Clinics in Surgery

Prospective
Published: 24 Dec, 2018

Suture and Knotting Training for Young Doctors: A Prospective Randomized Study

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Objectives

Training in suturing and knotting is one of the firsts practical challenges young doctors must face. Nowadays, with the technological progress, the alternatives in this domain are more and more innovative and we have tried to propose a low-budget efficient alternative in comparison to the latest VR and digital simulators [1-5]. We have organized this prospective study to evaluate the skills developed by the students who utilized our simulator, trying to integrate the level of practical formation in our university.

Materials and Methods

The Suture & Knot trainer is a surgical simulator which makes possible to train in executing sutures and knots both in surface and in depth using plastic cylinders of different diameters, also taking into account the strength utilized to knot, thanks to the simulator of tension. Moreover, the knotting station can be removed to hold a suture pad specifically created using a specific silicon mixture, which tried to recreate the cutaneous/subcutaneous rapport (Figures 1-3). Our analysis is based on the data collected between November 2015 and September 2018 during the courses "Materiali e tecniche di sutura ed annodamento" organized at the University "Federico II" of Naples. The participants were 452 selected among senior students in med school, newly graduated doctors, and young specialist trainees. They were divided randomly into 2 groups of 226 (158 students, 55 newly graduated doctors and 13 specialist trainees) participants each. The specialist trainees were all from their first year in different surgical specializations.

Both groups were stratified taking into account their level of instruction (Table 1), thus obtaining two homogenous groups.

Everyone has assisted to one 3 hours long theory lesson and, later on, they've practiced for further 9 hours.

During the practical phase, group A utilized simple devices already present on the market, which didn't have neither simulators of depth nor the simulator of tension, both prominent features of the Suture & Knot trainer simulator; while group B used our device. All the participants have learned the following skills: Simple knot, surgical knot, one-handed knot, simple stitches, McMillan-Donati stitches, continuous suture and intradermal continuous suture.

Both groups attended the same theoretical lesson, followed by practical lessons with a standardized program, established beforehand by general surgery professors in our university.

The different skills, possessed and developed by the apprentices, were evaluated by 3 different surgeons, all professors at the university, employing the following parameters represented by a continuous line from zero to five points: grade of tension on the wound, symmetry in bite, symmetry in gap and juxtaposition of the margins; time of execution was also measured and compared. The assessment has been performed at the beginning (T0) and at the end (T1) of the practical lessons. Statistical analysis was performed using t-Student test with a significancy level $\alpha=0.05$: the differences between the two groups were statistically significant in each item we explored during the study.

Results

The scores of the two groups were similar at the beginning (A:5.7 pts *vs.* B:5.5 pts) (Image 1): group B has showed more growth in speed both in knotting(average time A:6 sec *vs.* B:3.9 sec) and in sutures(average time A:6.2 min *vs.* B:4.3 min) (Image 2); moreover it has shown higher quality results at T1 (A:11.8 pts *vs.* B:16.5 pts) (Image 1). Also, group B showed better results in each and every quality item analyzed (Image 3). The confrontation between the results at T0 and T1 has

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Received Date: *10 Dec 2018*
Accepted Date: *20 Dec 2018*
Published Date: *24 Dec 2018*

Citation:
De Werra C, Cardone R, Autorino G, Miranda L, Galloro G. Suture and Knotting Training for Young Doctors: A Prospective Randomized Study. Clin Surg. 2018; 3: 2271.

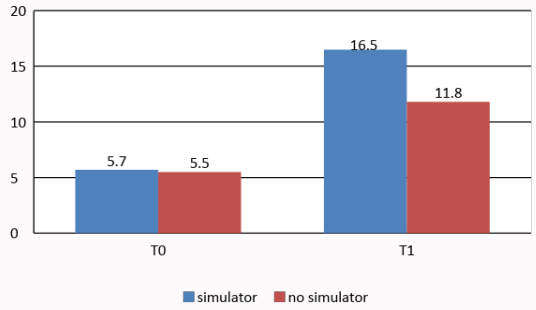

Image 1: Score of the two groups at T0 and T1.

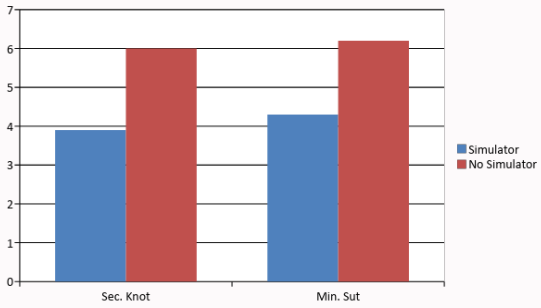

Image 2: Time to perform Knot and sutures.

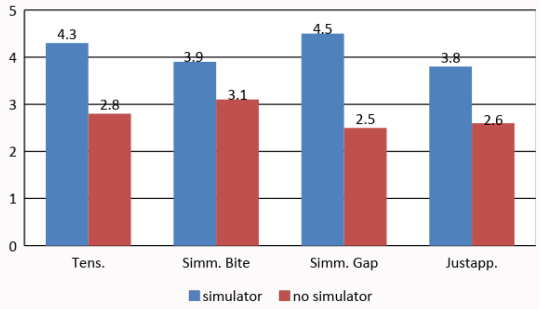

Image 3: Specific score between 2 groups.

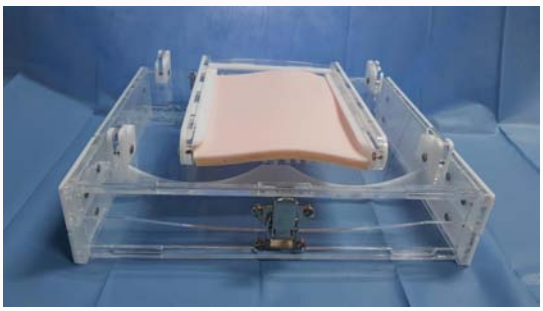

Figure 1:

demonstrated a greater development for group B (score T1 - score T0=11 pts for group B *vs.* 6.1 pts for group A), without significant differences among students, doctors and specialist trainees.

Conclusion

The utilization of the Suture & Knot trainer guarantees better results in learning the basic suturing and knotting skills, independently from the basic level of knowledge and skills. This device is thus an

Figure 2:

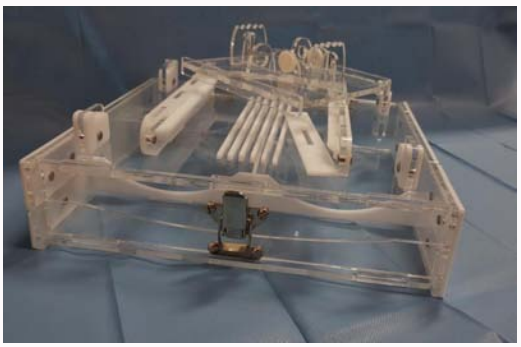

Figure 3:

Table 1: Composition of the 2 groups.

	Group A	Group B
Average Age	23 (21-27)	22 (20-28)
Students	79	79
Newly graduated doctors	28	27
Specialist trainees	6	7

helpful instrument in the young doctors' formation, giving them the chance to acquire the necessary skills of the basic surgery. It should also be noted that dedicated courses for senior students should be organized during med school [5-16]. It is because of these promising results that we're already working on a Suture & Knot trainer 2.0, with new telescopic cylinders and an electromagnetic tension simulator.

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