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AN ALTERNATIVE MODEL FOR TEACHING TENDON REPAIR AND SURGICAL TECHNIQUE IN HAND SURGERY

UM MODELO ALTERNATIVO PARA O ENSINO DE REPARO TENDÍNEO E A TÉCNICA CIRÚRGICA EM CIRURGIA DA MÃO

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ABSTRACT

Introduction: At the beginning of the medical career, the orthopedic surgeon in academic training needs valid methodologies for training complex surgeries in tissues that simulate real situations. With training in animal tissue, adapted to approach human tissue, it is possible to simulate procedures and decisions that will be necessary in real situations. Objective: This study consists in presenting a simple and reproducible simulation model for surgical repair of tendons by training on fresh tendons fixed on a wooden frame. Methodology: The model construction consists of a flat piece of Medium Density Fiberboard (MDF) and two threaded hooks were used on the board, to which Nylon threads are attached to tie the tendon, allowing a satisfactory simulation of a human tendon. Conclusion: This is a simple, inexpensive, and effective method for tendon suturing training, through which the trainee can develop repair techniques and basic surgical principles, such as instrument handling, safety, and sharps disposal. This approach aims to improve the trainee's skills and dexterity when placed in live surgery. The surgical techniques developed include the modified Kessler and Bunnel sutures. ***Level of Evidence IV, Descriptive Study.***

Keywords: Tendons. Suture Techniques. Hand Injuries.

RESUMO

Introdução: No início da carreira médica, o ortopedista em formação acadêmica necessita de metodologias válidas para o treinamento de cirurgias complexas em tecidos que simulem situações reais. Com o treinamento em tecido animal, adaptado para abordar o tecido humano, é possível simular procedimentos e decisões que serão necessários em situações reais. Objetivo: Este estudo consiste na apresentação de um modelo de simulação simples e reprodutível para reparo cirúrgico de tendões por meio do treinamento em tendões frescos fixados em estrutura de madeira. Metodologia: A construção do modelo consiste em uma peça plana de Fibra de Média Densidade (MDF) e foram utilizados dois ganchos roscados na prancha, aos quais são fixados fios de Nylon para amarrar o tendão, permitindo uma simulação satisfatória de um tendão humano. Conslusão: É um método simples, barato e eficaz para o treinamento de suturas tendíneas, por meio do qual o trainee poderá desenvolver técnicas de reparo e princípios cirúrgicos básicos, como manuseio de instrumentos, segurança e descarte de objetos cortantes. Este método visa melhorar as habilidades e destreza do trainee quando colocado em cirurgias ao vivo. As técnicas cirúrgicas desenvolvidas incluem as suturas Kessler e Bunnel modificadas. ***Nível de Evidência IV, Estudo Descritivo****.*

Descritores: *Tendões.Técnicas de Sutura. Traumatismos da Mão.*

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INTRODUCTION

Hand flexor tendon repair is a technically demanding procedure with a narrow margin of error in its acceptability for a satisfactory result. The repair must be strong enough to allow early mobilization and, at the same time, it must be simple, sparsely bulky and atraumatic to allow smooth sliding of the tendon into the flexor sheath during postoperative active mobilization.[1-4] The greatest advance in the basic science of flexor tendon repair is the understanding of the multiple factors that can affect repair strength. The tension of the central suture, the size of the suture fixation area, the curvature of the tendon slip, and the presence of intact main pulleys (A2 and A4) affect the repair strength.[5]

Training in tissue of animal origin, adapted to approach human tissue allows the possibility to simulate procedures and decisions that will be necessary in real situations. This study consists in using a simple and reproducible model for simulating the surgical repair of tendons. The construction of the model was made with a flat piece of medium density fiberboard (MDF) and two threaded hooks on the plate, to which Nylon threads are tied to fix a fresh bovine tendon, allowing a satisfactory performance simulation of

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a human tendon. It is a simple, low cost and effective method for training tendon sutures, through which orthopedists in academic formation who use the simulator can develop repair techniques and basic surgical principles, such as instrument handling, safety and disposal of sharp instruments. The types of sutures to be practiced include modified Kessler and Bunnel sutures.[6-8]

In one year, approximately 18,000 primary tendon repairs are performed in England, most of them by orthopedists in academic formation.[7,8] Associated with serious complications intrinsic to the procedure, such as tendon rupture and adhesion formation, we also have those that can be triggered or aggravated by inadequate surgical techniques and the surgeon's inexperience.[9] In addition, the success of surgical repair of the injured tendon is limited by its diminished ability to recover.[8]

Training and practice for a hand surgeon in this technique is essential to reduce patient morbidity, associated with improving the learning curve. Therefore, professionals need realistic simulation and effective practice models to develop their skills and abilities. This skill is best taught in the anatomy lab and refined in the operating room (OR). The simulator provides a safe environment for orthopedists in academic formation and physicians to practice suture techniques, while surgical approaches and instrument handling skills are more appreciated in the OR. In suturing the tendon, placing the central stitch at an adequate distance from the edges and configuring the proper tie are the main components for the success of the procedure.[6-8]

