

## Review Article

# Impact of COVID-19 on the future of cadaveric dissection and anatomy teaching

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### ABSTRACT

The COVID 19 pandemic has left a major impact on medical education globally. We are undergoing crisis for humanity with this virus causing extensive damage to life and its aspects. Hence, we do not know how this will unfold in upcoming year. All the academic classes are suspended during nationwide lockdown to ease the propagation. It is high time to rethink ways to deliver quality medical education under restriction of social distancing in real time teachings and discussions. We propose based upon our experiences, replacement of anatomy dissection with virtual dissection and its implications. It has its own challenges which could overcome with the planned directives based upon current experience.

**Keywords:** Dissection, Prosected, Plastinated, Anatomage

### INTRODUCTION

It is primary rule to have a thorough understanding of human anatomy to become a medical professional. Different methods to teach human gross anatomy in the first-year curriculum include cadaveric dissection, drawing/showing pictures and animations, osteology, prosected specimens, embryology models, plastinated specimens and radiographs; and living or surface anatomy through mummified bodies. Illustration of bones, muscles, vessels, nerves, organs and other different types of tissues in the body in the textbooks and atlas helps the students to understand and correlate the knowledge they have obtained in the classrooms and dissection labs. Besides these usual methods, evolution in the technologies in the recent years has introduced modern ways to learn/teach anatomy, such as animations and live dissection videos with elaborative commentary or subtitles along with them, and relatively still newer techniques which allow cadaver less dissection with the help of Anatomage Virtual Dissection Table (AT).



**Figure 1: Anatomage virtual dissection table.**

It is dynamically suggested that students learn anatomy using dissection, which provides hands-on experience with three-dimensional (3D) view of complex anatomical structures and its relationships, which would provide the basis for understanding clinical problems along with its pathology. We regret that many medical schools reduced investment in effective anatomy education by reducing teaching hours, faculty and demonstrator recruitment and abolishing cadaveric dissection from the curriculum.<sup>1,2</sup>

## REVIEW OF LITERATURE

At present anatomists are increasingly using innovative, engaging and creative approaches to demonstrate anatomy.<sup>2,3</sup>

The analysis was performed on students who enrolled for anatomy course. They were divided into two groups in which students in the cadaver dissection and model groups scored higher than those in the virtual dissection group in anatomy, and students preferred cadaver dissection over virtual dissection. In spite of numerous teaching methods, 69% of anatomists and 90% of students favor cadaveric dissections over other teaching tools.<sup>4</sup>

When the subjects were asked about their interest in actual performance of dissection, only one fifth of them said that they like to visualize the dissection rather than actually performing it, and majority of them (more than 80%) said that they are in favor of dissection. Contradictory, when they were asked about the behavior of the students surrounding them in the dissection hall, as high as 70 percent recorded their observation as most of the students preferred to watch the dissection and very few of them were enthusiastic about doing the dissection themselves. Thus, it was surprising and interesting that almost 80 percent of them said they preferred to actually dissect rather than just watch; 70 percent expressed that most of their colleagues preferred watching the dissection rather than actually doing it.<sup>5</sup>

The most of students (71%) consider the cadaveric dissection experience to be more useful than the virtual dissection experience (47%) in developing 3-dimensional view of anatomy. However more students (64%) perceived the virtual experience as useful in developing an independent approach to learning as the real experience (51%). This difference is to be expected as students work in peer groups of 4-5 for the real dissection, whilst the majority of students (78%) reported using the virtual dissection materials alone.<sup>6</sup>

## DURING COVID-19

'COVID-19 has changed the world. Academics and the roles of faculty, administrators and students will also change'.

