A NOVEL ELASTIC LOADING-BASED EXERCISE PROGRAM IMPROVES BOTH STRENGTH AND POWER AT THE ANKLE JOINT

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INTRODUCTION

The ankle joint plays a key role in human movement. Walking, running, balance, jumping and athletic performance all rely to varying degrees on strength and power generated at the ankle. Thus, this joint is frequently targeted by exercise professionals for strength and power improvements. In recent years elastic bands have successfully been added to many college-level and adult strength training programs to increase athletic strength and power. The mechanisms behind these improvements are not fully understood, but may involve changes in lift kinetic and kinematic measures resulting changes in muscle recruitment patterns [1,2] This study is unique, however, in that it uses the bands alone, with no other exercise equipment. The authors are not aware of any other studies utilizing the bands as a resistance training tool exclusively. The goal of this study was to determine whether an elastic loading-based exercise program using elastic bands can improve strength and average power produced by the ankle. The elastic bands used are a large version of a rubber band, about one meter in length, with varying widths which provide different levels of resistance.

METHODS

Ten healthy young subjects (7 males, 3 females, age: 24.2 ± 3.7 years; height: 172.4 ± 9.95 cm; weight: 73.1 ± 13.08 kg) with no contraindications to exercise, and no previous history of ankle injury participated in this study. One subject’s data was removed due to a collection error, resulting in nine subjects completing the study. Subjects underwent elastic band exercise training instruction with a fitness professional and then completed the elastic band exercise protocol (unsupervised) three days per week for eight weeks.

Figure 1: Ankle Specific Exercises (left, plantar/dorsiflexion and right, inversion/eversion.

The exercise protocol included 10 lower-extremity exercises, with two (plantarflexion/dorsiflexion and inversion/eversion against band tension) exercises specifically targeting the ankle. Workouts were varied so different exercises were performed during each session. Pre- and post-exercise training strength testing was performed utilizing the Biodex 3 Isokinetic Dynamometer (Biodex Medical Systems, Shirley, NY) All subjects performing the Ankle Plantarflexion/Dorsiflexion tests for speed and average power. The strength test utilizes a fixed maximum movement speed of 60°/second for movement from full dorsiflexion to full plantarflexion and back, for five repetitions, while the average power test uses a fixed maximum movement speed of 180°/second. Subjects were instructed to give maximal effort throughout all five repetitions.

The Biodex Dynamometer provides a score for strength (torque/BW) and average power for
dorsiflexion and plantarflexion for each leg. Strength and average power for right and left legs of each subject were included in the analysis. Baseline and post-exercise scores were compared using dependent t-tests. Significance was set at $p = 0.05$.

RESULTS AND DISCUSSION

Scores for both Strength and Average Power improved from Baseline to Post-Protocol testing, with statistical significance achieved in all but one category. Plantarflexion Strength, as measured by torque/bodyweight, improved from 26.02% to 30.57% torque/BW ($p = 0.01$). Dorsiflexion Strength improved from 12.25% to 12.5% of torque/BW ($p = 0.53$). With regard to power improvements, Plantarflexion Average Power improved from 39.24 watts to 46.83 watts ($p = 0.04$). Dorsiflexion Average Power increased from 23.02 watts to 25.05 watts ($p = 0.03$).

Broading the subjects’ age, demographic, and activity range may be beneficial during future research in this area. Elderly and sedentary individuals were not included in the study. These individuals may have greater potential for strength and power gains than young healthy subjects who are already more active and may exhibit higher levels of postural control.

CONCLUSION

We concluded that exercise training using an elastic loading-based methodology such as elastic bands show promise for improving ankle strength and power. Further research in this area should involve larger sample sizes, and a variety of age ranges and activity levels. Protocol experimentation should also be considered.

REFERENCES


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