

---

**ORIGINAL ARTICLE****Comparative study of viva voce on formalin embalmed cadaver and virtual cadaver using objective structured viva voce as an assessment tool in formative assessment of first MBBS students***Darshna Fulmali<sup>1\*</sup>, Gaurav Mishra<sup>2</sup>**<sup>1</sup>Department of Anatomy, <sup>2</sup>Department of Radio-diagnosis, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha-442004 (Maharashtra) India*

---

**Abstract**

*Background:* Many anatomic shortcomings of real cadaver are solved by virtual cadavers. Objective structured viva voce is a newer concept that is a systematic, preplanned, organized, effective, and efficient approach for proper assessment of undergraduates minimizing subjectivity. *Aim and Objectives:* To compare the efficiency of the virtual cadaver over the formalin preserved cadaver for conducting viva-voce during the practical examination of first-year medical undergraduate students using objective structured viva voce. *Material and Methods:* Objective structured viva voce was conducted for all study participants on formalin preserved cadaver and virtual cadaver followed by a tabulation of results and analysis of the score. Perception regarding the experience of students in both settings was taken by using five points Likert scale. *Results:* Mean score of the students in viva voce on virtual cadaver was higher as compared to viva voce on the real cadaver. Students felt that detecting and distinguishing between structures was quite challenging due to the color shift in tissue with time in embalmed cadaver. Though they needed to improve their technical skills they were pleased with the various tools on the Anatomage table. *Conclusion:* It is wise to invest in newer technology in which virtual tools played an important role in teaching/learning and assessment of medical students due to cadaver scarcity.

**Keywords:** Anatomage table, objective structured viva-voce, virtual cadaver

---

**Introduction**

Assessment is an integral part of teaching-learning process, it aids in the professional development of all health care personnel and also in the continuous improvement of the institutions. It should be objective and unbiased. Traditional dissected body viva voce is not structured. The reliability of non-structured viva voce is less compared to structured viva voce [1]. The Objective Structured Viva Voce (OSVV) is a new concept in the assessment of students. It is a systematic, preplanned, organized, effective and efficient approach for proper assessment, and also minimizes subjectivity. The Medical Council of

India also emphasized the need for introducing structured viva voce in all subjects to have objectivity in evaluation. Our institution has introduced objective structured viva voce in practical examinations since two years.

Assessment of the gross anatomy knowledge during the summative or formative practical examination of first-year medical undergraduate students is done by taking dissected body viva voce on formalin preserved dissected cadaver. The cadavers that are used for examination purposes were dissected and preserved for years to years. It is not always possible and feasible to

dissect a new cadaver for examination because of the scarcity of cadavers. As most of the cadavers are obtained from forensic mortuary as unclaimed bodies and very few are obtained through a body donation program. During such a long period, the cadavers are not handled properly, so they lose their texture and color, and become dried so the structure becomes difficult to identify for the students [2]. The major drawback of a cadaver used for examination is that it is a representation of postmortem anatomy. In this environment, emptied veins and arteries appear very similar. Students found it very difficult to identify and differentiate the structures on the hard cadaver.

Cadavers are cumbersome and difficult to reposition, constraining students' visualization of certain structures. So questions related to deeper structure and dorsal aspects are routinely not asked in the examination. Many of the anatomic shortcomings of real cadavers are solved by virtual cadaver. Since virtual cadavers are created by loading CT scans performed on living patients. In virtual dissection, students can study how organs appear in real life. In our first-year medical undergraduate anatomy curriculum we include both real cadaveric dissection and virtual cadaver dissection by using Anatomage table or virtual dissection table. Anatomage table or virtual dissection table is the fully segmented real human 3D anatomy system where four 3D life-size virtual cadavers are created by using slice data from real people, it also provides high-resolution regions of the body, a case library which is a database of CT and MRI cases both normal as well as pathological cases, database of 2D histology slides, segmented anatomy, virtual 3D prosecuted surface models of cadavers. Virtual dissection

table through touch screen technology, allows students to dissect a virtual cadaver in 3D form and transect them to appreciate anatomical form and complex relationships. It allows a better appreciation of the vascular anatomy such as the major branches of the aorta. It isolates different structures in 3D form, reconstructs, zooms in and out of the structure, and revisits the different structures by creating a preset with fingertip only. It also allows students to interact with young and well-preserved cadavers instead of old and degenerated bodies. The accurate anatomical details and rich contents increase student interest and attention leading to more educational outcomes. Various keys of the table make it a perfect material to be used for examination purposes. We can dissect the virtual body in a fraction of time and the area dissected can be used to frame a questionnaire. In addition to that virtual dissection table is very student friendly and avoids exposure to formalin [3]. As a result, a pilot research was conducted to assess the effectiveness of a virtual cadaver with formalin preserved cadaver for conducting viva voce of first-year medical undergraduate students during formative assessment using objective structured viva voce as an assessment tool.