The COVID-19 pandemic was declared in the mid-March 2020; numerous universities decided to suspend teaching to protect staffs and students from ongoing battle of corona virus. During this tumultuous situation there was a teaching break off, academic staff actively rebuild and renovate resources, upgraded digital competencies and developed new stuffs to shift from one on one and merged to remote online teaching, and anatomy teaching was transformed to an abrupt 'virtual mode'.<sup>7,8</sup>

With various resources for human anatomy education during pandemic, academicians are having relevant question is:

Can we modify innovative teaching methods to teach anatomy face to face or remotely during this unique time and change the perception of anatomy, as mentioned, 'from a mnemonic and tedious subject to an engaging and engrossing one'?

Does cadaveric dissection necessary for medical students during this pandemic? Any alternative methods sufficiently provide necessary knowledge of gross anatomy? Could the conventional hands-on cadaveric dissection be restored with substitute methods like Anatomage Table?

With all the above questions finally, since last year most of the medical schools have switched for Virtual learning and things are working well. Most of them have benefited by this because we have to move on with whatever comes on our way. However, despite the increased use of technology-enhanced learning (TEL) options, during the current pandemic, one on one teaching is still preferred as the "most relevant method to ensure student success" in teaching anatomy. Most of the faculties worked day and night, challenges like crucial timelines and an arduous workload, adjusting to work from home with simultaneous tasks of child-care and home schooling.<sup>7,8</sup>

During regular lab sessions like osteology, prosected specimens, embryology models and histological slides cannot be utilized in this pandemic; hence, every anatomist feels exhort to unlock technology in the delivery of quality education. Indeed, virtual anatomy teaching made it difficult for the students to grasp and visualize the spatial orientation and neurovascular relationships.<sup>8,9</sup>

Role of professor's setback from small one on one group teaching to online versions and streaming small-group teaching sessions via streaming platforms. IT staff are also upgrading into new skills, trying for new software to fulfill the needs of students.<sup>10</sup>

## POSSIBILITIES AND CHALLENGES OF FACE-TO-FACE ANATOMY TEACHING

During this turbulent situation face-to-face teaching environment with social distancing inadequate exposure

to broader educational teaching techniques that are conventionally adopted by faculty and student teachers under normal circumstances. During regular classes professors could teach effectively with students' interaction, solving the doubts, especially those at risk of underperforming during small face-to-face group teaching sessions, which could easily go amiss during online sessions.<sup>11,12</sup>

A study performed by UK and Irish Universities on anatomy course delivery during COVID-19 reported that 14% of universities did not have a practical examination, 36% cancelled their assessment and 21% had online digital spotter examinations. The most of the faculties were concerned and invested lot of time in the development of new resources to replace lectures and practical's (57%), 36% of universities identified reduction in student involvement, while 21% showed concerns in regards to Professor-student relationship, 14% on assessments and 7% on temporary suspension of body donation programs and lack of technical support.<sup>12</sup>

However, majority of students were absent due to pandemic lockdown has caused stalling and postponement of study plans, impeding academic progress and student satisfaction, thus posing a challenge for academics.<sup>13</sup> The American Council of Academic Physical Therapy addresses the complications associated in classroom teaching with social distancing, laboratory considerations and resources to be considered for returning to in-person educational practices.<sup>14</sup>

With the confidence of anatomical understanding and several years of experience, students and teachers of anatomy which includes PGs and professors will be better prepared and confident enough to enter the employment market. During this pandemic there are no new openings for the faculties.<sup>15</sup>

At present we can be positive and make use of available cadavers to maximize educational benefits by the dissecting the cadavers, preparing prosected specimens and creating image libraries for short education courses as well as spotter assessments. This can facilitate the faculty to allow interested students to complete their dissections in the new academic year in a safe environment.<sup>15</sup> Dissecting the cadavers are the first patients of clinicians; due to absence of cadaveric experience deprives them from the emotional experience of working with cadavers, lack of hands-on experience, and empathy, communication and teamwork skills, clinical skill building in surgery residents and also devoid of appreciation of anatomical variations.<sup>16,17</sup>

