Proposal of a synthetic ethylene-vinyl acetate bench model for surgical foundations learning. Suture training[1]

Modelo de bancada sintético de etileno vinil acetato para a aprendizagem das bases da cirurgia. Treinamento de suturas

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ABSTRACT
Due to ethical and legal aspects involved in the handling of cadavers and animals the synthetic simulators are an alternative for learning how to suture technique plus the practice of various procedures such as incision and surgical flap. In this context, this paper describes and propose the use of a synthetic model manufactured from plates of ethylene-vinyl acetate (EVA) to teach primary surgical skills in medical students with no previous exposure to surgery. The model that provides the convenience of being easily reproducible, allowing the students in training can thus improve their skills before applying the technique in clinical practice.
Key words: Education, Medical. Students, Medical. Teaching. Surgery. Sutures.

RESUMO
Devido aos aspectos éticos e legais envolvidos no manuseio de cadáveres e animais, os simuladores sintéticos surgem como alternativa para o ensino-aprendizagem de técnicas de sutura e simulação de procedimentos, como a confecção de incisões e retalhos cirúrgicos. Neste âmbito é proposto e descrito um modelo de bancada sintético confeccionado a partir de etileno vinil acetato (EVA) para o ensino de habilidades cirúrgicas básicas, em estudantes de medicina sem exposição prévia a cirurgia. O modelo fornece a praticidade de ser reprodutível, barato e de fácil aquisição, possibilitando que o acadêmico em formação possa, portanto, aperfeiçoar suas habilidades antes de aplicar a técnica na prática clínica.
Descritores: Educação Médica. Estudantes de Medicina. Ensino. Cirurgia. Suturas.

Introduction

Due to ethical and legal aspects involved in the use of cadavers, experimental animals, and real patients, for training purposes, coupled with the high cost and difficulties in obtaining virtual reality training models, the teaching of surgical techniques necessary for the education of physician has become extremely difficult[1-4].

Synthetic bench models were developed as an alternative for teaching surgical instrument techniques, learning how to suture technique plus the practice of various procedures such as small excisions and surgical flap during medical training[1,5-7]. To this end, there is a plethora of synthetic materials available such as latex forms, surgical gloves, polyurethane cartons, subcuticular suturing models (Simulab Corp®), tissue suture pads (Simulab Corp®) and Allevyn (Smith-Nephew®)[3,6].

This form of teaching is designed with the student´s needs in mind[8] with chief aim of preparing students before exposure to clinical practice[3,5]. To achieve this goal, these inanimate simulators offer a series of benefits, such as stress reduction while learning, and an opportunity for organized repetitive practice, compared to the real world situation of learning strictly by observation. In addition, errors in execution of the maneuvers are harmless, whereas learning by one´s mistakes in this way would be unthinkable in the clinical setting[1-3,7,8].

Against this background and seeking a low cost model, simple, versatile, practical, portable, and reproducible, in 2008, was introduced a model made from plates of Ethylene-Vinyl Acetate (EVA) into classes on practical surgical techniques, in the Course on Clinical Surgery of the School of Medical Sciences at the University of Marilia, State of Sao Paulo, Brazil.

The purpose of this study was describes and propose the use of EVA as a learning tool for simple surgical techniques, principally in teaching suturing techniques in medical students.

Preparation of the synthetic bench for teaching of incisions and suturing techniques

EVA plates of 4mm were purchased from handcraft shops. The model was made by marking out a spindle with a ball point pen. Subsequently, the students used a scalpel to make an incision on the mark. It is important to do this with a piece of wood or other firm material held behind the EVA, in order not to cut or scratch the bench surface. These incisions for the removal of the EVA should be made no further than 0,5 cm from the border, in order that the edges of the newly created "wound" will come together without any significant tension, which could tear the EVA (Figure 1).

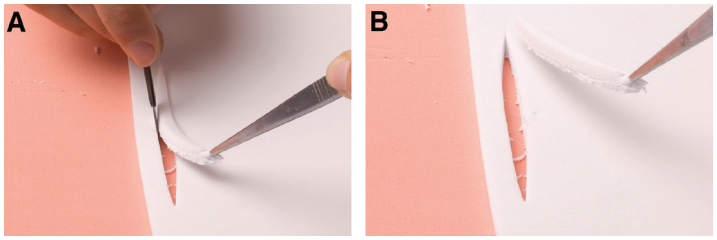

FIGURE 1 - Model for the learning of sutures. Preparation of the wound with a scalpel near the model's edge.

The handling of the scalpel offers to teach the correct way to handle the instrument, its position with the "skin" (relationship of the angles) and the way of the cut (firm and no movements of "aliasing").

In this manner, the students create a 'wound" which allows for the practice of different types of interrupted sutures using mononylon 4.0 with a 2.0 cm needle (the most suitable for our model). The possible sutures are: simple interrupted sutures, horizontal mattress sutures, vertical mattress sutures, half-buried mattress sutures and subdermal interrupted sutures. The model also allows to perform running sutures such as running simple suture, running locked suture and running subcuticular suture (Figure 2).

