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The Effect of Using Virtual Reality Method on the Learning Practice of Suturing Procedure in Students of Surgical Technology

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Abstract--- *Virtual system training is one of the new methods of skill training. Virtual reality technology has been used since several decades ago in various job training programs, including surgery. This study aimed to evaluate the effect of using the virtual reality method on the level of learning suturing practice in operating room students of Isfahan University of Medical Sciences in 2019. In this quasi-experimental study, 64 operating room students of Isfahan Nursing and Midwifery Faculty were randomly assigned into two groups of traditional training (n=32) and virtual reality training (n=32) after obtaining their written consent. Data were collected through a researcher-made checklist (suturing practice), used after confirming its content validity and reliability. Data were analyzed through SPSS 16 software using descriptive and analytical tests with a significance level of p<0.05. The mean scores of learning suturing practice were 10.44±2.03 in the traditional group and 9.87±3.20 in the virtual reality training group. There was no significant difference between the traditional training group and the virtual reality training group after providing the training (p=0.05). Although the mean scores of learning the suturing practice were the same in both training methods, it seems that applying virtual reality training along with traditional training can have a significant role in improving students' suturing practice learning and reducing educational costs.*

Keywords--- *Virtual Reality, Learning, Suturing Students of Surgical Technology.*

I. INTRODUCTION

Learning is considered as a vital component of the curriculum in medical education and plays a major role in developing students' professional capabilities and competencies [1,2]. Some skills are required to achieve high standards in surgery. These skills need to be measured and assessed, such as mastery of a scientific basis, decision-making power, communication skills, and so on. However, there are some skills that their assessment is more difficult, such as skills in the techniques and applied methods. These skills are acquired through experience [3]. Along with the development of technology, training surgical and health care skills changed and acquiring the surgical skill through traditional and practical approaches is no longer useful and effective. It is not possible to gain adequate experience in the surgical skills without being exposed in the real situation, due to human and ethical considerations [4-6].

Simulation has recently played a major role in surgical training. In this approach, students can gain practical

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knowledge and experience in safe and risk-free conditions in a low-stress environment and able to correct functional errors [7]. Virtual reality (VR) technology approach includes a wide range of domains and is a combined (human-machine) interface that produces computer simulation and interaction by integrating a variety of components such as computer graphics, image processing, pattern recognition, artificial intelligence, audio systems, and network and its provides the sense of a real setting for user through the various sensory feedbacks such as visual, auditory, tactile, etc. [8,9]. In this new technology of the graphical environment, the user not only feels the physical presence in the virtual world but can also constructively interact with that environment.

Results of the studies suggest that the use of virtual reality as a new tool in types of rehabilitation, neuroscience treatment, and psychiatric disorders such as pains, stresses, fears, and common anxieties and modern medical trainings such as surgery has drawn much attention. Thus, it plays now a major role in medical, psychiatric and other fields [10,11]. Many studies have been conducted on the effectiveness of using virtual simulation systems such as virtual reality, which include a 360-degree video recording of educational content along with the use of virtual glasses. It places the student in the educational setting and improves the student learning performance [12-14]. However, in skills training, the traditional method is still used by teachers and colleges and educational institutions by the educators. The question asked here is: what is the effect of this method on education and which of them is more effective in learning the skills, and if virtual training can be a good alternative to traditional education. This study aimed to evaluate the effect of using virtual reality methods on the level of suturing practice learning in operating room students of Isfahan University of Medical Sciences in 2019.

II. METHODOLOGY

This study is a quasi-experimental study conducted at two stages. Using two methods of traditional training method and virtual reality training method, it examines the effect of the dependent variable of the training method on suturing practice learning. All students who had completed this course between semester 1 and semester 4 of the operating room in the Faculty of Nursing and Midwifery of Isfahan University of Medical Sciences in 2018-2019 (64 students) were included in the study as the first a sampling using Convenient Sampling method. Then, they were randomly assigned to traditional and virtual training groups. Inclusion criteria included studying in the Faculty of Nursing and Midwifery of Isfahan University of Medical Sciences, studying in the operating room field of study and willingness to participate in the study. Exclusion criteria also included being absent in training and test session.