#### **CONFLICTS ON APPLICATION OF HANDS-ON AND VIRTUAL DISSECTIONS**

It is very common for debates that ethical issues dominate but learning outcomes of different variants of dissection used in teaching anatomy are usually not

considered. If we consider only key anatomical knowledge, then according to the recent studies, differences between hands-on and virtual variants of dissection, are minimal or are even it favors virtual or it might be alternative that both variants are of equal value.<sup>18-20</sup>

Due to several studies, when accounting for multiple benefits of hands-on dissection it can be recognized that hands-on dissection should be favored method in medical education.<sup>19,21,22</sup> It is proposed that society opinions and associated students' attitudes to a substitute of hands-on dissection will slowly change; resulting in decrease in the frequency of hands-on dissection and replacement with various kind of dissection alternatives such as figures, models, dissection videos, animations, virtual dissection, etc.<sup>23,24</sup> However, it seems that such reduction, if happens, would not favor the preferences of a majority of students in some countries.

Alternatives that have currently the greatest potential to replace traditional hands-on dissection in schools are virtual ones in a range from multimedia presentations to interactive simulations.

The main appraisal in using virtual worlds goes toward levels of details and accuracy of representation of real specimens.<sup>25,26</sup> Students often feels the virtual dissection as a suitable teaching technique and also students who used the virtual dissection scored the same or better results because they better understood the theoretical nature relation.<sup>27</sup> And they were not forced to memorize their knowledge and they even had ample of time during online classes to study anatomy.<sup>28</sup>

Indeed, few researchers feels teaching anatomy using only virtual support of dissection activities leads to lower levels of understanding the human body in fact using a combination of virtual (electronic) and hands-on dissection.<sup>29,30</sup> The similar finding is reported in the one the study.<sup>31</sup>

#### **APPROACH TOWARDS HANDS-ON AND VIRTUAL DISSECTION AND INFLUENCE ON ITS EXECUTION**

Professors are the key mentors for introduction of instructional practices in a classroom. Results of studies on teachers' preferences toward hands-on and alternative methods of dissection are mixed, and reflects their personal attitudes, worldview, motivation, opinions of their students, school culture, syllabi, and available technology.

Students often feel hands-on dissection as difficult to be accepted during ongoing pandemic, perhaps, good for their education. One of the possible barriers in introduction of virtual dissections can be invisible in broader context of appropriateness and attitudes toward technology.

### ***Advantages of dissection***

The cadaver is known as “silent teacher” to medical students. A unique advantage of making use of cadavers is that dissection is often student’s first encounter with death, reminds the reality of disease and medical professionals cannot save anyone. Cadavers have the potential to teach students to respect their patient, even after death and gratitude to the generosity of the body donors and their families.

Students will not have early exposure to develop skills of handling basic surgical instruments and to develop manual deftness. Cadaveric dissections usually allow students to learn the skill of using a scalpel, various types of scissors and various types forceps (blunt forceps, toothed and pointed forceps).

Dissection helps students to identify structures along with tactual information on tissue texture, which provides tactile learning along with 3D visualization of anatomic structures.

Even students will also miss out on the opportunity to develop and enhance their teamwork skills. It often requires the effort of a team of students to dissect through cadaver.

### ***Advantages of virtual dissection***

Virtual dissection has some advantages over cadaveric dissections. The virtual dissection is operated by touch or styluses and provides life-size digital cadavers of male and female bodies, which can be rotated, magnified, labeled, and dissected with virtual scalpels. Students can isolate structures in three-dimensional form, dissect, reconstruct, magnify, and transect regions and structures to appreciate anatomical form and relationships.

Simultaneously they can reconstruct and save dissections is a unique feature that provides visualization and personalization to students anytime and they even can visualize these saved files when required. Unlike cadaveric dissection, virtual dissection allows the same structure or region to be dissected repeatedly and customized to the students’ specific needs. Structures are indestructible and safe from inexperienced dissection.

