

DENERVATION IMPAIRS ACHILLES TENDON HEALING IN RAT MODEL

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INTRODUCTION

With the advance of immunohistochemical techniques, the role of nervous system in successful repair of injured tissue has been recognized. Evidences have shown the importance of innervation in promoting wound, bone and ligament healing. [1,2] How peripheral nervous system contributes to repair of tendon remains unknown. In this study, we investigated the effect of denervation on healing of rats using biomechanical and histological methods.

METHODS

Hemi-transection of the right Achilles tendon was performed on 28 adult male Sprague-Dawley rats. An additional sciatic neurectomy (SN) (n=14) or patella tenotomy (PT) (n=14) was also performed on the limb with AT injury. At 4 weeks after surgery, all rats were sacrificed and their bilateral Achilles tendons were subject to biomechanical test/histological analysis.

The medial portion of Achilles tendon, with the intramuscular tendinous fibers and the calcaneal bone were dissected out, and was attached to the MTS Synergie 200 machine (MTS Systems Corporation, Minnesota). The tendon was subjected to ultimate tensile testing at an elongation rate of 500mm per minute until failure. [2] The load-displacement curve was plotted with the peak of the curve representing the ultimate tensile strength (UTS) and the gradient in the linear portion representing the stiffness. (Figure one) Finally, all the above values of right leg were normalized against the left leg of the same animal for further analysis.

Statistical tests were used for the result of biomechanical test. Student t-test was used to compare the difference between the means of biomechanical test parameters (UTS, Stiffness and load relaxation) of injured legs between PT and SN groups, as well as the normalized UTS, stiffness and load relaxation. α was set at 0.05 for all tests.

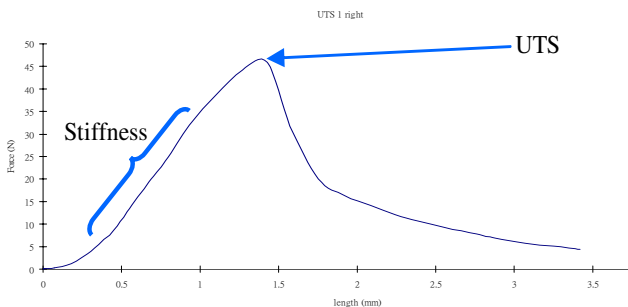


Figure one: Load-displacement curve of tendon

RESULTS AND DISCUSSION

The mean ultimate tensile strength (UTS) of the injured tendon in SN group was significantly lower than of the PT group. (*:p<0.05, Figure two) However, no significant difference in stiffness and load relaxation was found between these two groups. After normalizing the right leg values (UTS,

stiffness and load relaxation) with that of the left leg, no significant difference in all normalized values was found among three groups. (Figure three) Denervation result in scar tissue with irregular collagen alignment and higher cell to matrix ratio. Whereas immobilization with patella tenotomy revealed a relatively mature scar tissue with more mature fibroblasts and better alignment of collagen matrix. (Figure four)

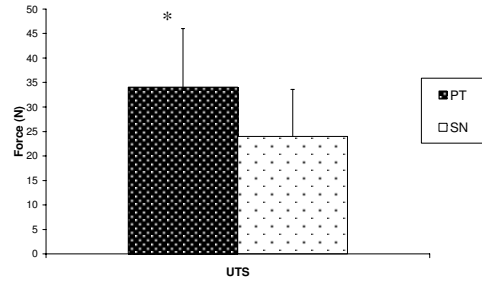


Figure two: Mechanical test result: Right leg UTS

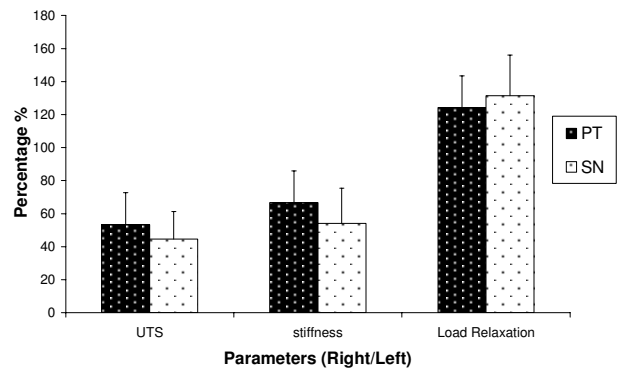


Figure three: Mechanical test result: Right/leg %UTS, stiffness and load relaxation

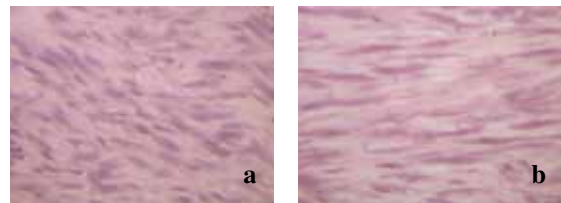


Figure four: Histology of scar tissue in SN (a) and PT (b) group

CONCLUSIONS

Denervation affects tendon healing, during which the scar tissue is biomechanically and morphologically inferior to that of innervated tendon. An intact nervous system is vital for normal healing of tendon.

REFERENCES

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