2B09-1 Stretch-activated channel blocker inhibits effects of electrical stimulation-induced muscle force on reducing disused bone loss

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Purpose: We tested the hypothesis that streptomycin, a stretch-activated channel (SAC) blocker, can essentially abolish the reduction in bone loss elicited by direct electrical stimulation (ES).

Methods: Direct ES with an intensity of 16 mA and a frequency of 10 Hz for 30 min/day for 6 consecutive days was applied to the tibialis anterior (TA) muscle after unilateral sciatic denervation in 7-week-old male rats as follows: control (CON); denervation (DN); DN with direct ES (DN-ES); and DN with ES treated with streptomycin (DN-ES-Str). The metaphyseal trabecular regions of the tibiae were analyzed using micro CT and histomorphometry.

Results: Significant losses in trabecular bone in the tibiae was evident in the DN rats. Trabecular bone volume fraction, thickness and number, as well as connectivity density and osteoid thickness were increased in DN-ES compared with DN rats at 1 week after denervation. However, these parameters were lower in the DN-ES-Str than in the DN-ES group.

Conclusion: These findings suggest that SAC blocker inhibits the ability of ES-induced muscle force to reduce the loss of disused bone. Activation of SACs might thus explain why ES-induced muscle tension applied to bone reduces bone loss in the denervated rat hindlimb.

Key words: mechanotransduction, bone, muscle, electrical stimulation

2B09-2 Early onset of exercise is effective for healing in muscle injury

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Purpose: This study aims to elucidate the effect of early onset of exercise on muscle injury.

Methods: Mice were divided into 3 groups, control group, injury group and exercise group. For injury group and exercise group, we forced mice to get muscle injury (eccentric-stimulation induced muscle injury). Then, for only exercise group, we let mice exercise (60 minutes swimming for 3 in every 4 days) after 7 days of muscle injury. All groups were sacrificed 21 days after muscle injury.

Result and Discussion: we observed that the cross sectional area of the regenerating myofibers in exercise group was larger than that in injury group and the level of fibrosis in the exercise group was lower than that in injury group. Then, we measured mRNA level of collagen1α2 and collagen5α3, which are known to be fibrosis structural component. Collagen1α2 mRNA level are almost the same among 3 groups. On the other hand, in collagen5α3 mRNA level, exercise group showed less collagen5α3 mRNA level than injury group. Then, in order to reveal how exercise inhibits fibrosis, we measured mRNA level of TGF-β1, which is a cytokine for promoting fibrosis. We observed that TGF-β1 mRNA level of exercise group was less than that of injury group. Taken together, our data suggests that exercise improves healing process and exercise inhibit fibrosis via TGF-β1 down regulation.