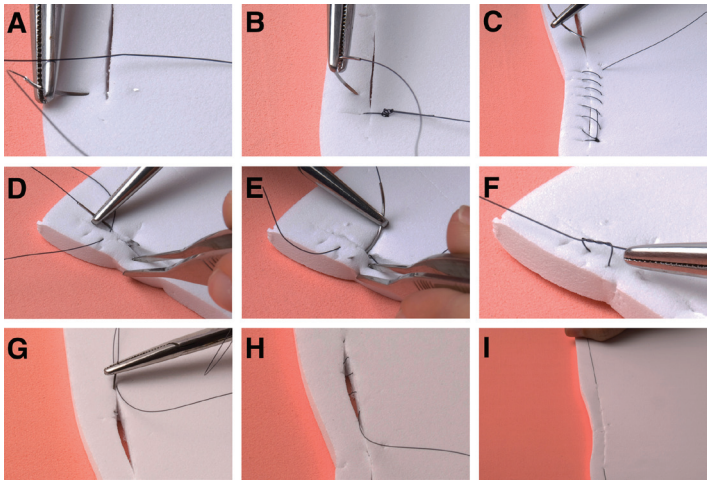

FIGURE 2 - Model for the learning of sutures. (**A-C**) Running simple suture. (**D-F**) Half-buried mattress suture. (**G-I**) Running subcuticular suture.

During the teaching-learning technique is explained on the advantages and disadvantages of each suture and concepts about choosing surgical thread. It also emphasizes the correct use of rat tooth forceps and proper movement of the needle (following its curvature).

Bench model's use for the surgical flaps teaching

This model also provides an excellent simulation of surgical flap. During the simulation, the defects are hypothesized and the flap planned, always following guidance schemes. Squares of approximately 10 to 15 cm are made with 2 mm EVA plates. After that, the injury and the flap are designed and then incised. After the flap's elevation, its movement is made to cover the defect produced. Strategic simple interrupted sutures can be made to show the effects as seen in Figure 3. With the EVA, the flap's are easily performed, which makes it easier for the students to grasp the process.

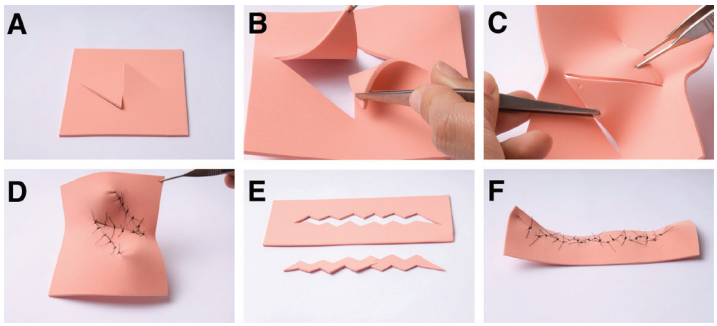

FIGURE 3 - Model simulating z-plasty. (**A**) Incision. (**B**) Flap's transposition. (**C**) Edges approximation to carry out the sutures (**D**). (**E**) Model showing one w-plasty with resection of the supposed defect and (**F**) edges approximation after suture.

Discussion

The ability to suture technique is essential in the training of a general practitioner and should form part of the arsenal of all physicians as it has important implications for good patient care[6]. It is the cornerstone upon which all surgical techniques are based[1,3,5,9]. In spite of its importance, a high level of expertise is not attained by a large proportion of students during medical school[3,9], and best patient care can only be obtained by teaching and experience[6]. Training based solely upon observation, without active and practical participation, is relatively inneffective[8]. However, there is still no consensus on an ideal model for the teaching of these skills[6,8].

In this context, the principal focus of this study was to propose the use of a new model made of EVA plates to initiate medical students in suturing techniques. To the best of our knowledge this is the first report of EVA use for this application.

The advantage of using an EVA model is that it is inexpensive (a 50 x 60 cm plate costs around 4 dollars - 750 cm^2/dollar). This material is readily available in most countries, is practical, portable and easy to use. Given these characteristics, the student can use EVA at home as many times as necessary and bring it to classes to discuss any doubts or difficulties with the professor. Indeed, the students showed great interest and reported how enjoyable was to work with this model. One characteristic of the material, which could be deemed as a potential problem (it can easily tear), appears in fact as an advantage of our model, because tearing only occurs when the student makes a wrong movement by either not following the needle curve or in applying excessive force. This characteristic can actually serve as an important feedback mechanism for perfecting techniques.

The Global Rating Scale, previously validated[10,11] and adapted for surgical application[12] can be used to evaluate the performance (acquisition skills) of each student.

Another advantage of the EVA model is that the sutures are done in three dimensions, and thus a subcuticular running suture, half-buried mattress suture, subdermal interrupted suture as well as Donati and Allgower, can all be learned on this material, as is shown in Figure 2. This capability is one of the features which set the material apart from other equally inexpensive materials such as surgical gloves or a frame. EVA is also lower cost than others three-dimensional models such as the subcuticular suturing model, from Simulab Corp® (approximately 45 dollars each piece measuring 10.5 x 10.5 cm – 2.45 cm^2/dollar) which is also very difficult to acquire in many countries of the world.

Subjectively, we noted that all the students who had previous experience with the EVA were easily able to perform small surgical procedures on patients under supervision of a professor. Training using the model boosted student confidence and improved their manual dexterity. This renders any contact with the patient, often rare, extremely productive. The literature presents evidence that skills learned on a surgical bench can lead to better performance by the students on cadavers, animal models, and in the operating room[2,4,13-15]. These studies also demonstrate that for beginning surgical trainees, the manual dexterity and knowledge obtained using cheaper models with little resemblance to real tissues can be as effective as training done on expensive models with closer fidelity to real life situations, or on virtual reality models[7].

Conclusion

The ethylene-vinyl acetate model is practical, reproducible, portable, extremely low-cost, readily available, and also enables the teaching two and three-dimensional suturing techniques, thus allowing medical students to perfect their suture abilities before applying them in a clinical setting.

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