

## **Muscular Contracture Plays Only A Minor Role In The Development Of Posttraumatic Joint Stiffness (PTJS) – A Randomized Study In A Rat Model**

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### **Background**

Joint contracture after trauma or immobilization (IM) has far-reaching effects on a person's daily life and ability to work. A muscular component seems to play an important role in IM-related contractures, but is reversible through remobilization (RM).

### **Objectives**

In our study, we analyzed posttraumatic contractures before and after RM. The effects of the antifibrotic drugs atorvastatin and losartan on muscular (MC) and arthrogenic (AC) components of PTJS were investigated.

### **Study Design & Methods**

72 rats were randomized into 3 blocks of 24 animals each (Block A-C). On day 1 of the study, a knee joint injury was induced in all animals. This was followed by knee joint IM using K-wires. Each block was divided into 3 groups of 8 animals each. Group I received losartan, group II a placebo and group III atorvastatin. Block A was euthanized after 2 weeks, block B after 4 weeks. In block C, the K-wire was removed after 4 weeks and RM was performed for 4 more weeks. After euthanization, joint angle measurements were performed before and after myotomy of the muscles near the joint.

### **Results**

The physiological inhibition of extension-ROM (E-ROM) by musculature amounts to  $21.7 \pm$

6.5° in rats. In group I, MC was stable after 2 and 4 weeks (27.5° and 26.5°) and decreased to 22.9° after RM. In group II MC dropped from 29.7° to 23.5° (block A/B) and after RM further to 20.4°. Group III reduced MC the most from initially 37.5° to 26.8° and 12.7° to RM (blocks A-C). 2 weeks after trauma, MC was higher than normal in groups 2 and 3 ( $p < 0.05$ ), after RM, MC was below normal in group 3 ( $p < 0.01$ ). E-ROM after myotomy describes the AC. The E-ROM in group I was 111.9° and 105.7° (block A/B) under immobilization and improved to 137.5° after RM. Group II showed a stronger restriction from 116.6° to 99° under IM, E-ROM recovered to 135.5° after RM. Group III had the most severe AC with 117.7° and 89.3° E-ROM (Block A/B), which recovered to 134.3° under RM. The physiological E-ROM after myotomy in rats is  $159.3 \pm 4.3^\circ$ . In all groups a significant AC was present at all times. While AC did not differ between the groups after 2 weeks IM and RM, AC was improved by losartan after 4 weeks IM compared to atorvastatin ( $p < 0.05$ ).

## **Conclusions**

Muscular contracture plays only a minor role in posttraumatic joint contracture. Only in the acute phase 2 weeks after trauma there is a significant increase in muscular participation. After four weeks of immobilization muscle tension does not deviate from uninjured animals. Through the administration of atorvastatin, muscle tension can even be reduced below the normal level during remobilization. Compared to the control group, both drugs show no significant improvement of the arthrogenic contracture.