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If lives gives you tomatoes, training microsurgery

Se a vida lhe der tomates, treine microcirurgia

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ABSTRACT

Objectives: *Develop a training model using tomatoes to acquire ophthalmic microsurgical skills.* ***Methods:*** *Two species of immature and mature tomatoes (long life and cherry tomato) were used. A 0.5cm radius circle was delimited with a permanent marker. Under a magnification by a video system, the peel was separated, trying to avoid damaging the fruit. After dissection, it was performed the raffia of the peel with 10-0 mononylon thread.* ***Results:*** *The models used proved to be viable for training in microsurgical dissection, regardless of the species. The average cost of each simulator was less than U$ 1.00. The average dissection time was 10.40 ± 1.84 minutes for ripe tomatoes and 15.20 ± 2.25 minutes for greens. Only in immature tomatoes was it possible to make the raffia.* ***Conclusion:*** *The training model developed proved to be suitable for the initial training of many ophthalmic skills. In addition, it has a low cost and is easy to purchase and manufacture.*

Keywords: *Microsurgery; Ophtalmologic surgical procedures; Simulation training; Dissection*

RESUMO

Objetivo: Desenvolver um modelo treinamento utilizando tomates para aquisição de habilidades microcirúrgicas oftalmológicas. **Métodos:** Duas espécies de tomates (Tomate longa vida e cereja) foram utilizados, sendo utilizados tomates verdolengos e maduros. Delimitou-se com marcador permanente um círculo de raio de 0,5cm. Sob magnificação de um sistema de vídeo, foi realizado a separação da casca, tentando evitar lesionar a fruta. Após a dissecção, foi realizado a rafia da região removida com fio de mononáilon 10-0. **Resultados:** Os modelos utilizados mostraram-se viáveis para a realização do treinamento de dissecção microcirúrgica independente da espécie. O custo médio de cada simulador foi de menos de R$2,00. O tempo médio de dissecção foi de 10,40 ±1,84 minutos no tomate maduro e 15,20 ±2,25 minutos no verdolengos. Apenas nos tomates verdolengos foi possível realizar a rafia. **Conclusão:** O modelo de treinamento desenvolvido mostrou-se adequado para o treinamento inicial de várias habilidades oftalmológicas. Além disso, apresenta um baixo custo e fácil aquisição e confecção.

Descritores: Microcirurgia; Procedimentos cirúrgicos oftalmológicos; Treinamento por simulação; Dissecação

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Introduction

Since the 19th century, surgeons' training is based on the maxim "see one;, do one". Student or residents are firstly introduced to a situation and after a brief lecture, the practice can be carried out.[1-4] This training model has several advantages, however, it seriously injures the patient-safety principle, since training surgeons low experience is associated with longer hospital stay, complications, morbidity and mortality.[2-6]

Surgical activities within ophthalmology require large learning curves, since the approached anatomical structures are very fragile and small, in addition to a need for training in micro-surgical microscope.[7,8] Therefore, it is important highlighting the importance of simulators to ensure respect for patients' safety.

Several simulation systems were recently introduced in large training and education centers due to advances in new technologies.[4,5,8] However, several training and education centers cannot adapt to the new technologies due to high cost with infrastructure and microsurgical instruments; therefore, they end up returning to the traditional system.[9-11]

Thus, the aim of the current study was to develop an economically viable model for initial microsurgical training in ocular structures based on using tomatoes as training models in order to overcome the aforementioned limitations

Methods

Experimental cross-sectional research. The Brazilian legislation on the use and breeding of animals was followed (Law n. 794/08). The Animal Ethics Committee has assessed the research protocol and granted it "exemption" for evaluation since the research did not directly use animals.

Two tomatoe specimens were used in the experiment: 1) garden tomato (Solanum lycopersicum L.) and 2) cherry tomatoes (Solanum lycopersicon L. var. cerasiforme). They were acquired at local supermarkets and kept in airy environment until the beginning of the study. Ten units of each species were used (5 green and 5 ripe). Each tomato was fixated on surgical board with adhesive tape. A 0.5cm radius circle was drawn in the tomato with the aid of permanent surgical marker. Tomato peel removal was made at video system magnification and such an attempt aimed at not damaging the fruit. Conventional microsurgical scissors and tweezers were used in the protocol.

The operated area was sutured with 10-0 nylon after peel removal. Four simple knots were initially made in the cardinal points and four more knots were made between the existing ones. Figure 1 summarizes the steps set to the proposed training.

Microsurgical training was performed in video magnification system[9,10], which consisted of a Sony© Handycam HDR-XR160 camera connected to a 55 'Curve Full HD TV through HDMI cable. Two fluorescent light sources were set near the surgical board in order to provide adequate lighting to the operating field. Two surgeons - with more than 5 years of experience in video microsurgery - performed the surgical procedure.

The assessed parameters were: 1) Model making time; 2) Dissection time; 3) Circle perfection; 4) Pulp peel area, calculated in ImageJ© software to assess e total area and pulp area. Microsoft® Word and Excel software were used for data assessment, graph plotting and photo editing.

