Original Research Article

Implementation of use of hand-made three-dimensional models to teach Anatomy with supplement to traditional methods with limited resources

Bhadreshkumar P Vaghela [1],*, Satish M Patel[1],*

[1]Dept. of Anatomy, Namo Medical Education & Research Institute, Silvassa, Dadar Nagar Haveli, India

ABSTRACT

The status of anatomical education in modern medical programs is a cornerstone of medicine.[1] Anatomy is one of the basic subjects in First Year MBBS curriculum. Apart from important it is also a lengthy subject to complete in allocated time duration of First MBBS. There are various subdivisions of anatomy like gross anatomy, developmental anatomy, microscopic anatomy, genetics, surface anatomy, radiological anatomy etc. Out of which gross anatomy is difficult to understand as time constraint is there in duration of First MBBS.[2] In medical and allied branches total hours allocated for anatomy teaching and laboratory practical hours have reduced. Result in triggered the emergence of innovative ideas to maximize students learning.[3] While studying the gross anatomy three-dimensional orientation is must to learn actual structure and relation with other viscera and vessels. Traditional way of teaching anatomy uses wall charts, books, slides, anatomical specimens, and practical anatomy as teaching resources and methods. It is fact that in most institutes, three dimensional models are available in their Anatomy Museum, but many Anatomists have complained about fault in exact structure, labelling and it's relationship in these models because sometime these models are made by amateur technicians. As the medical education expanded and the reduction in human anatomical specimens due to shortage of dead body donations, as well as the limitations of time, place and other resources for anatomical training, the quality of anatomy teaching has been seriously affected.[4] Apart from shortage of these resources, another big issue with development of skill laboratory which is now mandatory as per new NMC guidelines. Establishment of skill lab requires ample amount of finance. Though, skill lab can provide excellent resources to meet the existing lacunae in teaching Anatomy to students by virtual media and simulations. Latest innovations in better teaching aids in Anatomy, in market virtual dissection table is available now, which can provide in depth understanding and orientation of three-dimensional body structures. But as mentioned above, the cost of this virtual dissection table is too high that every institute can not able to afford it. In this situation, to provide better understanding and three-dimensional orientation to students making hand made models from cheap and easily available materials are better options for teachers and students as they can make themselves.

Anatomy is a discipline where spatial visualization is of importance. Even anatomy textbooks and atlases provide two-dimensional static anatomical illustrations. To teach some anatomical structures by traditional cadaveric dissection or by traditional lectures is difficult. Some of the structures like gross anatomy of urinary bladder or facial nerve anatomy are difficult to learn by textbook which cannot give exact perception of real anatomy. Additionally, many structure get distorted while removing from cadaver or not able to trace even. In some cases, specific models are also not available for instance course of facial nerve from origin to its termination where hand-made models give excellent three-dimensional understanding. For students' proper anatomical knowledge of anatomy/organs help them to improve surgical skills. Finally, surgical outcome will be better with less morbidity and mortality.

For reprints contact: reprint@ipinnovative.com

1. Aims and Objectives

1. To improve understanding of the 1st MBBS students.
2. To improve learning of three-dimensional anatomy to the 1st MBBS students.
3. To facilitate teaching by teachers with limited resources.
4. The aim of this study was to evaluate the effect of a three-dimensional model in learning anatomy.

2. Materials and Methods

The study was conducted in Department of Anatomy, NAMO Medical Education & Research Institute, Silvassa on 1st MBBS students with prior permission from ethics committee of our institute. All the 150 students of the whole batch were involved in the study. In this study, all the 150 students were divided into 2 equal halves; named Group 1 and 2. Each group was having 75 students. The students of both groups had no previous education concerning the relevant topics selected for the study. Two topics were selected for present study purpose. Topic A was gross anatomy of the urinary bladder and topic B was course and arrangement of branches of the facial nerve. The topics for teaching and assessment for Group 1 were, Topic A (gross anatomy of the urinary bladder) with model and Topic B (course and arrangement of branches of the facial nerve) without model. The topics for teaching and assessment for Group 2 were, Topic A (gross anatomy of the urinary bladder) without model and Topic B (course and arrangement of branches of the facial nerve) with model. The Study was conducted in following 2 phases. All the classes were taken by myself only.

2.1. Phase 1: Model making

The aim of this phase was to make handmade model with limited resources. I have gathered the material required from the department. After learning the gross anatomy from various textbooks, watching videos and from technology like three-dimensional models and PDFs. The models were created using gathered materials like cardboard (thick and thin), waste papers, plastic straw, gum, etc. After making the models validation were made from the colleagues of my department.

2.2. Phase 2: Study conduction

The aim of this phase is to conduct the class for both the group A and group B. The sessions without handmade model were carried out through only power point presentation lectures. For other sessions power point presentation lectures were supplemented by handmade models. After completion of each topic with and without

* Corresponding authors.

E-mail address: patelsatish979@gmail.com (S. M. Patel).

handmade models for the Group A & B, I have conducted quick examination immediately after class. The form of this quick examination was MCQs based. Also feedback form were collected of power point presentations lectures conducted with and without handmade models from each student. The MCQs of the quick examination were validated by other faculty of my department.

3. Observation and Results

Table 1: Shows number of students passed the immediate post test MCQs examination for Topic A (gross anatomy of the urinary bladder)

Topic	Group 1 (n=75 students) With handmade model	Group 2 (n=75 students) Without handmade model
A	67 (89%)	47 (63%)

Shows number of students passed the immediate post test MCQs examination for Topic B (course and arrangement of branches of the facial nerve).