### **Material and Methods**

Comparative study was carried out in the Department of Anatomy J. N. M. C Sawangi Meghe Wardha from October 2019 to September 2020 after obtaining Institutional Ethics Committee Clearance. The sampling technique used for the present study was convenient purposive sampling technique. It resulted in inclusion of only first-year medical students who were taught the subject of Anatomy and had

provided the statement of informed consent after being briefly explained about their participation details, the benefits and risks involved, and the provision that the participants were free to dissociate from the study on their own will. In such a manner, the sample size comprised of 40 first year MBBS students who willingly participated in the present study after giving an informed consent.

All faculties from the department of anatomy and study participants were sensitized about the conduction of practical examination on a virtual cadaver. Written informed consent was taken from the study participants. Objective structured viva voce cards were prepared and verified by subject experts. Objective structured viva voce was conducted for all study participants on a real cadaver and their marks were tabulated. Perception regarding the experience of students on exposure to OSVV on real cadavers was taken. Objective structured viva voce was conducted for

all study participants on virtual cadaver in Anatomage skill lab and their marks tabulated. Perception regarding experience of students on exposure to OSVV on a virtual cadaver was taken by using five point Likert scale. Score of the study participants in OSVV on real cadaver and virtual cadaver were assessed. Perception of the students regarding their experience about exposure to real and virtual cadaver for examination was analyzed.

**Results**

**Comparison of mean score of students in viva voce on formalin embalmed cadaver and virtual cadaver**

It was found that the mean score of the students in viva voce on virtual cadaver was high (Table.1, Fig. 1) as compared to their score in viva voce on a real cadaver. The mean score in viva voce on a real cadaver was 14.35 out of 20 marks while on a virtual cadaver it was 15.75 marks. The standard deviation of viva on a real cadaver was 2.22 and on virtual cadavers, it was found to be 1.70.