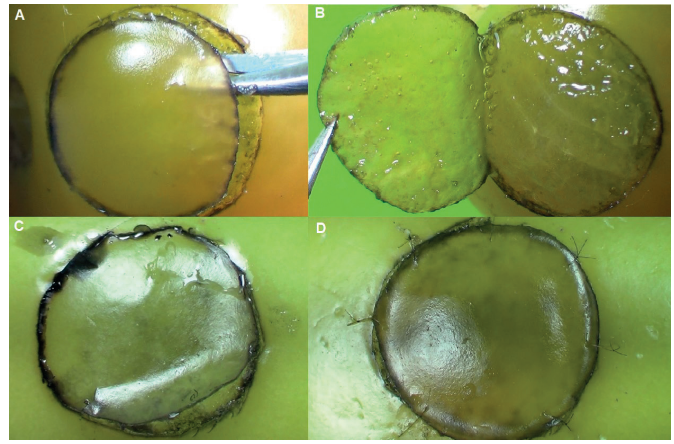

Figure 1: Training steps. A. – Peel dissection. B. Peel release. C. Peel positioning. D. Sutured peel

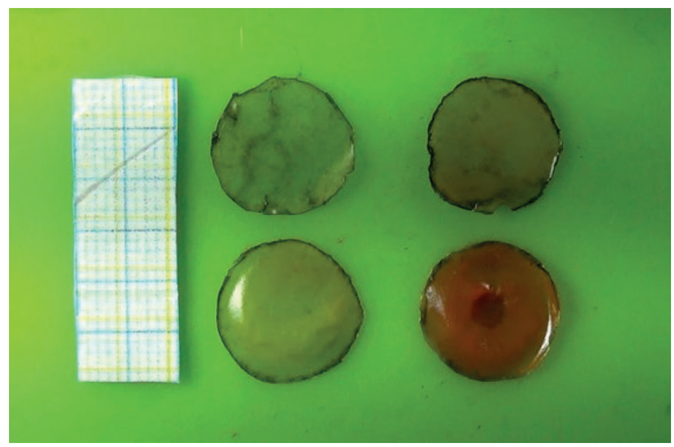

Figure 2: Peels dissected under video magnification

Results

The used models were viable for microsurgical dissection training, regardless of their species or ripeness. The mean cost of every simulator was less than R$2.00. The mean dissection time was 10.40 ±1.84 minutes in the ripe tomato and 15.20 ±2.25 minutes in the green ones.

It was possible to perfectly dissect the peel flap in the desired shape regardless of tomatoes' species or ripeness (Figure 2). However, the mean flap area with pulp on accouonted for 1% in ripe tomatoes and for 2% in green tomatoes, in both species.

It was not possible suturing ripe tomatoes because there were tears in the peels during the knot making; therefore, it was only possible there were tears simulating knot making, but, knots could not be tight. It was possible suturing the green tomatoes - reported mean suture time was 24.64 ±4.88 minutes.

Discussion

Ophthalmology residents who were trained in simulators reported shorter surgical time, learning curve and less intraoperative complications.[12,13] Such outcomes highlight the importance of training in safe environments before practicing in humans.

The current training model is cheap and can be easily purchased in comparison to pig eye – the most used training model.[14] In addition, video magnification system using reduces initial costs for training centers and allows training outside workplaces, which reduces contamination caused by organic material using.[10,15]

The current model is viable for both training and keeping track of skills, since it is possible using closed parameters (dissection time, circle perfection, peel area with pulp) to confirm skill learning. It is possible establishing a cut-off that allows ophthalmologists' training to advance from simple to complex or to allow future practice in humans.

Green tomatoes reported greater pulp adherence to peel than the ripe ones; therefore, it is the most advanced model regarding differences between different ripeness stages. Based on the current model, the peel corresponds to the cornea, whereas fruit pulp is the aqueous humor. Therefore, greater adherence requires more delicate and accurate movements in order to avoid damaging the pulp.

It is also important highlighting that it was possible suturing the peel and simulating cornea suture making only in green tomatoes. This procedure reinforced the highest degree of difficulty and the wide variety of techniques applied to simulations ed in this training model. This training is very important because it simulates knot making, which isthe biggest difficulty gaced during initial microsurgical training.[16]

Cherry tomatoes diameter (14.85 mm)[17] is similar to that of eye bulb (14.85 mm)[17], whereas garden tomatos are larger (approximately 52.66mm in diameter)[19] Garden tomatoes are adequate to initial training, whereas cherry tomatoes are more adequate to final training stages.

One of the limitations of using tomatoes as simulators lies on the hard time fixing them, given their rounded shape. This limitation can be minimized by making a cross-section in their median plane. Another limitation is the lack of three-dimensional vision because of the video system. The current model cannot perfectly simulate all human–eye structures. However, these limitations do not render the model useless; therefore, it can be widely used in initial training stages.

Conclusion

The developed training model proved to be suitable for the initial training of different ophthalmic skills. In addition, it is cheap and easy to be purchased and manufactured. Green tomatoes have the most adherent skin; therefore they are a model of greater difficulty, which allows suture training.

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