Training content included one 2-hour training session of 4 types of suturing (simple, far & near, subcutaneous, continuous) on the calf's leg practically for the traditional group in the nursing and midwifery clinical skills class. Accordingly, 4 types of sutures were individually trained on a 10-cm cut with 2/0 nylon yarn classically in the practice room. In the virtual reality group, the videos of these 4 sutures were recorded by a panoramic or 360-degree camera and it was processed special computer software and it was provided for students. They could watch the video by installing this app in their mobile and through a virtual glass placed on their eyes as a headset. The training session was also 2 hours in this group. Moreover, adequate time was considered to answer the students' questions and resolving the ambiguities on the procedure during a session. After the completion of one training session, data were collected in two groups during the suturing technique. The data were collected through a researcher-made

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checklist consisting of 20 two-option questions (correct and incorrect suturing practice). It was used after confirming the content validity and reliability (Cronbach's coefficient of 91%). The suturing practice learning scores were calculated based on 20. The students enrolled in the current research unanimously. The data were analyzed by SPSS ver.16 using descriptive and analytical statistics (Chi-square, independent t-test,Levene's test, and Kolmogorov-Smirnov tests) at a significance of 0.05.

III. RESULTS

A total of 64 students participated in the study, 32 of whom were included in the traditional training group and 32 were included in the virtual training group. In this study, 29 of the participants were female (45.3%) and 35 were male (54.7%). The age range of students was 19 to 26 years. The results revealed that gender and age there was no significant difference between traditional training and virtual reality training methods (p> 0.05) (Table 1, 2). The results revealed that 16 students were in the second semesters and 16 were in the fourth semesters. The results revealed that semester there was no significant difference between traditional training and virtual reality training methods (P >0.05) (Table 3). Mean and standard deviation of suturing practice learning scores in the two groups of traditional training and virtual reality training were 10.44 ± 2.03 and 9.87± 3.20), respectively**.** The Levene's test showed that there is homogeneity of variance between the two groups of traditional training and virtual reality training (P> 0.05). The results of the independent t-test showed that there was no significant difference between traditional training and virtual reality training methods in terms of the score of suturing practice learning (P> 0.05) (Table 4).

Table 1: Determination and Comparing the Age Average Distribution in Two Groups

Age / ***Group***	***Mean***	***Standard Deviation***	***T***	***P Value***
Traditional training	22.21	1.4969	0.864	0.434
Virtual training	22.43	1.4333		

Table 2: Determination and Comparing Frequency Distribution Gender in Two Groups

Sex / ***Group***	***Number***		***F***	***P Value***
	Male	***Female***		
Traditional training	19	13	0.044	0.965
Virtual training	16	16		

Table 3: Determination and Comparing Frequency Distribution Student Semester in Two Groups

Student semester / *Group*	*Student semester*		*F*	*P Value*
	The second(N)	*The fourth(N)*		
Traditional training	16	16	0.044	0.965
Virtual training	16	16		

Table 4: Determination and Comparison of the Mean Score of Suturing Practice Learning between the Traditional Training and Virtual training Groups

The mean score of suturing practice learning / **Group**	**Mean**	**Standard Deviation**	**T**	**P Value**
Traditional training	10.445	2.03	0.831	0.404
Virtual training	9.871	3.20		

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IV. DISCUSSION

This study aimed to evaluate the effect of two methods of traditional training and virtual training on learning suturing practice learning of students in the operating room of Faculty of Nursing in Isfahan University of Medical Sciences and compare these two methods. The results suggest that there is no significant difference between the mean scores of the traditional training group and the virtual reality training group, which means that the virtual reality training is similar to traditional training. In other words, students who received virtual reality training showed suturing practice similar to students received traditional training. In addition, operating room students have a high level of stress when participating in critical surgeries, leaving a negative impact on their self-efficacy [15]. Moreover, some of the medical training activities of the operating room students are unique and cannot be trained at any time, as they are associated with some disadvantages of high cost, risk, time-consuming, unethical or infeasibility [16]. Hence, given the similar practice learning in virtual reality training and traditional training and the goal of adopting new technologies that is facilitating the process of learning and improving the practice [17], virtual reality training can be used instead of traditional training and expensive, risky, time-consuming trainings to stimulate the learning in the practical setting and make the learning inexpensive, safe, and ethical.