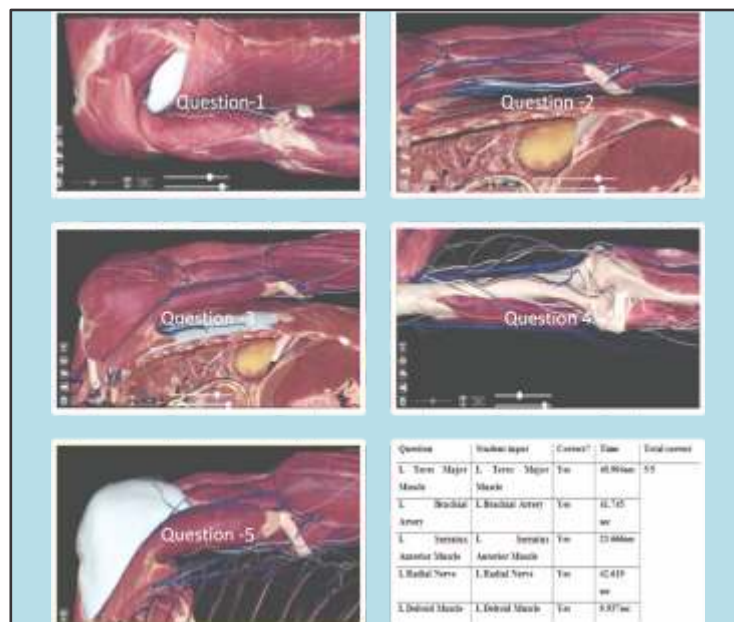


Figure 1: Sample of answer card of stored on Anatomage table

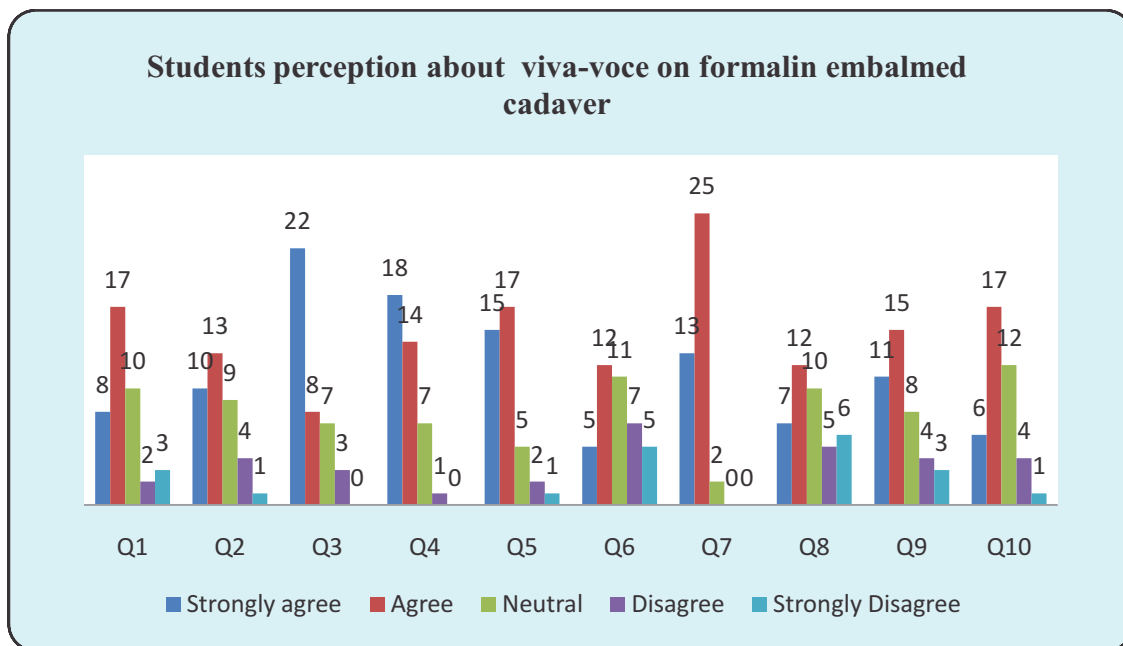
**Table 1: Comparison of mean score of students in viva voce on formalin embalmed cadaver and virtual cadaver**

Comparison of mean score of students	N	Mean score of students	Std. Error Mean	Mean Difference	t-value
Viva voce on real prosecuted cadaver	40	14.35±2.22	0.35	1.40 ± 0.44	3.15 P=0.002, S
Viva voce on virtual cadaver using Anatomage table	40	15.75±1.70	0.26		

**Perception of students about viva voce on formalin embalmed cadaver**

Forty two percent of students agree that they feel anxious to appear for dissected body viva on real cadaver. Thirty two percent of students are reluctant to appear for the viva. Fifty five percent of students strongly agree with the fact that formalin vapors irritate and weaken their performance in viva voce on real cadaver. Forty five percent of students strongly agree that they cannot appear for viva without wearing hand gloves. Forty two percent of students agree that deeper structures

were not possible to identify in cadavers. Most of the students (30%) agree that they were not able to differentiate between artery, vein and nerves on real cadaver. The majority of students (62%) thought that questions on the dorsal aspect of the body was not routinely asked in the exam. Thirty seven percent of students agree that the time allotted for them to answer the question in viva was found inadequate as most of the time was used in searching the structure in question. Because of all those reason, many of the students (43%) opined that dissected body viva is obsolete and tedious.



**Figure 2: Student's perception about viva-voce on formalin embalmed cadaver**

**Table 2: Perception of students about viva voce on formalin embalmed cadaver**

Perception of students	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
Experience anxiety to appear for dissected body viva	8(20%)	17(42%)	10(25%)	2(5%)	3(7.5%)
Reluctant to appear for dissected body viva	10(25%)	13(32%)	9(22%)	4(10%)	1(2.5%)
Formalin odour irritates /troubles you while appearing for the viva	22(55%)	8(20%)	7(17%)	3(7.5%)	0
Use of gloves is must while appearing for dissected viva	18(45%)	14(35%)	7(17%)	1(2.5%)	0
Identification of structures is difficult in real cadaver	15(7.5%)	17(42%)	5(12%)	2(5%)	1(2.5%)
Not able to differentiate between artery, vein and nerves	5(12%)	12(30%)	11(27%)	7(17%)	5(12%)
Question related to dorsal aspect of body are not routinely asked during viva	13(32%)	25(62%)	2(5%)	0	0
Deeper structures are difficult to pick up with forceps	7(17%)	12(30%)	10(25%)	5(12%)	6(15%)
Time allotted for each question is inadequate as most of the time is wasted in searching the structure	11(27%)	15(37%)	8(20%)	4(10%)	3(7.5%)
Dissected body viva are obsolete and tedious	6(15%)	17(42%)	12	4(10%)	1(2.5%)

