



Effectiveness of Exposure to Virtual Learning before Cadaveric Dissection to Study Anatomy for Students in Health Sciences at DMIMSU Wardha, Maharashtra

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Anatomage dissection table offers detailed and interactive anatomical images which complement the anatomy textbook and the cadaveric studies. In this regard, the study was carried out to assess the effectiveness of exposure to virtual learning on the Anatomage table before cadaveric dissection and to assess the perception of students about the virtual dissection.

Methods: A comparative cross-sectional study was conducted on 200 first phase medical students from Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Science, Sawangi, Meghe, Wardha. Study participants were divided into two groups, group A and group B. Group A performed dissection of the triangle of the neck on the Anatomage table before performing the traditional dissection of the same region while group B performed traditional only. Pre and post-tests were conducted for both group participants using a pre-validated questionnaire. 5 point Likert scale was used for obtaining feedback from study participants. The student's t-test was used for statistical analysis.

Results: Observation Post-test score in group A, exposed to virtual dissection prior to cadaveric dissection was 9.18 (Std = 0.84) as compared to the post-test score of 7.11 (Std = 7.01) in group B

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which was not exposed to the virtual dissection table. 144 (72 %) of students agreed that virtual dissection helps in better understanding of the complex relation of structure with each other and 152 (76 %) students feel that prior exposure to virtual dissection develops an interest in cadaveric dissection.

Conclusions: Exposure to virtual dissection before cadaveric dissection was very effective way to learn anatomy for students of first MBBS as students were used to enjoy learning anatomy when virtual dissection was complemented with used before real cadaveric dissection.

Keywords: Anatomage table; virtual learning; cadaveric dissection.

1. INTRODUCTION

Dissection and prosection on human cadaver remain the gold standard method for the teaching/learning anatomy to first phase medical students around the world. Real cadaveric dissection in dissection hall provides the visual and tactile experiences to students which is necessary to learn anatomy in detail. But the use of cadavers for dissection is expensive, time consuming and potentially hazardous too due to exposure to formalin.

The use of modern technology in medical education is constantly evolving and increasing now a day. The style of anatomy teaching gradually progressed over the years with the use of prosected and plastinated specimens, computer - based learning, multimedia learning and anatomy software. Use of virtual dissection or Anatomage table is one of the modern teaching learning tools which provide students with new opportunities to learn anatomy.

Anatomage table or virtual dissection table is the fully segmented real human 3D anatomy system where in four 3D life - size virtual cadavers are created by using slice data from real people, it also provides high resolution regions of the body, case library which is a database of CT & MRI cases both normal as well as pathological, data base of 2D histology slides, segmented anatomy, virtual 3D prosected surface models of cadaver [1].

Students can dissect a virtual cadaver in 3D using touch screen technology, which allows them to understand complex relationships by transecting them in order to appreciate anatomical form, isolate different structures in 3D form, reconstruct, zoom in and out of the structure, and revisit the different structures by creating presets with figure tip only [2].

It also allows students to interact with young and well preserved cadaver instead of old and

degenerated bodies. The accurate anatomical details and rich contents pique student's interest and attention leading to more educational outcomes.

There is yet to be discovered a single teaching/learning instrument that meets all of the anatomy curriculum criteria. Combining several instructional tools that complement each other is the best strategy to teach anatomy. When multimodal techniques are used, students tend to learn more efficiently. There is very limited data in the literature in regard to how the use of this technology is impacting students' learning [1,2].

Our study involved exposure of first year medical student to virtual dissection table prior to routine cadaveric dissection in order to assess their learning outcome & perception with the combined use of virtual as well as cadaveric dissection.

2. METHODS

Comparative cross sectional study was carried out at Jawaharlal Nehru Medical College Sawangi Meghe Wardha in anatomy department, during year 2018 - 19. Study participants were 200 students of the first phase MBBS from 2018 - 19 batch. Informed consent was taken from the study participants. Participants were categorized into two groups, A and B. Didactic lecture was taken for the both group on the topic "Division of triangle of neck & their contents". Didactic lecture was followed by dissection of the same topic. Student from group B performed it by traditional method on real cadaver. Student from group A performed virtual dissection of the same topic on Anatomage table under supervision of the faculty from the department before dissecting the region on real cadaver. Pre and post-tests were conducted for both group participants using a pre-validated questionnaire (multiple option type) on the topic 'Division of triangle of neck & their contents' to assess the effectiveness of use

of virtual dissection before cadaveric dissection in understanding the topic.

