ANKLE MUSCULAR ACTIVITY DURING LANDING IN VOLLEYBALL PLAYERS WITH FUNCTIONAL INSTABILITY

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INTRODUCTION

The ankle sprain is one of the most common injuries in athletes, particularly in sports in which participants frequently jump and land on one foot like the volleyball. 90% of ankle injuries in volleyball occur during landing after a blocking maneuver. The most common complication following ankle sprains is functional ankle instability (FI) that has been defined as a tendency for the foot to give away after an ankle sprain with no evidence of ligament injuries [1]. The pathogenesis of FI is considered to be multifactorial, with mechanical, muscular, and sensorimotor factors playing a role [2]. The purpose of this study was to compare the muscle activation patterns of selected ankle muscles of volleyball athletes with and without FI performing a landing after the blocking maneuver. We believe that subjects with functional ankle instability present different patterns of muscular activation when compared with normal ones.

METHODS

Nine subjects were studied (age 24.1±3.1 years). Four had complaints of FI with no clinical evidences of mechanical injury and were considered as the functional instability group (FIG). Five subjects had no complaints about instability and had no history of lower limbs injuries and were considered as the control group (CG). All subjects were professional or recreational volleyball players. Surface electromyography were collected from peroneus longus (PL), tibialis anterior (TA) and gastrocnemius lateralis (LG) muscles while subjects performed a jump in the volley blocking. Electrodes were placed on the muscle belly, far away from the innervation zone [3]. The task was performed 8 times and a synchronized electrogoniometer signal placed on the ankle allowed the recognition of the landing phase. The RMS values and temporal variables in linear envelopes, both normalized by each subject's maximal voluntary isometric contraction (MVIC), were obtained for each muscle. The linear envelope's variables obtained were TA maximum peak, TA minimum peak, PL maximum peak and GL maximum peak. Groups were compared using t test for independent samples when normal distribution was present, and Mann-Whitney tests when the data was not normal. We adopted p value lower than 0.05.

RESULTS AND DISCUSSION

Results are displayed in Table 1. The RMS values showed significant differences in TA muscle activation between groups but not in the PL or LG muscles. The PL is a potentially critical muscle in preventing ankle sprains injuries as a protective mechanism to balance inversion [4], but interestingly we observed a significant difference only in the TA muscle: a lower activation in FIG subjects. TA is also an important muscle in preventing ankle sprains by impeding excessive plantar flexion, a primary mechanism in ankle sprain injuries since the inversion movement has a plantar inversion component associated [4]. The linear envelope variables showed that TA has an earlier peak of activation in FIG subjects; therefore this TA activation is statistically lower than the CG. A study showed a decrease in onset latency for the TA muscle after 8 weeks of proprioceptive training [5]. Although our subjects hadn't been specifically trained, they are active athletes and this pattern may be due to a compensatory learning. We can also observe that subjects in FIG had an earlier LG peak of activation than the control ones. This activation can help individuals to diminish impact during landing and it can also be due to a compensatory pattern. If the LG is activated earlier, the TA as an antagonist also has to be active earlier in order to counteract the LG action. This GL earlier activation can also predispose the individuals with FI to an inversion sprain since a more plantar flexion position during landing can predispose the individual to an inversion sprain.

CONCLUSIONS

Our results showed that individuals with FI have a muscle activity pattern that predisposes to an ankle inversion sprain since subjects in FIG showed a lower TA activation during landing when compared to controls. Besides that subjects with FI also showed an activation pattern probably compensatory, with TA and GL muscles activating earlier.

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Table 1: RMS values (% of MVIC) and linear envelope variables (% of movement cycle) for TA, PL and LG muscles of CG and FIG.

Muscle	RMS **CG**	RMS **FIG**	p	Envelope variables	CG	FIG	p
TA	**83,51±7,8**	**66,73±3,7**	**0,002***	**TA max peak**	**20,56%±1,429%**	**13,22%±1,85%**	**0,009***
PL	45,12±3,07	49,11±3,45	0,301	**TA min peak**	39,66%±2,256%	44,96%±3,979%	0,56
GL	48,7±3,99	44,2±3,81	0,504	**PL-max peak**	14,47%±1,653%	14,06%±1,912%	0,165
				LG-max peak	**13,90%±1,695%**	**3,125%±1,564%**	**0,000***