### Perception of students about viva voce on virtual cadaver

Participants (25%) were very comfortable and confident while appearing for viva voce on virtual cadavers. Students were able to recognize the questioned structures in the virtual body with the use of life-size structures, high-resolution photos, touch screen technologies, and zoom-in and out

features in Anatomage. Eighty seven point five percent of students were happy with the bias-free results on the Anatomage table. Seventeen point five percent of students agreed that dissected body viva should be taken on virtual bodies regularly even if students must acquire technical skills to appear for viva.

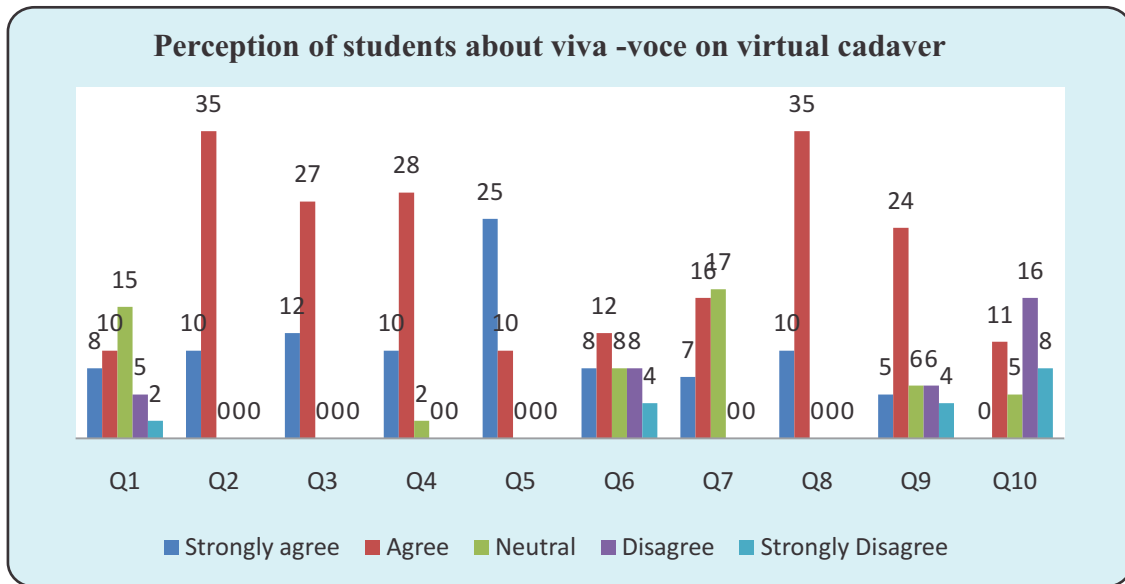


Figure 3: Perception of students about viva-voce on virtual cadaver

Table 3: Showing perception of students about viva voce on virtual cadaver

Perception of students	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
Feel confident to appear for virtual body viva	8(20%)	10(25%)	15(37.5%)	5(12)	2(5%)
Ambiance during virtual body viva is comfortable	10(25%)	35(87.5%)	0	0	0
Touch screen technology help student to identify the structures with ease	12(30%)	27(67.5%)	0	0	0
High-resolution, life-size structures are easy to identify in virtual body	10(25%)	28(70%)	2 (5%)	0	0
Zoom in and out helps to dissect and search deeper structures	25(62.5%)	10(25%)	0	0	0
Differentiation between vessels and nerve is possible	8(25%)	12(30%)	8(25%)	8(25%)	4(10%)
Questions on all aspects of body ventral or dorsal are asked in the exam	7(17.5%)	16(40%)	17(42.5%)	0	0
Results of test on Anatomage table are biasfree	10(25%)	35(87.5%)	0	0	0
Require more time to acquire technical skill to appear for viva	5(12.5%)	24(60%)	6(15%)	6(15%)	4(10%)
Dissected body viva should be taken on virtual body on regular basis	0	11(17.5%)	5(12.5%)	16(40%)	8(25%)

