3D Anatomage™ as a Supplement in Learning Tracheostomy among Otorhinolaryngology and Head Neck Residents

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Abstract

Tracheostomy is a tricky procedure but very crucial for ENT surgeons to master. Medical colleges use innovative tools to implement the teaching of anatomy to students and one such tool is the 3D Anatomage™ table which is a fully segmented touch interactive real human 3D anatomy platform that helps to visualize human anatomy just as it can be seen on a fresh cadaver. This study is based on advanced clinical skills program that was conducted for 26 ENT residents whose knowledge was assessed before and after the training and a feedback was taken to assess the usefulness of 3D Anatomage™. After the Module, an average of 23 students found it useful and superior to the old fashioned mannequin method of demonstration; 22 students showed significant improvement in knowledge and skills.

Keywords: 3D Anatomage™; Virtual Dissection; Tracheostomy.

INTRODUCTION

In recent years, technology has driven its way into almost all areas making the quality of life easier. It has also become a major tool in teaching students from kindergarten till university. One such use of technology is 3D Anatomage™ which has made its way in making the concepts of anatomy easier in medical colleges particularly in teaching complicated anatomy of the human body to medical students.[1] Cadaveric dissection helps the students to touch and feel the organs to understand the anatomy and also the related nearby structures.[2,3] In resource poor settings where availability of cadavers is less due to lesser donated bodies and higher costs, the virtual anatomy learning table 3D Anatomage™ is a valuable tool.[1] 3D Anatomage™ is envisioned by a firm in California in collaboration with the Stanford Clinical Anatomy Department. It involves 3-dimensional reconstruction of stereoscopic images of different body parts. Different body parts can be displayed layer by layer to study muscles, bones, organs, nerves and blood vessels. Also, different parts can be studied in all planes, thus understanding the relationship between various structures. With an integrated imaging technology, students are able to understand imaging of the structures side by side with the gross description of the body parts. Since it's a digital platform, the structures can be seen repeatedly any number of times unlike conventional dissection wherein each dissected can be carried out only once.[4-6]

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MATERIALS AND METHODS

This study was conducted to assess the knowledge of Post Graduate students pursuing Otorhinolaryngology course. The site was advanced Clinical Skills Lab attached to a medical college in North Karnataka. 26 students were selected. A pre-test Google form questionnaire (https://forms.gle/mkdV48Ss8bgWic2G8) was designed to assess their knowledge regarding tracheostomy and this was followed by a brief training module educating them regarding tracheostomy by demonstration of the relevant anatomy using 3D Anatomage™ table by a senior faculty who also stressed upon the clinical applications of the same. After this, a post-test Google form questionnaire (https://forms.gle/U7QXYBAaoMGv4a3a9) was given to the students and the results were compared.

The study was exempt from Institutional Ethics Committee clearance; however, a prior permission was taken from Academic Director, Advanced Skills Lab dated 13/04/2022. All students who participated in the study gave consent for the same.

A total of 12 questions were used to assess the knowledge of the students before and after the training module. (Appendix 1)

RESULTS

Figure 1 shows the question wise analysis of responses wherein it is clear that the candidates benefitted by the training module. The average correct answers scored by each candidate improved by 11%. Using paired t-test, the results were found to be statistically significant p-value. Some candidates showed an improvement by almost 35%.
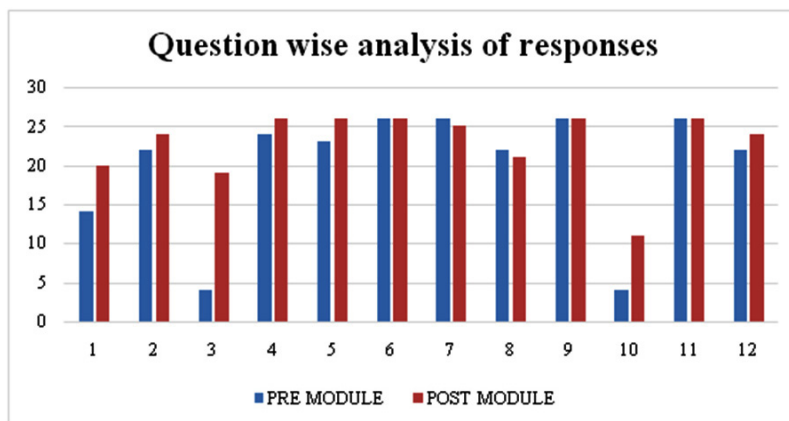

Fig. 1: Question wise analysis of responses

Table 1 shows the feedback received by the candidates with respect to their experience with the 3D Anatomage™ table. It is clear that 3D Anatomage™ table is a valuable tool to supplement their learning.

