AGE INFLUENCE ON CUT-OUT RESISTANCE OF SUTURED MENISCUS: AN EXPERIMENTAL CADAVERIC STUDY

A. Peña-Trabalon (1), B. Estebanez-Campos (1), S. Moreno-Vegas (1), A. Perez-Blanca (1), M. Prado-Novoa (1)

1. Clinical Biomechanics Laboratory of Andalusia (BIOCLINA), University of Malaga, Spain

Introduction

Surgical treatment of meniscal root detachment is changing from partial meniscectomy to root reinsertion with sutures [1] due to alterations in the knee joint contact biomechanics and early cartilage loss development [2]. Suture fixation techniques of meniscal roots can be grouped into transtibial [3] and *in situ* fixations [4], both techniques pierce the meniscal horn to pass a suture thread through the hole and reconnect meniscus to bone. Despite its importance for the survival of the repair, few works focus on determining the resistance of meniscal tissue cut-out by direct thread traction on the suture hole and, as far as we are aware, the influence of age on this resistance has not been yet studied.

Methods

This study tested 44 half human meniscal horns (resulting from splitting the meniscus perpendicularly to its transverse plane in two) of different age group: young ≤ 60; 60 < old. They were sutured with Nº2 UHPW thread using a simple stitch. Two ink points at the suture hole area were marked on the meniscus surface aligned with the direction of the longitudinal meniscal root fibers. A displacement-controlled load-to-failure test was conducted using an universal testing machine. The meniscal horn was fixed with its longitudinal root fibers aligned with the suture thread and the traction direction (Figure 1). During testing, the marks were continuously recorded using a video camera synchronized with the testing bench. Using a custom videogrammetry software, evolution of the distances between marks was computed and used to determine the start of meniscal tissue cut-out at the suture hole.

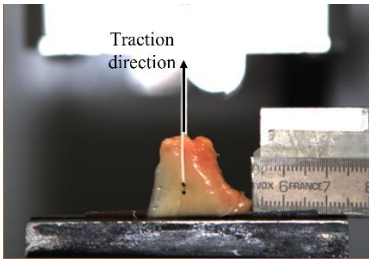

Figure 1: Meniscal horn located in the testing machine.

Meniscal horn tissue cut-out resistance, S_c, was:

$$S_c = \frac{F_c}{d \cdot t} \qquad (1)$$

where F_c is the traction at cutting time, and $d \cdot t$, the projected suture-tissue contact area at the hole, where d is the thread diameter, and t, horn thickness at the hole.

Two-tailed independent measure t tests were conducted to evaluate differences between groups. P values ≤ 0.05 were regarded as significant.

Results

For tissue cut-out resistance, S_c, no significant differences between groups were found for lateral meniscus specimens. For medial meniscus, the young group needed a higher stress level to start tissue cut-out (Figure 2a). For each age group, average resistance was higher in medial specimens than in the lateral ones.

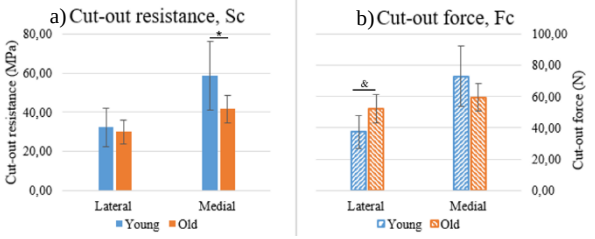

Figure 2: Meniscal horn tissue at cut-out. Significant differences, ∗: p=0.032; &: p=0.038.

Regarding specimen resistance, F_c, for the lateral meniscus significant higher values were found for the old group, due to its higher thickness. No differences were found for the medial meniscus (Figure 2b). Medial meniscus showed higher average F_c than lateral ones.

Discussion

Medial meniscal horn showed more tissue and specimen resistance for both groups. At the lateral horn, no differences were found for S_c between age groups, but due to its age-thickening, F_c was significantly higher for the older group. However, at the medial horn the opposite was found. The older tissue was less resistant, but due to a lower age-thickening, its F_c did not result significantly different. Therefore, from a biomechanical point of view there is no reason to not repair detachments of older lateral meniscus roots using suture techniques, as currently done with younger menisci.

References

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Acknowledgements

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