Exercise-induced ultrastructural changes of myotendinous junction in rat

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The myotendinous junction (MTJ) is the region that transmits the force of contraction of skeletal muscle to its tendon. The proximal extremity of the tendon forms finger-like processes, penetrating into the muscle mass, to increase the contact area between muscle and tendon [1,2]. A digitated profile indicates the separation between the muscular striated tissue and the fibrous connective one and can be considered the site of muscle-tendon crosstalk [3].

The aim of our work is to examine exercise-induced ultrastructural changes in the MTJ of rat *extensor digitorum longus* (EDL) muscle.

In the present investigation, 24 male albino Sprague-Dawley rats, aged 9 weeks, were used. After 1week of acclimatization, 12 rats were randomly chosen to run on a six-lane rodent treadmill 1 h a day, three times a week, at 10% grade slope. The speed was gradually increased to reach 25 m/min in 5 weeks, which corresponds to ~60% VO_{2max} [4], then was maintained constant for a further 5 weeks. Control animals were placed on a non-moving treadmill during the training sessions. At the end of the 10-week training, six rats, randomly chosen from control (A,C) and trained (B,D) animals, were immediately killed [5].

EDL muscle fragments were withdrawn, quickly fixed with 2.5% glutaraldehyde in 0.1 M phosphate buffer and maintained under tension with pins, during fixation. The specimens were successively reduced in small strips, post-fixed with 1% OsO_4 in the same buffer, dehydrated with alcohol, and embedded in araldite [6]. Thin sections, stained with uranyl acetate and lead citrate, were analysed with a Philips CM 10 electron microscope [7].

The observations indicate, as supposed, that also at ultrastructural level, changes in the MTJs occurred as an adaptation to exercise-induced tension increase [8]. Tension at the junctions is indeed lower during rest than during exercise, which is the condition in which it acts as a shearing force for the junction. The branching of the finger-like processes allows contact areas to increase, which leads to enlarge the whole tendon-muscle surface area, therefore better resisting to the tension. The MTJ can then adapt to the shearing force, if needed, by increasing muscle-tendon branch number and their distribution complexity [9] . Further studies are in progress to characterize these features by different technical approaches.

1. J.G. Tidball et al., Cell Tissue Res. **257** (1989) p77.
2. J.G. Tidball et al., Dev Biol. **163** (1994) p447.
3. M. Rodriguez-Guzman et al., Dev Biol. **302** (2007) 267.
4. U. Wisloff et al., J Physiol. **537** (2001) 607.
5. M. Marini et al., Histochem Cell Biol. **129** (2008) p479.

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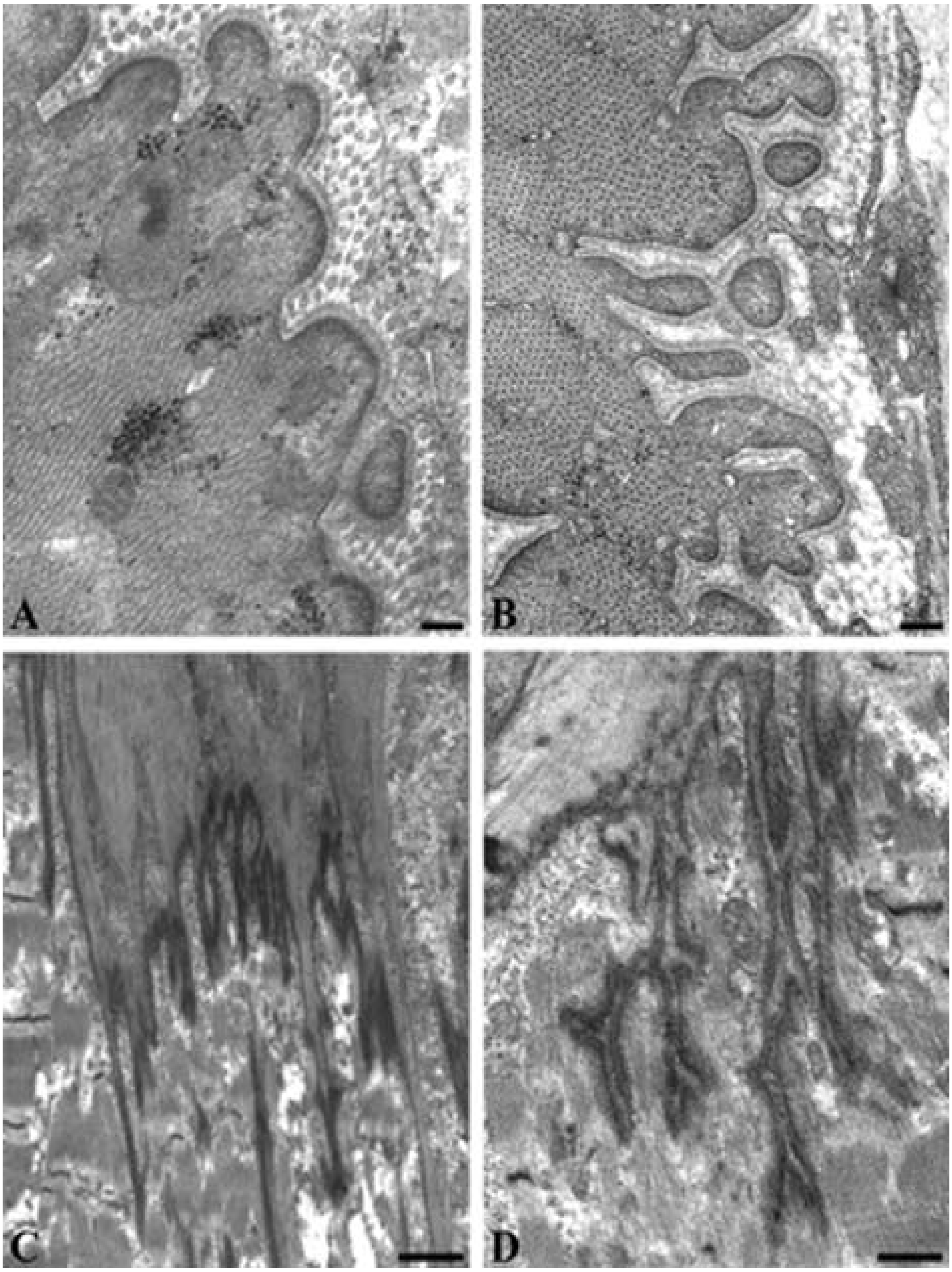
6. R. Curci et al., Micron **39** (2008) p843.
7. S. Burattini et al., Eur J Histochem. **48** (2004) p223.
8. H. Kojima et al., J Orthop Sci. **13** (2008) p233.
9. A. L. Mackey et al., Connect Tissue Res. **49** (2008) p165.



EDL TEM from control (A,C) and trained (B,D) rats, in transverse (A,B) and longitudinal (C,D) sections: the increasing of folds (B), as well as the branching of the finger-like processes (D) are evident in trained rats.
A,B, bar= 0,1µm; C, bar= 1µm; D, bar= 0,5µm

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