Fig. 2 shows that each of the candidates benefitted from the training module. Among the 26 candidates,

22 candidates showed improvement in the test scores after the module, 1 candidate who performed the same and 3 candidates who did not show any improvement. Using paired t-test, the results were found to be statistically significant p-value.
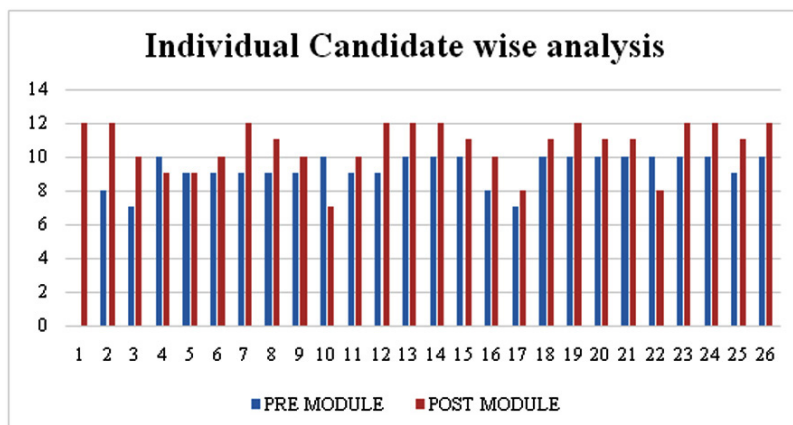

Fig. 2: Individual candidate wise analysis of responses

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Table 1: Feedback received from the candidates

Using paired t-test, the results were found to be statistically significant with a p-value of	1. Do you find 3D Anatomage as an addition to simulation mannequin is helpful in learning for surgical anatomy of trachea for tracheostomy.	2. Did you benefit from applying 3D Anatomage in learning the anatomy of trachea?	3. Do you feel that simulation mannequin is more superior to 3D Anatomage	4. Do you feel using 3D Anatomage helps in learning surgical anatomy of trachea and its related structures in all possible planes?	5. For future simulation simulation studies, do you feel using 3D Anatomage as a supplement is useful to enhance gross learning of the subject?
Yes	25	25	17	24	24
No	1	0	2	0	1
Maybe	0	1	7	2	1

DISCUSSION

In today's world of technological advancement, students prefer to learn concepts when it is supplemented by good use of technology.[7-8] The use of novel ideas to teach explain the greater understanding of the students of the complicated anatomy and also the clarity in appreciating three-dimensional visualization of structures over two-dimensional images in books.[9] Due to the unlimited use, the cost of procuring cadavers and embalming them is completely negated using Anatomage™. Also, there is no issue regarding the disposal of cadavers using this technology. The in-depth understanding is supplemented by the fact that each structure can be visualised in all planes by the student thus understanding relations to other structures easier. Also, the integration of radiology with the gross images side by side makes application of knowledge gained in the advanced skills lab into clinical practice easier.[1] A few disadvantages that could be appreciated by the students is that variations in normal anatomy cannot be learnt using Anatomage™. Also, the normal feel of the tissues is not possible using this technology.[10,11] The present study was aimed to evaluate how well students understandinmg of concepts related to tracheostomy was better understood by using 3D Anatomage™ as a supplementary tool in their understanding of the surgical anatomy. We are also of the opinion that since this is an interactive device, it would encourage self-dependent study and foster team work and inter personal skills development amongst students.

CONCLUSION

3D Anatomage™ virtual dissection table is useful to learn anatomy and its use as a supplement to cadaveric dissection is beneficial to students. The wider use of its repeatability, accessibility, ease and interactive nature of use, integrative radiology, multi-planar understanding of structures and its relations is beyond doubt a boon to the students. We need to conduct further studies to evaluate if the knowledge gained through the usage of 3D Anatomage™ can be retained for a longer time as against the knowledge gained by cadaveric dissection. Also, we need to conduct similar studies across undergraduate and super specialty course students to assess its applicability across all student populations in a medical college.

APPENDIX- 1

A total of 12 questions were used to assess the knowledge of the students before and after the training module. The questions were as follows:

1. Which type of incision is taken in case of emergency tracheostomy?
*   Vertical Incision below the Cricoid
*   Vertical Incision above the Cricoid
*   Horizontal Incision below the Cricoid
*   Horizontal Incision above the Cricoid

2. Which of the following is not a Strap muscle?
*   Sternohyoid
*   Sternothyroid
*   Omohyoid
*   Thyrohyoid
*   Cricothyroid

3. Which of the following is not a part of tracheostomy set?
*   Trousseau dilator
*   Allis forceps
*   Langenbeck retractors
*   Skin hooks

4. Which number blade is used for creating Tracheal window?

- No. 11
- No. 12
- No. 13
- No. 15

5. Tracheal window is created at what level?

- At 1st tracheal ring
- Between 1st and 2nd tracheal rings
- Between 2nd & 3rd tracheal ring
- At 2nd tracheal ring

6. Which of the following is not an Immediate Complication?

- Primary Hemorrhage
- Aspiration of blood
- Air embolism
- Tracheo-oesophageal fistula

7. Which among the following tubes come with an inflatable cuff

- Portex Tracheostomy Tube
- Jackson tracheostomy tube
- Fuller bivalved tracheostomy tube
- Negus tracheostomy tube

8. A high tracheostomy is done at

- Above thyroid isthmus
- Behind thyroid isthmus
- Below thyroid isthmus
- At the level of thyroid isthmus

9. At what position is the patient kept while performing a tracheostomy?

- Neck extended with a shoulder roll.
- Hyperextend neck
- Rose position
- 30 degree head end elevation

10. Which of the following is not an indication for tracheostomy?

- Retained secretion
- Respiratory obstruction
- Respiratory Insufficiency
- All of the above

11. Which of the following is not a late complication of tracheostomy

- Subglottic stenosis
- Tracheal stenosis
- Persistent tracheo-cutaneous fistula
- None of the above

12. Functions of Tracheostomy include

- Relieves upper airway obstruction
- Improves alveolar ventilation by decreasing dead space
- Administration of anesthesia
- All of the Above

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