The Feasibility and Efficacy of Elastic Resistance Training for Improving the Velocity of the Olympic Taekwondo Turning Kick

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Abstract

Jakubiak, N and Saunders, DH. The feasibility and efficacy of elastic resistance training for improving the velocity of the Olympic Taekwondo turning kick. *J Strength Cond Res* 22: 1194–1197, 2008–In the Olympic sport of Taekwondo (TKD), elastic resistance training (ERT) is often used with the aim of improving kicking performance; however, the efficacy of this has never been examined experimentally. The purpose of this study was to investigate the effect of a TKD-specific, progressive ERT protocol on the velocity of the TKD turning kick. Twelve TKD athletes were randomly allocated to receive either a 4-week intervention of ERT plus usual TKD training ($n = 6$) or to a control group receiving 4 weeks of usual TKD training only. Kicking velocity from initiation to impact on a target was measured pre- and postintervention using a digital timer and two pressure switches. Kicking velocity improved significantly (by 7%) in the ERT group, whereas there was no improvement in the control group ($p < 0.05$). These data suggest that ERT is a feasible means of sport-specific resistance training for TKD and that TKD performance could benefit from an improved velocity of the attacking turning kick.

Key words explosive strength

Introduction

Taekwondo (TKD) is a modern Olympic martial art. Although TKD involves punching, most scoring (98%) arises from kicking (6). The turning kick is the most frequently used kick (7,13); it has the highest velocity (11) and a high impact force (10). As a result, opponents have less time to react and are more likely to concede points because of the forces produced. Therefore, the explosive turning kick is a principle focus of TKD training, and resistance training is widely adopted as an adjunct to this. Although maximal strength training has been shown to improve muscle contraction velocity in TKD (15), the transferability of strength gains achieved from general resistance training methods to sport-specific performance remains an issue (3,8). It is thought that a better training transfer can be achieved from exercises that display mechanical specificity to the movement performed in competition (12) and specificity of velocity of movement (5). Therefore, the use of long elastic cords to resist kicking during TKD training has been recommended (2) to improve kicking performance. Only one controlled study has examined the effect of ERT on explosive sports performance; Treiber et al. (14) showed that ERT improved the speed of serving in elite tennis players ($n = 11$), but these data were confounded by the concurrent use of free weights. Therefore there are currently no controlled data of any relevance to either accept or reject ERT for TKD kicking performance.

Therefore, the specific aims of this study were to: a) determine whether a TKD-specific, individualized, progressive, elastic-resisted kick training intervention is feasible; and b) determine whether an elastic-resisted kick training intervention plus usual TKD training is more effective at increasing turning kick velocity compared with usual TKD training alone.

Methods

Experimental Approach to the Problem

A randomized, controlled, unblinded design was used to compare changes in turning kick velocity in TKD athletes ($n = 6$) after receiving a 4-week intervention of ERT plus usual TKD training, compared with those in the control group ($n = 6$) receiving 4 weeks of usual TKD training only.

Subjects

Twelve experienced male TKD athletes were recruited. Each volunteer gave written informed consent, and the University of Edinburgh research ethics committee approved the study. All of the subjects were injury-free and had not performed ERT systematically before this experiment.

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22(4)/1194–1197

Journal of Strength and Conditioning Research

Assessment of Turning Kick Velocity

Before and immediately after the training interventions, each subject performed three maximal turning kicks using the preferred leg. Kicks were timed with a digital timer (Quantum, RS, Corby, UK), starting as the kicking foot left its start position on a floor-mounted pressure sensor and stopping when the foot impacted on a second sensor housed within a TKD kick-training target (Adidas, Jewoo Sports Co., Seoul, Korea) held by an experienced coach (Figure 1). A comfortable kicking distance from start point to target was established and replicated before every kick (Figure1). The average kick velocity ($m \cdot sec^{-1}$) was determined for each individual at the pre- and postintervention tests.