In line with the results of the present study, the results of the study conducted by Nourian et al to compare the two virtual and traditional training methods in teaching a theoretical community-based dental course for dentistry students showed that there was a significant difference between students of traditional teaching method and students of virtual training method in terms of their level of knowledge in the theoretical community-based dental course. The virtual training method could achieve its main goals of developing a positive attitude in students and satisfying them with community-based dentistry issues, so it can be used as an alternative method in dental faculties of Iran by providing educational facilities and conditions [18]. Thus, its results are in line with that of our study. In a study conducted by Dehghan and Ghadami, the effect of the video displaying before craniotomy surgery on self-efficacy and stress of operating room students in Isfahan University teaching hospitals was evaluated on 50 students clinically in two stages. The data collection tool included two researcher-made questionnaires of the Perceived Stress Standard Questionnaire (PSS) and the Scherrer Self-efficacy Questionnaire. With regard to the test group, data were collected before video displaying and after surgery. The surgery video was displayed to the test group students in the morning of the surgery in coordination with the person in charge of the operating room. This 25-minute training video displayed all the surgical procedures and techniques as well as the tools needed. The results revealed that there was no significant difference between the two groups in terms of gender and semester frequency distribution and mean perceived stress scores in the virtual training group "through video display" were significantly lower than those in the traditional training group, indicating the effectiveness of the virtual training method [15].

Moreover, the results of the research conducted by Azizi et al. (1) to compare the effect of virtual training method with lecture on students' learning in oral and maxillofacial diseases course and their satisfaction with their study revealed that virtual training method improved the learning, but satisfaction was not significantly different between the two methods [19]. Usman et al. [1] conducted a study entitled "The effect of virtual reality training on the motivation and learning skill of medical students" among 87 fourth-year medical students from three public colleges and five private medical colleges. Laparoscopic surgery was selected in consultation with senior medical

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consultants for this test. The tested cases were organized based on virtual reality (comprehensive technologies and video) and text-based training. In the end, participants completed a questionnaire on motivation for learning and learning competence through various media. A significant difference was reported between the level of motivation and learning through virtual training methods (comprehensive technologies and video) and text-based learning, and most students reported that the video-based virtual training was more effective than other training methods [20]. In a study entitled "Evaluation of the effect of virtual reality simulators in laparoscopic surgery training", Yiannakopoulou et al. [1] stated that it does not seem that training of virtual reality simulators on the acquisition of basic surgical skills to be different from the effect of physical simulators. In other words, the acquisition of surgical skills by both methods is similar, so they stated that virtual reality simulation training is an alternative method for improving the practice of laparoscopic surgery [21-25]. In the study carried out by Bruno et al. [26] to evaluate the virtual reality simulators and clinical training in surgery, the first group consisted of 25 first-year general surgery students and the second group consisted of 25 second-year general surgery students. These students received standard surgical trainings. However, second-year surgery students received more clinical trainings. During the nine months before the study, these students could improve their laparoscopic skills at a virtual reality center. The standard for this training had been defined to be 72 hours. Finally, students were invited to perform laparoscopic cholecystectomy three times in accordance with standard protocol under the supervision of a simulator instructor and the best performance according to the defined indicators was considered as an evaluation criterion. Based on the amount of time required to acquire skills and complete one academic year, the data were analyzed. The results showed that virtual reality training is as effective as acquiring operating room skills, so virtual reality training is very useful in enhancing patient safety and improving the students' skills [27, 28].

In a study entitled "using simulation to achieve laparoscopic suturing skills", Dehabadi et al. [29] reviewed 68 articles related to this topic. They stated that simulation is an effective method for training laparoscopic suturing and the skills acquired by this method can be successfully transferred to the operating room setting. They introduced simulators as a smart tool for assessing trainees' skills. Finally, they stated that questions such as the effect of type of simulators on training and the way of integrating current trainings with simulator-based trainings have remained unanswered and need to be investigated [30, 31]. The results of the present study are in line with those of this study and suggest that virtual reality training is better or more effective than other methods. Hence, it seems that using virtual reality training along with other trainings can help operating room students perform better. However, given the high cost of providing simulation equipment and the need for proper cost management in training centers, it is necessary to conduct the needed studies on the outcomes of using different types of training. Moreover, based on the effect of different types of stimulators, necessary steps need to be taken to prepare them and provide for the students. This study suffers some limitations, including the small sample size and individual differences in the use of educational content and software. According to the results of this study, it is recommended to use virtual reality training in teaching the operating room students.

V. CONCLUSION

The present study showed that the efficiency of training suturing through the virtual reality training method was similar to that of the traditional training of suturing. In other words, virtual reality suturing training was as effective

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as traditional suturing training. Thus, applying this method along with other training methods can have a significant role in improving the suturing learning performance of students.

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