Table 2: Shows number of students passed the immediate post test MCQs examination for Topic B (course and arrangement of branches of the facial nerve)

Topic	Group 2 (n=75 students) With handmade model	Group 1 (n=75 students) Without handmade model
B	62 (83%)	43 (57%)

In feedback form total 5 multiple choice questions were asked of which following are the responses:
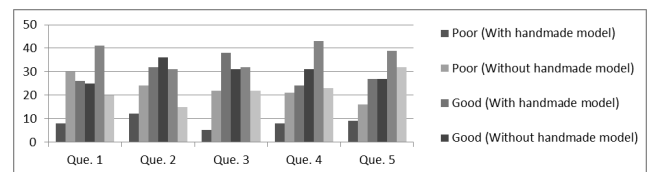

Fig. 1: Showing feedback response of Topic A (gross anatomy of the urinary bladder) with and without handmade model
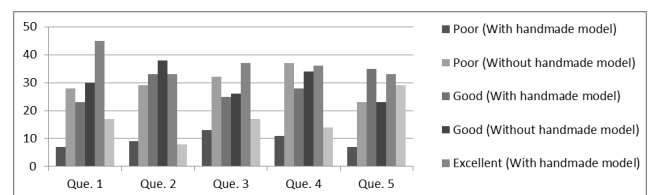

Fig. 2: Showing feedback response of Topic B (course and arrangement of branches of the facial nerve) with and without handmade model

4. Discussion

In present study, significantly better outcome was obtained for the students whose lectures have been taken using the handmade models for both the topics A and B. After conduction of study, for Topic A (gross anatomy of the urinary bladder), 26.66% more students were able to pass immediate post test MCQs examination who were taught with handmade model compared to those who were taught without handmade model. In the same manner after conduction of study, for Topic B (course and arrangement of branches of the facial nerve) 25.33% more students were able to pass immediate post test MCQs test who were taught with handmade model compared to those who were taught without handmade model. It shows significantly better result when handmade models will be added with traditional lectures.

In previous study by Navid S et al,[1] after study when analysis was done of pre test and post test resuts, showed a significant differences (p≤0.001). Also they found significant difference in the mean of their first experience where they used with the heart sheep and in second experiment when they used three dimensional model (p=0.16). But surprisingly they did not found any significant difference in the comparison pre-test scores between allotted groups (p=0.28). Another finding they observed is that there is positive effect of three dimensional model in learning anatomy in comparison with traditional education methods such as power point presentation slides or chalk and board methods.[1]

In previous study by Sonia Pujol et al,[5] observed that scores of the quizzes conducted after lectures conducted using three dimensional models have better scores and understanding of three dimensional spatial relationship of anatomical structures was better. Also they observed use of three dimensional models have positive outcome in doing human cadaveric dissection. After study, they also take feedback of students regarding use of three dimensional which reflects positive responses of using three dimensional models in study as they are helping in better understanding of complicated subject.[5]

In previous study by Jeremy Houser and Peter Kondrashov, received the better understanding and positive feedback from students by using multimedia dissector, split laboratories, virtual human dissector and other resources available in the institute for teaching. But, availability of such type of resources in every institute is not there so in such case hand made models is also good option.[6]

Secondly, while considering feedback responses (Figures 1 and 2) showed positive feedback response in closed-ended questions like "interest in session with handmade model", "the session with handmade model helped in better understanding" etc. However, not much difference is seen in "Good" response, with or without handmade model lectures.

5. Conclusion

In present study, we conclude that better result observed in understanding of three dimensional anatomy by using hand made models when limited resources available in institute. After learning students themselves can also able to make three dimensional models at hostel or home using affordable material. Making three dimensional models by own also help student to clear concepts of gross anatomy and relations of that structure more in comparison with traditional methods. Improved result of immediate post test also reflects success of supplementing traditional classes with hand made models. Also students had given positive feedback for with handmade model lecture. Quality of education among Indian Medical Graduate can be improved by applying this method in medical education where limited resources available. Better understanding of anatomical concepts will in turn give better surgical output and less complication.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare no conflict of interest.

References

1. Navid S, Sajjadi SM, Khoshvaghti A. The Effect of 3DModel on Learning of Cardiac Anatomy. 2017;4(1):1061.
2. Yang J, Chen N, Zhang S, Xu Y, Tan L. Modeling and simulation of an anatomy teaching system. *Vis Comput Ind*. 2019;2(8). doi:10.1186/s42492-019-0019-4.
3. Khoshvaghti A, Ghasemi H. The Effect of 3D Model on Anatomy Learning of Middle Ear. *J Iran Anat Sci*. 2010;7:153–62.
4. Burk ZJ, Johnson CS. Method For Production of 3D interactive Models Using Photogrammetry For Use in Human Anatomy Education. *HAPS Educator*. 2019;23(2):457–53.
5. Pujol S, Baldwin M, Nassiri J, Kikinis R, Shaffer K. Using 3D modeling techniques to enhance teaching of difficult anatomical concepts. *Acad Radiol*. 2016;23(4):507–16.
6. Houser JJ, Kondrashov P. Gross anatomy education today: the integration of traditional and innovative methodologies. *Mo Med*. 2018;115(1):61–5.

Author biography

Bhadreshkumar P Vaghela, Associate Professor
https://orcid.org/0000-0002-2467-4152

Satish M Patel, Assistant Professor