Statistical Analysis: 5 point Likert scale was used for obtaining feedback from study participants. The student's t-test was used for statistical analysis. Chi square test using descriptive and inferential statistics was used for statistical analysis. 24.0 version of SPSS software was used for analysis. $p < 0.05$ was considered as level of significance.

3. RESULTS

Mean pretest score of both the group A and B were 3.70 ± 4.30 and 3.26 ± 1.04 respectively but the post test score in group A which was exposed to virtual dissection prior to cadaveric dissection was 9.18 ± 0.84 as compared to the post test score of 7.11 ± 7.01 in group B which was not exposed to virtual dissection Table 1.

Most of the students 144(72%) agree that virtual dissection helps in better understanding of the complex relation of structure with each other in Head Neck & Face region and prior exposure to virtual dissection creates interest in cadaveric dissection 152(76%) as they know where and how to search for the required anatomical structure.

75.5% of students were agree with the fact that though cadaveric dissection gives the tactile experience but it should be preceded by virtual dissection to add to the knowledge and Virtual dissection should be included in the curriculum. Students were of the opinion that they need to well prepared with the topic for cadaveric dissection but virtual dissection can be performed with ease and without prior preparation. They were happy with the experience of virtual dissection as they don't have to wear gloves and free from irritant effect of formalin. 78% of the students suggested that virtual dissection should be used for revision of the syllabus prior to summative examination.

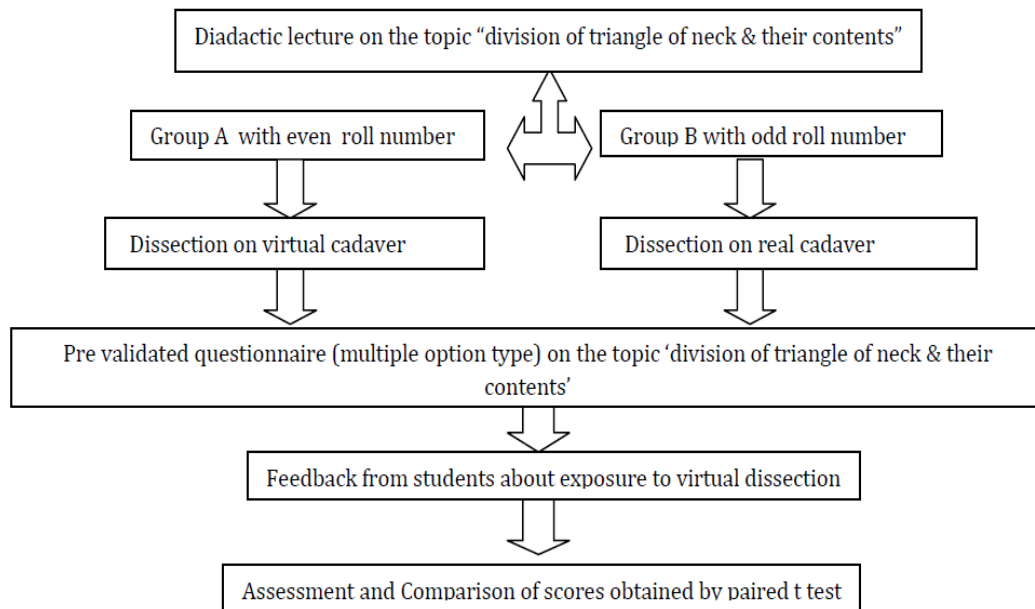
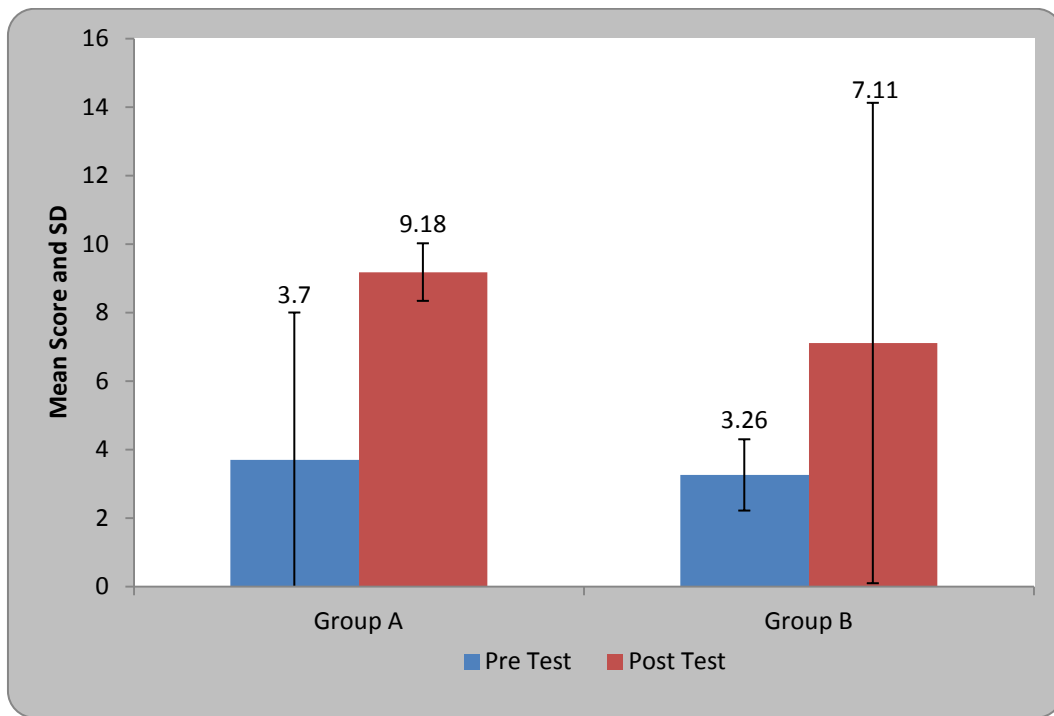