## Discussion

### Comparison of mean score of students in viva voce on real cadaver and virtual cadaver

Based on the findings of this study, the mean score of students in OSVV on virtual cadaver was higher than OSVV on actual cadaver. Because this is a pilot research, there is no data to compare the results of pupils who used virtual and real cadaver, but positive outcome of virtual learning were observed by many researcher. Students who utilized virtual dissection tables perform better on laboratory tests than those who used models or cadavers, according to Afsharpour 2018 [4]. In a randomized controlled trial involving second-year medical students, Berto *et al.* (2020), found that medical students who applied to virtual dissection were three times more likely to report a positive outcome than those who applied to textbooks of anatomy at the post-dissection check [5]. According to Macchiarelli, Bernardi (2017) although each student has a unique set of needs and baseline skills, integrating a virtual dissection table in the anatomy curriculum improves student performance [6]. But Singel *et al.* (2017) found that there was no significant difference in learning gain between students who were exposed and those who were not exposed to virtual dissection of neuroanatomy [3].

### Perception of students about viva voce on virtual cadaver

Students feel comfortable and at ease during their viva voce on a virtual cadaver. Though they need to improve their technical skills in order to appear for viva, they were pleased with the various tools on the Anatomage table, which helped them recognize structures more easily. Custer, Michael

(2015) surveyed students' opinions and discovered that 96% of them believed the Anatomage table was a positive/beneficial tool for learning imaging-based anatomy and pathology through focused group discussion [7]. Students enjoy to use cross sectional planes and photographs, as well as the ability to rotate the body to examine the body system using the Anatomage table, according to Bharati *et al.* (2018) [8]. Singel *et al.* (2017), as well as Macchiarelli, Bernardi (2017), believe that virtual dissection is beneficial to learn anatomy [3] [6]. Virtual dissection is a very stimulating way for students to study anatomy, according to Martin *et al.* (2018) [8]. Some downsides of the Anatomage table, according to Bharati *et al.* (2018), include the difficulty to distinguish between artery and vein, the difference in colour of tissues in virtual and actual cadavers, and the time and technical competence that students must acquire to operate the Anatomage table [9]. However, students in our research were pleased with the different tools on the Anatomage table. They were also pleased that questions covering all aspects of the region were asked, and the Anatomage result was bias-free.

### Perception of students about viva voce on real cadaver

Although the viva is a classic assessment tool, it may be utilized to improve learning by boosting internal motivation and giving chances for self-evaluation, knowledge, and skill development when used properly. According to Jaiswal (2015), a viva on a dissected body is the best evaluation tool for evaluating abilities in practical for 80% of medical students [10]. Students in our study believe that during a real cadaver viva, they feel nervousness. Finkelstein, Mathers also in their

research have also found that cadaveric dissection is linked to severe emotional stress in the form of anxiety [11]. According to Penney, physical symptoms accompanying anxiety included nausea, fainting, loss of appetite, sleeplessness, and/or nightmares are related with real cadaveric dissection [12]. They must wear gloves and use forceps to pick up the structure which is not the case with Anatomage table and they also have eye discomfort and watering, which adds to their bewilderment. Similar finding were reported by Noha, Mohamed (2017) such as unpleasant smell (91.2%), itching in the eyes (81.3%), and excessive lacrimation (76.1%) [13]. Students felt that detecting and distinguishing structures in cadavers were challenging due to the colour shift in the tissue with time. Similar finding were observed by Lakal (2015) [14]. According to Lakal, main drawbacks were 'difficulty in locating proper structures,' and 'time-consuming nature of dissection,' as well as 'smell of the embalmed cadavers.' During real cadaveric viva, questions on the dorsal aspect of the body are rarely posed. In a dissected body viva, the time provided for responding to questions is insufficient because the most of it is taken up with looking for the anatomical structure. Students in their study of Mutalik and Belsare [15] stated that cadaveric dissection was time-consuming and unpleasant for them. The majority of the students reported they did not enjoy the cadaver dissections. About 25.8% of students stated that methods other than cadaveric dissection assisted them to comprehending anatomy better. About 90% of students preferred cadaveric dissections over alternative teaching techniques.

