



Effectiveness of a 3DBody Software-based Online-offline Hybrid Model Applied to Teaching Radiation Oncology

Xin Sui

The First Affiliated Hospital of Zhengzhou University, Zhengzhou 450052, Henan., China

Abstract: Objective: To explore the effect of online-offline hybrid mode based on 3DBody software applied in teaching radiation oncology. Methods: The interns (n=90) who received the teaching of radiation oncology were selected, and the groups were divided into equal proportions with reference to the method of randomized numerical table: Group A received the traditional teaching method (n=45), and Group B received the on-line and off-line blended mode of teaching based on 3DBody software (n=45), and the time of inclusion was from 2023.1 to 2024.6. The time of teaching for Groups A and B was 3 months, and the data of the indicators of all the groups were statistically compared. groups' index data were statistically compared. Results: The scores of professional and technical abilities (analysis of tumor clinical characteristics, target area outlining, ability to formulate radiotherapy plan and evaluate the plan) of group B were higher than those of group A. After teaching, the total satisfaction of teaching of group B was higher than that of group A. $P < 0.05$. Conclusion: Compared with traditional teaching, adopting the online-offline hybrid mode based on 3DBody software in the teaching of radiation oncology is conducive to the enhancement of the professional and technical abilities of the interns and to the increase of Conclusion.

Keywords: radiation oncology; hybrid model; 3DBody

1. Introduction

Traditional teaching modes mostly rely on two-dimensional images, atlases and models, which have limitations in presenting the three-dimensional spatial relationship between tumors and surrounding tissues, making it difficult to meet the needs of modern radiation oncology teaching. With the development of digital technology, 3D visualization software brings new opportunities for medical education [1]. 3DBody software contains rich human anatomical structure models, which can display human organs, tissues and lesions in three-dimensional form, providing a more intuitive and vivid teaching tool for radiation oncology teaching [2]. Based on this, the purpose of this paper is to analyze the effect of online-offline hybrid mode based on 3DBody software applied in the teaching of radiation oncology, which is reported as follows.

2. Information and methodology

2.1 General information

The interns (n=90) who received radiation oncology teaching were selected and divided into group A (n=45) and group B (n=45) according to equal proportions by reference to the random number table method, from 2023.1 to 2024.6. The male to female ratios of the interns in the two groups A and B were 27:18 and 26:19, respectively; the age ranges of the interns were 20-26 years old and 21-25 years old respectively; and the average age was (22.23 ± 0.32) and (22.19 ± 0.28) years old, respectively. (22.23 ± 0.32) years old and (22.19 ± 0.28) years old respectively. There was no difference in the above data of students in Groups A and B when compared between the groups ($P > 0.05$), which is suitable for statistical research and comparison. The application of this study to the relevant data has been agreed by the interns and in this study, all have signed the consent for participation. Exclusion criteria: those who did not participate in the examination; those who took leave of absence during the teaching period; those who transferred to other hospitals halfway through the study, etc. Inclusion criteria: those who entered our internship for the first time; those who had a high level of acceptance of each teaching program; those whose academic qualifications were at undergraduate level full-time and above, etc.

2.2 Methods

Group A adopts the traditional teaching mode. The interns were divided into head and neck, chest, abdomen and gynecological tumor groups according to the specialty of the department, and were led by the corresponding instructors. The learning content includes three parts: centralized theoretical teaching, ward patient management and clinical practice operation, which involves clinical characteristics of tumors, anatomical distribution, target area outlining, treatment plan

evaluation, etc., in order to master the professional knowledge and improve the practical ability. Group B adopts the online and offline hybrid teaching based on 3DBody software, and the content of the learning is the same as that of Group A, with the specific process as follows: (1) Before teaching, the trainees are instructed to download and install 3DBody software, explaining the application method and precautions. 3DBody software, explain the application method and precautions, and ask them to master it by themselves. Before the first application, the teaching faculty demonstrated the operation method with head and neck tumor case data. (2) During the teaching, the instructor will carry out routine theoretical teaching offline, guide the reading of films, outline the learning of target area and validate the radiotherapy plan, take the interns to check the room, and explain the radiotherapy process, specification and design with the cases; online, with the aid of 3DBody software, the instructor will demonstrate the tumor site, lymph nodes and the surrounding tissues and organs, so as to help the interns to clarify the relationship between the tumor and the surrounding structures, determine the target area of radiotherapy, and cultivate the abstract thinking. (3) In the stage of in-depth study and practice, students are guided to analyze the scope and location of tumor invasion with the help of CT localization image data. After the offline teaching, 3DBody software is used online to demonstrate the local anatomy of the tumor, the surrounding tissues and the anatomy of the nerves, etc., so as to deepen the interns' understanding of the relationship between the tumor and the surrounding tissues. At the same time, the interns will be instructed to independently complete the operation of radiotherapy target area outline, irradiation field adjustment, dose distribution, plan evaluation and physical plan validation for tumors and normal organs. Duration: 3 months for both groups.