Fig. 1. Flowchart of study methodology

Table 1. Comparison of pre and post test score in two groups student's paired t test

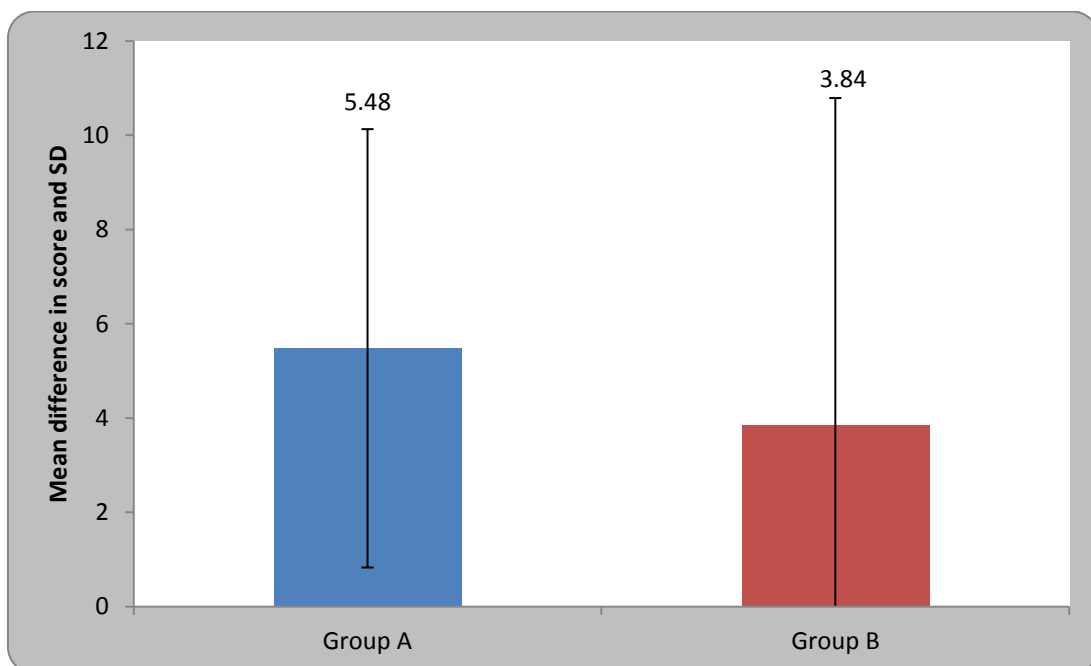
	Pre/post test	Mean	N	Std. deviation	Std. error mean	Mean difference	t - Value
Group A	Pre Test	3.70	100	4.30	0.43	5.48±4.65	11.77 p=0.0001,S
	Post Test	9.18	100	0.84	0.08		
Group B	Pre Test	3.26	100	1.04	0.10	3.84±6.95	5.53 p=0.0001,S
	Post Test	7.11	100	7.01	0.70		