### **Conclusion**

Performance of student in OSVV on virtual cadaver was better as compared to real cadaver as students face difficulty in identification of structure due to the loss of colour and texture in formalin embalmed cadaver. They found it difficult to pick up deeper and fine structures with forceps and were anxious and confused due to formalin vapors. In contrast, they were content and at ease in the favorable virtual lab setting with the Anatomage table-viva and were able to recognize the structure on the Anatomage table with the tip of their fingers. Students were happy with the unbiased, quick and immediate display of the score card of Anatomage table screen.

### **Future Scope**

Anatomy educators are investigating new and conventional teaching-learning approaches in the post-COVID-19 learning period in an effort to reform or advance the existing anatomy teaching and evaluation system through the appropriate and reasonable use of available resources. The results of this pilot study will enable us to evaluate undergraduate medical students using the Anatomage table in circumstances when there aren't sufficient cadavers available. 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.

### **Limitation**

Anatomage table is not cost effective.



## References

1. Tutton P, Glasgow E. Reliability and predictive capacity of examination in anatomy and improvement in the reliability of viva voce examination by the use of standard rating system. *Clin Anat* 1989; 2(1):29-34
2. Brenner E. Human body preservation- old and new technique. *J Anat* 2014; 224(3): 316-344.
3. Anand MK, Singel TC. A comparative study of learning with anatomage virtual dissection table verses traditional dissection method in neuroanatomy. *Indian J Clin Anat Physiol* 2017; 4(2):177-180.
4. Afsharpour S, Gonsalves A, Hosek R, Partin E. Analysis of immediate student outcomes following a change in gross anatomy laboratory teaching methodology. *J Chiropr Educ* 2018; 32(2):98-106.
5. Berto RB, Tortorella C, Porzionato A. The additional role of virtual to traditional dissection in teaching anatomy: A randomised controlled trial. *Surg Radiol Anat* 2020; 43(4): 469-479.
6. Macchiarelli G, Bernardi S, Adelaide M, Biasi JD, Palmerini MG, Bianchi S. Student learning performance in human anatomy using a virtual dissection table. *Italian J Anat Embryol* 2017; 122(1):124.
7. Custer T, Michael K. The utilization of the anatomage virtual dissection table in the education of imaging science students. *J Art Radiat Sci Tech Educ* 2015; 1:1-5.
8. Martín JG, Mora CD, Henche SA. Possibilities for the use of anatomage (the anatomical real body - size table) for teaching and learning anatomy with the students. *Biomed J Sci Tech Res* 2018; 4(4):1-4.
9. Bharati AS, Surya KN, Rani VS. A study on student perception of virtual dissection table (anatomage) at GSL Medical College, Rajahmundry. *Acad Anat Int* 2018; 4(2): 28-31.
10. Jaiswal R, Sathe S, Gajbhiye V, Sathe R. Students perception on methods of anatomy teaching and assessment. *Int J Anat Res* 2015, 3(2):1103-1108.
11. Finkelstein P, Mathers LH. Post-traumatic stress among medical students in the anatomy dissection laboratory. *Clin Anat* 1990; 3:219-226
12. Penney JC. Reactions of medical students to dissection. *J Med Edu* 1985; 60(1): 58-60.
13. Noha SME, Madiha AEM. Toxic effects of formalin-treated cadaver on medical students, staff members, and workers in the Alexandria Faculty of Medicine. *Alexandria J Med* 2017; 53(4): 337-343.
14. Lakal O, Dissabandara, Selvanayagam N, Nirthanan, Tien K, Khoo, and Raymond Tedman, Role of cadaveric dissections in modern medical curricula: a study on student perceptions. *Anat Cell Biol* 2015; 48(3): 205-212.
15. Mutalik M, Belsare S. Methods to learn human anatomy: perceptions of medical students in paraclinical and clinical phases regarding cadaver dissection and other learning methods. *Int J Res Med Sci* 2016; 4(7): 2536-2541.

**\* Author for Correspondence:**

Dr. Darshna Fulmali, Department of Anatomy,  
Jawaharlal Nehru Medical College, Sawangi (Meghe),  
Wardha-442004, Maharashtra,  
Email: bhotmagey2010@gmail.com Cell: 9921192383

**How to cite this article:**

Fulmali D, Mishra GV. Comparative study of viva voce on formalin embalmed cadaver and virtual cadaver using objective structured viva voce as an assessment tool in formative assessment of first MBBS students. *J Krishna Inst Med Sci Univ* 2022; 11(3):30-38

Submitted: 15-Jan-2022 Accepted: 30-May-2022 Published: 01-July-2022