Students can perform virtual dissections with greater time-efficiency and more seamless than cadaveric dissections. Exposing structures on the AT requires a few touches to the screen. The faster and seamless virtual dissections allowed for more repetitions with the material and more time viewing the structures, rather than finding the structures.

Faculty and students familiarize themselves with the AT and its functions and capabilities with little effort. In this case experience, the learning curve was small, which faculty attributed to similar functionality between the AT,

smart phones and iPads. Conflicting evidence suggests that some students may have a greater learning curve for navigating the AT, as introducing new technology may increase students’ cognitive load.<sup>32</sup>

### ***Virtual dissection disadvantages***

There are few drawbacks in virtual dissection which prevents students from appreciating the feel and texture of specific anatomic organs, such as muscles, tendons, bones, heart, and lungs, which restricts the tactile form of learning.

Smooth and effective integration of technology into the classroom can be challenging. Faculty must be appropriately trained related to using the technology and incorporating technology into teaching, and if faculty is not provided this training, they will not be capable of using it to at the maximum. With the ongoing advancement and upgrades related virtual cadavers, this training needs to be ongoing. Faculty who are less fluent with technology, such as the AT, can face challenges by instructing digital natives in a digital environment.

It takes time to attend training and practice using virtual cadavers, causing some faculty to resist this change as to not add something to their already busy schedules. Like other technology, the AT is subject to technical difficulties, such as freezing, sluggish warm-up and shutdown periods, requirements for up-grades, and computer viruses. While these technical difficulties are minimal in our experience, and can easily be rectified, they do occur.

## **DISCUSSION**

There was tremendous importance of cadaveric dissection for learning anatomy in the ancient times, which obvious as there was no other method available to understand human anatomy those days. There is a long history of use of dead bodies to gain knowledge of anatomy. In ancient days cadaveric dissection was the only way to observe what is beneath the skin. Through dissection, medical students could study the size, shape, color, texture and spatial orientation of the body parts. So, learning human anatomy by cadaveric dissection is a traditional and time-proven method.

One must appreciate that whatever may be the method of learning, the educationists/professors are always more concerned about better understanding of human anatomy by the students. Some researchers have conducted studies in past to compare between cadaveric dissection and prosection as methods to understand and recall human anatomy, where they found a better/equal performance of the students and in addition they found the prosection to be time saving.

Instead of using a single method, application of different methodologies to understand a subject is a very common



thing. Perception of knowledge by an individual student is different according to his primary mental ability, and so such a combination of methodologies is helpful for majority of the students.

## CONCLUSION

Professors talk about the most effective way to teach anatomy. This case and literature review support the hypothesis that students can adequately learn anatomy by using different modalities and approaches. Educators and their institutions must determine the most effective anatomy education model while considering which educational methods best matches certain professions; for example, cadaveric dissection for surgeons and virtual dissection of imaging science students. Cost and time of various educational methods as well as the curricular models, regions-based versus systems-based, utilized by the institutions will be factors in which educational methods are most appropriate. No single teaching tool achieves all curriculum outcomes. The best way to teach anatomy may be combining multiple pedagogical resources to complement one another. Combination of cadaveric and virtual dissections seems to be a likely solution. Application of different strategies to understand a subject is common as blending of methodologies is beneficial for students.

Virtual dissections might enhance traditional cadaveric dissections to allow further inspection of anatomic structures, and application of anatomy to clinical context for health science clinical students. Visualization, a core strategy for learning human anatomy, allows students to link structures together in a three-dimensional manner, while respecting scale and function, for a deeper understanding. Combination of cadaveric and virtual dissection can fulfill their visualization.

The overwhelmed dissection table can retrospectively affect the interest and enthusiasm for dissecting and learning. The ideal student to cadaver ratio is 10:1.5. The valuable active learning of cadaveric and virtual dissection is enhanced by smaller student to cadaver ratios to allow more hands-on experience and self-discovery.

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