Graph 1. Comparison of pre and post test score in two groups

Table 2. Comparison of mean score in pre and post test score in two groups student's unpaired t test

Groups	N	Mean	Std. deviation	Std. error mean	t - value
Group A	100	5.48	4.65	0.46	1.98
Group B	100	3.84	6.95	0.69	p=0.045,S



Graph 2. Comparison of mean score in pre and post test score in two group

Table 3. Perception of students about virtual dissection before real cadaveric dissection

Perception of students about virtual dissection before real cadaveric dissection	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Virtual Dissection helps in better understanding of the complex relation of structures with each other in HNF	36(18 %)	144(72 %)	13(6.5 %)	4(2 %)	3(1.5 %)
High resolution images help to clearly identify the structures	11(5.5 %)	165(82.5 %)	19(9.5 %)	5(2.5 %)	0(0 %)
Prior exposure to virtual dissection develop interest in cadaveric dissection	39(19.5 %)	152(76 %)	9(4.5 %)	0(0 %)	0(0 %)
Cadaveric dissection should be preceded by virtual dissection to add to the knowledge	30(15 %)	151(75.5 %)	18(9 %)	1(0.5 %)	0(0 %)
Virtual dissection should be included in the curriculum	34(17 %)	148(74 %)	18(9 %)	0(0 %)	0(0 %)

4. DISCUSSION

Over the years, dissection of actual human cadavers has been the predominant anatomy teaching method in medical school for first-year medical students.

The main source of procurement of cadavers in most of medical institutions are unclaimed bodies. As these bodies were stored in freezer for some days before embalming they become hard and dry. It becomes very difficult for student to dissect these bodies affecting their interest for dissection. Regarding head neck and face region, one side of neck of cadaver was used commonly to perform cannulation for embalming, so structures on that side of the neck , usually lost their normal anatomical relations. Other side of neck is usually in stiff flexion so students face difficulty to dissect the region and as a consequence of which students lost their interests in dissection.

However, new technological advances have created new teaching learning tools, such as virtual dissection table or Anatomage table which provide students with new learning opportunities.

With the help of Virtual dissection table or Anatomage table students can dissect, separate anatomical structures in 3D form. They can zoom in and out the structures for better understanding. By generating presets in a virtual dissecting table, they may pause, rewind,

and explore different structures and systems [2].

In our institute, JNMC Sawangi Meghe Wardha, we are using Anatomage table for virtual dissection since two year. As only few medical institutions have the facility of Anatomage table, research work on the effectiveness of virtual dissection on Anatomage table are very few in number. There are some studies regarding the perception of students about the use of Anatomage table but very few studies on methods of its utilization so that its use become more effective. We are using cadaveric as well as virtual dissection routinely but want to assess the effectiveness of virtual dissection before cadaveric dissection.

Each teaching learning methods has its own advantages and disadvantages. Use of different teaching learning tool to maximize the learning outcome is the best policy today. The purpose of this study was to determine the usefulness of virtual dissection before real cadaveric dissection, as well as student perceptions of virtual learning using the Anatomage table.

4.1 Effectiveness of Use of Virtual Learning before Cadaveric Dissection

In comparative study involving 200 MBBS students from JNMC Sawangi Meghe Wardha, after taking didactic lecture on the topic "Division of triangle of neck & their contents" for whole batch, students were divided into two batches by

simple randomization into group A (100 students) and group B (100 students). Batch A was exposed to virtual dissection before cadaveric dissection and assessment test involving 20 MCQ from the same topic was taken by pen paper mode to assess the effectiveness of virtual learning in understanding the anatomy of the region. We observed significant difference between mean post - test score of group A (9.18) which was exposed to virtual learning and group B (7.11), not exposed to virtual learning before real cadaveric dissection.

Positive outcome of virtual learning were observed by Macchiarelli G, Bernardi S and Berto RB, Tortorella C, Porzionato A, [3,4]. Macchiarelli G, Bernardi S [3] observed that although each student has a unique mix of demands and baseline skills, including a virtual dissection table into the anatomy curriculum increases student performance., while Berto RB, Tortorella C, Porzionato A, [4] assess the additional role of virtual dissection to traditional dissection in teaching anatomy by randomized controlled trial involving second - year medical students observed that medical students who applied to the virtual dissection were over 3 times report a positive outcome at the post - dissection check than people who applied to textbooks of anatomy.

