EFFECTS OF EXTERNAL ANKLE SUPPORT UPON IEMG ACTIVITY IN THE LOWER LIMB WHILE RUNNING

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This study investigated the effects of ankle appliances upon the integrated electromyographic (IEMG) activity in the lower limb during a jogging gait before and after an exercise bout.

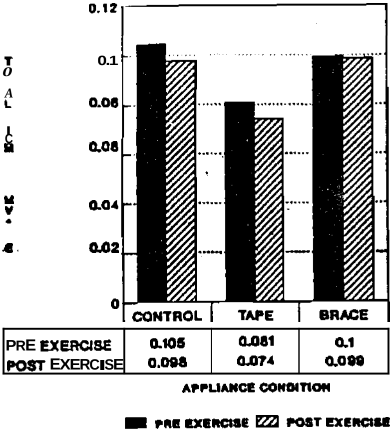
METHODOLOGY

Ten healthy college males volunteered to serve as subjects. They had not sustained any ankle injury in the previous five years and never had any type of ankle surgery. Each subject randomly experienced three ankle appliance conditions: 1) control (no support), 2) adhesive tape (closed basketweave, figure 8 and heel-locks). 3) Swedo lace-on ankle brace. The subjects performed 10 jogging trials at 5 mph, while being rimed by runway lights. IEMG data were collected on the last three trials. Each trial consisted of three steps thus resulting in a total of nine steps being used for analysis. IEMG data for the soleus, peroneus longus, and anterior tibialis was recorded using a Sensormedics dynograph recorder with a bipolar technique and three couplers. This process was repeated following 30 minutes of supervised basketball drills.

Three strides for 3 running trials were digitized for each muscle, appliance condition, and exercise group using a Numonics 1224 digitizer. The following variables were determined: 1) total time of muscular contraction, 2) peak IEMG activity, and 3) total electrical activity under the curve.

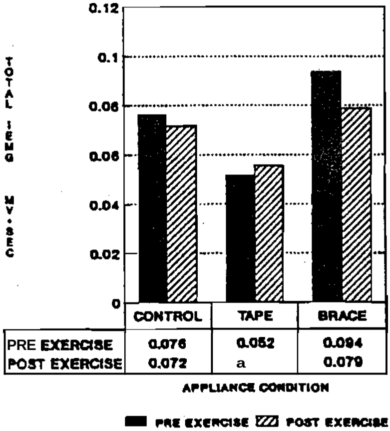
RESULTS AND DISCUSSION

A 2x3x3 ANOVA (exercise x appliance x trial) with repeated measures on all factors found a significant appliance main effect ($p<.05$) for the total IEMG activity elicited by the soleus and peroneal muscles. Post hoc analysis revealed that there was significantly ($p<.01$) lower IEMG activity in the soleus for the tape condition both pre- and post-exercise (see Figure 1). There were no differences found between the control and brace for either of the exercise conditions. In the peroneus longus, post hoc analysis showed a significantly ($p<.05$) lower IEMG activity pre- exercise in the tape condition (see Figure 2). There were no differences in pre-exercise peroneal activity for the control and brace conditions. Following exercise there were no differences in peroneal activity between the control and tape or the control and brace conditions, but the tape condition was significantly ($p<.05$) lower than the brace. The analysis failed to find a significant appliance main effect ($p<.13$) for the total electrical activity of the tibialis anterior muscle.



	CONTROL	TAPE	BRACE
PRE EXERCISE	0.105	0.081	0.1
POST EXERCISE	0.098	0.074	0.099

Figure 1. Total soleus IEMG activity for appliances and exercise conditions.



	CONTROL	TAPE	BRACE
PRE EXERCISE	0.076	0.052	0.094
POST EXERCISE	0.072	a	0.079

Figure 2. Total peroneal IEMG activity for appliances and exercise.

The taped condition elicited the lowest total IEMG activity in the soleus and peroneus longus muscles during a running stride. This reduction would be indicative of greater stabilization being provided by the tape rather than the lateral and posterior compartment musculature of the lower leg. Exercise resulted in a further reduction in the total electrical activity which may be reflective of greater elongation due to improved elasticity of the connective tissue and musculature in addition to increased stretching torques applied on the muscles as the tape's ability to resist elongation deteriorated over the time of the exercise bout. Another possible explanation for the reduction in the IEMG activity after exercise could be attributed to the trophotropic response of muscle to exercise producing a tranquil and relaxed muscle (DeVries, 1968; DeVries & Adams, 1972). This dependence of an individual's ankle on the tape support for stabilization rather than muscular support could provide the ankle with only limited protection after the tape loosens its adhesive support which may potentially lead to more severe injuries than subjects who were not taped (Garrick & Requa, 1973; Ferguson, 1973).

The ANOVA on the peak IEMG activity for the soleus, peroneus longus, and tibialis anterior found no significant effects for trials, exercise, or appliance factors (See Table 1).

TABLE 1. Peak IEMG Activity Averaged for 3 Strides (millivolts)

Muscle	Pre-exercise	Postexercise
Soleus		
Control	0.31 ± 0.32	0.30 ± 0.32
Tape	0.30 ± 0.32	0.40 ± 0.43
Brace	0.40 ± 0.41	0.29 ± 0.32
Peroneus longus		
Control	0.28 ± 0.13	0.30 ± 0.08
Tape	0.21 ± 0.08	0.24 ± 0.14
Brace	0.29 ± 0.16	0.27 ± 0.16
Tibialis anterior		
Control	0.30 ± 0.25	0.34 ± 0.25
Tape	0.25 ± 0.19	0.25 ± 0.16
Brace	0.30 ± 0.18	0.34 ± 0.18

The analysis of average time per stride for 3 strides found no significant effects for the trials, exercise, or appliance factors (see Table 2).

TABLE 2. Average Time per Stride for 3 Strides (seconds)

Appliance	Pre-exercise	Post-exercise
Control	0.75 ± 0.30	0.70 ± 0.30
Tape	0.66 ± 0.34	0.76 ± 0.45
Brace	0.80 ± 0.40	0.73 ± 0.31

In light of the insignificant differences for the stride time and peak IEMG, the significant differences observed for the total electrical activity under the curve must be attributed to differences in the average IEMG signal elicited during the stride.

CONCLUSIONS

The purpose of the external ankle support is to aid in stabilizing the ankle to thwart the chance of injury. In the tape condition the restriction of movement may be so much that normal muscle function may be impaired. Therefore, the muscles may begin to rely on the tape to support the joint instead of their own strength. This could in turn lead to an atrophying of the very muscles which need to be strengthened to help prevent injury.

In conclusion, external ankle support influenced the total IEMG activity of the lower leg during a jogging gait before and after exercise.

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