighted, and the remaining part is translucent, so that anatomical terms can be learned through the name of the structure.



Fig. 3. Exploration Tool and Visibility Control

III. RESULTS

In the human anatomy and practice hours of health students, my own anatomical learning method using the virtual anatomy table. This led to self-directed learning on human subjects of interest selected by students themselves, rather than the typical anatomical contents provided in anatomy textbooks. As shown in Figure 4, students selected and practiced various topics according to their interest in the human body. Students often explore topics related to their real life, such as musculoskeletal used in exercises such as yoga and Pilates, muscles used to play musical instruments, and the effects on the human body on smoking and high

heels. Here are some excellent examples of self-directed learning:



Fig. 4. Individual practice using Anatomage table

The digestive system collectively refers to a group of organs that perform ingestion, digestion, and absorption of food. The digestive system is composed of a digestive tract, which is a place where food passes through and is absorbed, and a digestive gland that secretes enzymes that help digestion. As the food enters, there are many lesions and many lesions in the stenosis and flexion areas are often found. In traditional anatomical textbooks, only the stenosis site is mentioned, but it is rarely provided for the anatomical content. However, using the anatomy table, we visualized the typical physiological stenosis sites, the Cricoid Cartilage (C6) region, the Aortic knob (T4), and the Diaphragm T11. In particular, as shown in Figure 5, the cause of stenosis was visualized through the curvature of Holzknacht Space in the esophagus.

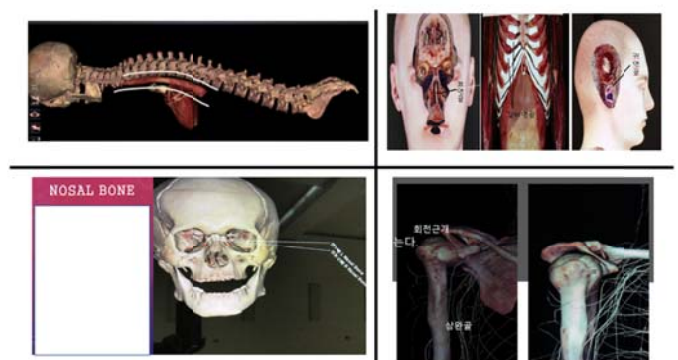


Fig. 5. A good story for anatomy practice

IV. DISCUSSION

In this paper, we introduce the important functions and characteristics of the anatomy table for the anatomy practice of the health department and introduce the self-directed anatomical learning application of the health department students using the anatomy table. If the specific section establishment of the Anatomage Table, and the search tool and image control button are utilized, the cross section which is typical or non-typical is visualized to the naked eye anatomical. In other words, various cross-sectional anatomical contents that were not provided in the existing anatomical textbooks can be generated through the anatomy

table. As shown in Figure 5, it has been shown that customized anatomical practices for students' interest in human subjects are possible through the Anatomy Table. In addition, through the selection of a specific cross-section, it is possible to more clearly identify important organs and organizations in the cross-section.

The typical visualization method of human anatomy is visualization through the process of medical illustration, but it takes a long time to increase the time and cost, especially to be reflected in the anatomy textbook. Anatomage tables have the advantage of being able to visualize desired cross-sections and institutions in real time in the educational field without any complicated process. In addition, in the illustration process of the anatomy textbook, the organs and tissues of the area are not visualized but are selectively visualized according to their importance. These illustrations may lack anatomical information when it is necessary to grasp the composition of the body according to the site and the relationship between each organ and tissue. On the other hand, when using anatomy, it is possible to visualize the contents necessary for systematic anatomy and local anatomy.

Therefore, the development of virtual anatomy practice system such as anatomy table will ultimately provide an environment like practice through actual cadavers, which will not only be helpful for anatomical subject learning but also provide a customized anatomy practice environment for students. In addition, it is expected that this will contribute greatly to the improvement of understanding of professional basic medicine of health students.

V. REFERENCES

- [1] S. David, J. Butler, and R. Lewis. "Hole's essentials of human anatomy & physiology", McGraw-Hill Education, New York, Jan. 2015.
- [2] G. John A., et al. "Human Anatomy, Color Atlas and Textbook E-Book", Elsevier Health Sciences, Feb. 2016.
- [3] J. T. Bushberg, and J. M. Boone. "The essential physics of medical imaging". Lippincott Williams & Wilkins, Nov. 2011.
- [4] P. Daniel, et al. "'Let's get physical': advantages of a physical model over 3D computer models and textbooks in learning imaging anatomy." *Anatomical sciences education* Vol. 6, No. 4 pp 216-224. Jan. 2013.
- [5] T. Custer, and K. Michael. "The utilization of the anatomage virtual dissection table in the education of imaging science students." *Journal of Tomography & Simulation* Vo. 1, No. 1 pp. 1-5 Sep. 2015.
- [6] H. M. Cho, et al. "Visualization of Gross Anatomy for Ultrasound Scanning Planes Using a Virtual Dissection Table." *International Journal of Morphology* pp.7-10, Vo. 39, No. 1, Jan. 2021.