Teaching the orthopedists in academic formation how to repair a flexor tendon is particularly difficult, as surgical skill is technically demanding and function recovery is directly proportional to it. Developing fine motor skills needed to repair a tendon through simulation, removing tension from the operating room, is ideal and should increase the training orthopedist's ability to concentrate and increase his chances of success when in the operating room.[5-8]

In line with this, realistic and low cost models allow residents to develop their repair skills before perform them *in vivo*.[9] There for, the orthopedist in academic training would also have the possibility of simulating, under test conditions, situations that are likely to occur in the real practice.[2] Regarding simulation, we can say that animal models are more commonly used because they are cheap, easily available and offer a realistic texture of the tissue. While commercial training kits are expensive and of variable designs.[8]

With this specific competence in mind, we designed a training model that consists of simulating a tendon injury and subsequently repairing it, using the modified Kessler and Bunnel suture techniques, working with two and four passes, respectively, which have progressive degrees of difficulty.[7]

The present study aim to propose a simple, realistic and low cost model that can allow surgeons in training to practice flexor tendon repair in an environment without clinical risks to patients.

METHODOLOGY

The proposed simulation initially requires the creation of a model that reproduces tendon injuries. For this purpose, an instrument that promotes tension in the tendon was developed, consisting of: a flat piece of wood in MDF, dimensions of 2cm x 29,7cm x 42cm, two threaded hooks for support and Nylon 1-0 threads tied to the hooks and to the ends of the pieces of bovine tendon. Other materials that make up the experimental model are: bovine tendon, 4-0 Nylon suture thread, surgical instruments (needle holder, tweezers and straight scissors), scalpel blade, procedure gloves and sharps disposal box. (Figure 1)

The procedure consists of using a model per student to teach two different tendon suture techniques: modified Kessler and Bunnel. Each student injuries the tendon of their model and then performs the repair, reproducing the techniques as they are taught by the guiding physician.

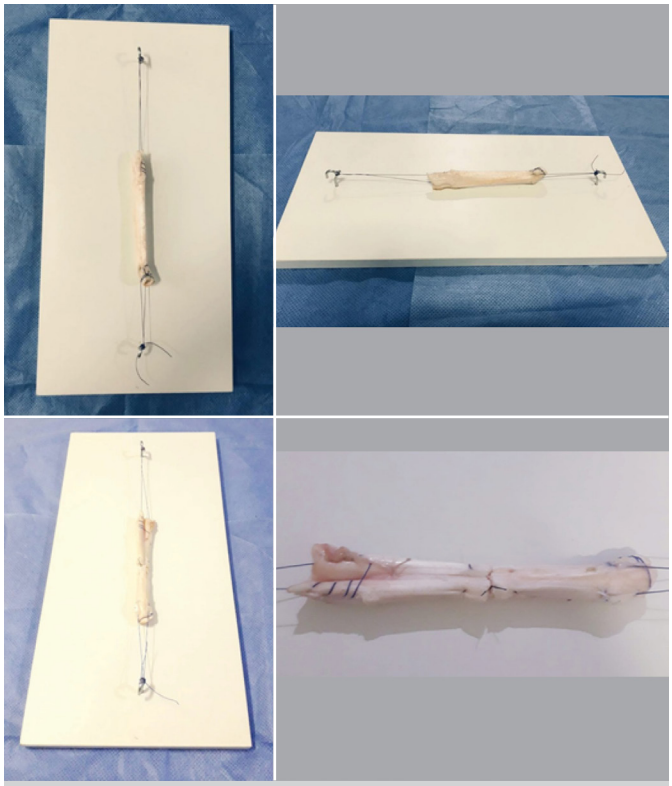

Figure 1. Final appearance of the simulator with the tendon before and after the suture.

This project has no conflict of interest, and has been aproved by the institution etic´s comitee (CAAE 45309421.0.0000.5373) and there was no need of aplication of conscentiment forms, according to the etic´s comitee resolution.

RESULTS

The elaborated model described presented a satisfactory simulation of the procedure for repairing tendon structures. Both the texture of the selected biological material and the tension developed by the model were within the expected range for training the surgical procedure. The students were able to elaborate the modified Kessler and Bunell suture techniques according to the guidelines described by the guiding physician.

DISCUSSION

Surgeon resident training presents the challenge of teaching tendon repair psychomotor skills to real patients. The early part of the learning curve is fraught with errors, which can have functional morbidity consequences. Ensuring that the interface between surgeon-in-training and patient occurs safely is one of the biggest challenges for assistant surgeons. What makes it clear that simulation models are a necessary educational tool, allowing the surgeon in training to develop their technical skills without pressure or risk of having to improve their technique directly on the patient.

CONCLUSION

The bovine tendon is easily obtainable and readily available for practice, when divided and fixed to a surface it can simulate the texture and structure of a human tendon, both are mostly made up of type I collagen and proteoglycans. The ability to practice on this model prepares students and orthopedic in academic formation in the development of their surgical skills before performing tendon repair *in vivo*.

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