

Importance of Evaluation of the Foot Muscular Tone for Type 1 Diabetes Mellitus Patients

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BACKGROUND In 2003, *Ardic F et al.* established that Dupuytren's contracture was the most frequent complication of the musculoskeletal system in the diabetics they had examined. In these cases, Dupuytren's contracture more often involved *palmar aponeuroses* [1]. In 2005, *D'Ambrogi E et al.* determined that diabetics have thickened Achilles tendons and plantar fascias and, according to them, this could play a significant role in the alteration of the biomechanics of the foot-ankle complex [2]. The aim of the study was to evaluate of the foot muscular tone for type 1 diabetes mellitus patients.

METHODS The study involved 70 at random selected subjects with type 1 diabetes mellitus: 31 men (44.3%) and 39 women (55.7%) at the age of 32.4 ± 10.3 years. The duration of diabetes was 18.7 ± 8.3 years. The study also involved 31 healthy subjects as controls – 12 men (38.7%) and 19 women (61.3%) at the age of 33.3 ± 10.0 years. The study of the selected patients was performed using a standardized questionnaire and examination. Myotonometry and equipment, which make it possible to measure the parameters of individual skeletal muscles, pedobarography for pressure distribution measuring, which make it possible to measure pressure distribution in the feet, were used in this study.

RESULTS It was found that the tone of the *tibialis anterior* muscle in the patients with type 1 diabetes mellitus was decreased, compared with the healthy controls. It was also determined that the tone of the *flexor digitorum brevis* muscle in the patients with type 1 diabetes mellitus was increased, compared with healthy controls. A Pearson correlation was revealed between the muscular tone of the right *tibialis anterior* muscle and the right body side weight pressure distribution (index P) in the patients with type 1 diabetes mellitus ($r = -0.54$; $p \leq 0.05$). A linear regression was determined between the muscular tone of the right *tibialis anterior* muscle and the body weight pressure distribution (index P) in the patients with type 1 diabetes mellitus ($R^2 = 0.29$; $p \leq 0.05$).

CONCLUSION Our findings permitted us to come to an assumption that the increased tone of the *flexor digitorum brevis muscle* in the patients with type 1 diabetes mellitus could result in the changes not only in the muscle itself but also in the *plantar aponeurosis* and *plantar fascia*. These changes are similar to those found in Dupuytren's contracture and they may lead to the deformation typical of the diabetic foot. The foot becomes more convex what leads to the increased pressure to inferior part of metatarsal heads. We suppose that rehabilitation of the patients with type 1 diabetes mellitus should include the approaches influencing myofibroblast activity in order to decrease tension in the *flexor digitorum brevis muscle* and ensure less convex shape of the foot and equalizing weight pressure's distribution in the feet.

REFERENCES

- [1] Ardic F, Soyupek F, Kahraman Y, Yorgancioglu R. The musculoskeletal complications seen in type II diabetes: predominance of hand involvement. *Clin Rheumatol* 2003 Sep;22(3):229–33.
- [2] D'Ambrogi E, Giacomozzi C, Macellari V, Uccioli L. Abnormal foot function in diabetic patients: the altered onset of Windlass mechanism. *Diabet Med* 2005 Dec;22(12):1713–9.