2.3 Observation indicators

① Professional and technical ability, from the clinical characteristics of the analysis, target area outlining, the development of radiotherapy plans, assessment of the ability to plan several aspects of the assessment, are set full score of 100 points, the higher the score, the stronger the ability. ② Teaching satisfaction, choose our own satisfaction scale, the total score is 100 points, dissatisfied: <50 points, satisfied: ≥50 points, <80 points, very satisfied: ≥80 points. Formula 1- number of dissatisfied/total number of people × 100%, calculate the overall satisfaction.

2.4 Statistical methods

The indicators were detected by SPSS 26.0, and the count data were output in the form of [case (%)] after the χ^2 test; the t-test measurement data were output in the form of (false), and $P < 0.05$ was considered a significant difference.

3. Results

3.1 Professional and technical competence

Table 1: After teaching, the scores of professional and technical abilities (analysis of tumor clinical characteristics, target area outlining, ability to formulate radiotherapy plan and evaluate the plan) were higher in group B than in group A. $P < 0.05$.

Table 1. Professional and technical competencies (false, points)

Groups	Number of examples	Ability to analyze clinical characteristics of tumors	Target Area Sketching Capability	Ability to develop radiotherapy plans	Assessing program capacity
Group A	45	83.11±2.21	84.24±2.71	84.27±2.25	85.29±3.09
Group B	45	89.11±3.28	88.02±3.04	88.51±2.58	89.69±3.05
t-value		-10.172	-6.225	-8.314	-6.800
P-value		0.000**	0.000**	0.000**	0.000**

3.2 Teaching satisfaction

Table 2: After teaching, total satisfaction with teaching was higher in group B than in group A. $P < 0.05$.

Table 2. Teaching satisfaction [Example (%)]

Groups	Number of examples	Very happy	Dissatisfied	Unsatisfactory	Total satisfaction
Group A	45	11(24.44)	21(46.67)	13(28.89)	32(71.11)
Group B	45	17(37.78)	25(55.55)	3(6.67)	42(93.33)
χ^2 -value					7.601
P-value					0.006

4. Discussion

In recent years, with the rapid development of information technology, digital teaching tools have been widely used in the field of medical education. 3DBody software, as a powerful three-dimensional medical visualization software, is able to display human anatomy in a three-dimensional and dynamic form. Through this software, students can observe the spatial position of the tumor and its surrounding tissues in an all-round and multi-angle way, and understand more intuitively the key knowledge of the tumor's growth and proliferation pattern as well as the dosage distribution in the process of radiotherapy. At the same time, the online-offline hybrid teaching mode can make full use of the rich teaching resources online and meet students' individualized learning needs due to the integration of the flexibility of online learning and the interactive advantages of offline teaching.

The results of this study showed that the scores of professional and technical abilities (analysis of tumor clinical characteristics, target area outlining, formulation of radiotherapy plans and evaluation of plans) of Group B were higher than those of Group A, suggesting that compared with traditional teaching, the adoption of online-offline hybrid mode based on 3DBody software in radiation oncology teaching is conducive to the improvement of the professional and technical abilities of the interns. The reason for this may be that 3DBody software displays the human anatomy with 3D models, and interns can observe the positional relationship between the tumor and its surrounding tissues from all angles, which plays a key role in accurately analyzing the clinical characteristics of the tumor and accurately outlining the target area. Based on 3DBody software, the online-offline hybrid mode breaks the time and space limitations of traditional teaching and provides an immersive learning environment for interns. Online, interns can use the software for independent learning at any time, repeatedly observing complex anatomical structures and simulations of radiotherapy processes; offline, under the guidance of the teaching staff, they combine the knowledge in the software with actual operation by combining clinical cases. This immersive learning experience allows interns to gradually become proficient in the skills of developing radiotherapy plans and evaluating plans through continuous practice and reflection .

The results of this study show that after teaching, the total satisfaction of teaching in group B is higher than that in group A. This suggests that compared with traditional teaching, adopting the online-offline hybrid mode based on 3DBody software in the teaching of radiation oncology is conducive to improving the satisfaction of teaching of interns. The reason may be that traditional teaching relies on two-dimensional pictures, text explanation and simple models, which makes it difficult for students to understand the complex anatomical structure of radiation oncology and the spatial relationship between tumors and surrounding tissues. The 3D model display of the software can present the human anatomy, tumor parts and surrounding tissues and organs to the interns in a three-dimensional and dynamic form, which makes the knowledge more acceptable and thus enhances the interns' interest in and satisfaction with the teaching content. Under the blended teaching mode, the online part of the students can independently learn the content in 3DBody software according to their own time and learning progress, repeatedly watching the anatomical structure demonstration, radiotherapy plan simulation, etc. . For interns who are slower to understand, they can review complex knowledge points several times, while those who have the ability to learn can expand their learning to learn more relevant content, and this personalized learning experience leads to a higher level of interns' satisfaction with the teaching.

5. Conclusion

In conclusion, compared with traditional teaching, adopting the online-offline hybrid mode based on 3DBody software in radiation oncology teaching is conducive to improving the professional and technical ability of interns and enhancing the satisfaction of teaching, which has the value of clinical promotion and application.

References

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