On contrary to the above finding TC Singel et al. (2017) observed that there was no statistical difference in learning gain between the student that were exposed and unexposed to virtual dissection of neuroanatomy [1]. Ian Chan [5] in a randomized control trial comparing Anatomage and prosection involving 16 undergraduate students also observed that differences in scores of students between the Anatomage (26.2 + / 5.9) and prosection (29.6 + / - 4.2) out of 41 groups, were not statistically significant. Differences between total diagnostic imaging scores of two groups were also not statistically significant.⁵ Afsharpour 2018 analyzed that Students who used virtual dissection tables performed better on laboratory exams than those who used models or cadavers [6].

4.2 Perception of Students Regarding the Use of Anatomage Table in Health Sciences

In our study, students were of the opinion that High resolution images, and various tool of the Virtual Dissection table helps in better understanding of the complex relations of structures with each other in Head Neck & Face

region. Prior exposure to virtual dissection develop interest in cadaveric dissection so cadaveric dissection should be preceded by virtual dissection to add to the knowledge and the teaching programme should incorporate virtual dissection. Like our observation TC Singel et al. 2017 and Macchiarelli G, Bernardi S [3] are of the same opinion that exposure to virtual dissection was helpful. The use of a virtual dissection table in the anatomical curriculum increases student performance by providing a better grasp of anatomical relationships. Bharati AS et al. [7] observed that students like to use cross sectional planes and images and ability to rotate the body to view the body system using Anatomage Table. Students were of the opinion that Dissection combined with Anatomage helped them understand Anatomy even better.

According to Martn JG [8], Anatomage is a highly motivating technique for students to learn anatomy. Students valued the opportunity to double-check anatomical sections or different organs and structures to make corrections using the names provided on the Anatomage screen. According to Periya SN [9], the possibility of using a virtual dissection table in conjunction with cadaveric dissections, may give an option for instructors desiring to augment anatomy instruction [9]. Custer T, Michael K [2] assessed students' impressions and found that 96 percent of students thought the Table was a positive/beneficial tool in terms of their learning in imaging-based anatomy and pathology through focused group discussion [2].

Bharati AS et al. [7] enlisted some disadvantages of the Anatomage table, like inability to differentiate between artery and vein, difference between colour of the tissues in virtual and real cadaver, time and technical skill those students has to acquire to use Anatomage table [7,8]. Georgia fyfe G [8] observed that students were unhappy with the graphics quality of the table and stated that though students likes measuring tool and to revel the relationship of anatomical viscera by rotating the images but were and the limitation to group interaction [9,10]. Students were initially dissatisfied with the screen - freezing problems and low - quality graphics, but were positive about the 3D aspect of seeing organ sizes and relationships, the slice tool for cross - sections, and avoiding the need for cadaver specimens. According to Fyfe S [11], indicating that touch - screen technology requires careful curriculum design and training for both students and staff to maximize its usefulness [11].

Anatomage table is a computerized machine. It is not cost effective. It can have technical error too which will in turn affect teaching learning process. But we should be prepared to invest in such new technology due to scarcity of human cadaver and to have technosavy infrastructure for the critical situation like COVID-19 pandemic in which virtual tools played an important role in teaching / learning and assessment of medical students.

5. CONCLUSION

Post-test score of students exposed to virtual dissection prior to cadaveric dissection was significantly higher as compared to the post-test score of students which were not exposed to the virtual dissection table indicating that virtual dissection before cadaveric dissection appears to be an effective way for teaching anatomy because students appeared to learn more. Students agreed that virtual dissection aids in better understanding of the complex relationship of the anatomical structure with each other as high resolution images and various tools on the Anatomage table help to clearly identify the structure and feels that virtual dissection should be included in the curriculum.

Combining numerous educational tools to complement one another is the best strategy to teach current anatomy. Although touch - screen technology requires careful curriculum design, training for both students and staff and not cost effective it can be included in the curriculum to prepare ourselves for the critical situation like COVID-19 pandemic in which virtual tools played an important role in teaching / learning and assessment of medical students

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The study was conducted after taking approval from institutional ethical committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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