ERT Intervention

Initial ERT resistance for each subject was established. Six turning kicks were performed, resisted by 2.4 m of stretch cord attached to the kicking foot and anchored 2.4 m behind the start point (Figure 2); the rating of perceived exertion (RPE 6–20) (1) was recorded immediately thereafter. After a minute rest, this was repeated with the cord prestretched by anchoring it further away in 30-cm increments. This process was performed three times using cords of different resistance (78, 108, and 157N per 100% elongation). The cord type and prestretch precipitating an RPE score nearest to 12 determined the ERT starting resistance. Because of the linear relationship between elongation and force, the resistance used had to be light enough to preserve technique and acceleration of the kicking movement. The experimental group received ERT three times per week for four weeks. ERT commenced with three sets of six repetitions at the predetermined individual kicking distance and starting resistance and progressing through the addition of one set per week, and 30 cm of additional prestretch per week, provided technique was uncompromised. Each session began with a 15-minute warm-up and finished with RPE being recorded. All subjects in both groups continued usual TKD training.

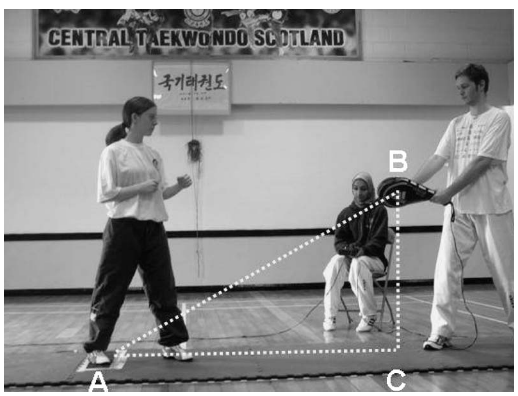

Figure 1. Measurement of kick performance. The Fin weight British Champion stands ready to kick, with the kicking foot in the start position (A). The distance from her instep to the center of the kicking target (A to B) and target height (B to C) has been measured and replicated before every kick. When the foot lifts off the pressure switch (A), the timer (held by the seated assistant) will start, and it will stop when impact is registered by a second pressure switch housed in the kicking target (B). Point-to-point turning kick velocity between A and B was determined in $m \cdot sec^{-1}$.

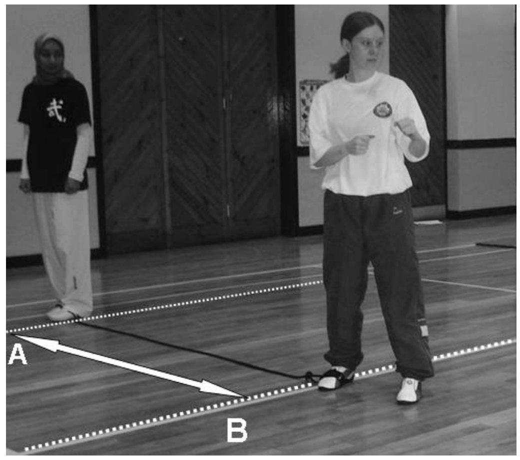

Figure 2. Elastic resistance kick training. The athlete on the right is ready to perform turning kicks resisted by 2.4 m of elastic cord. One end of the cord is secured to the floor (A), and the other to the preferred kicking foot (B). Throughout the elastic resistance program, the resistance to kicking was increased by anchoring the cord further away from the athlete (A).

Statistical Analyses

Two-way analysis of variance was used to compare the responses of the groups, and a *t*-test was used to compare the change scores. All tests were conducted using SPSS (version 12; SPSS, Cary, NC) with statistical significance set at $p \leq 0.05$.

Results

Observation by an experienced TKD coach established that subjects' technique was not adversely affected during resisted kicking. Those allocated to ERT had 100% attendance at, and 100% compliance with, the prescribed number of ERT sets and repetitions; most (five of six) progressively increased the training resistance and the level of effort. The analysis of variance showed a significant interaction ($p < 0.05$); when baseline differences in kicking velocity were considered, the ERT group showed an improvement (7%) that was significantly greater than the control group (0.1%; *t*-test $p = 0.03$; Figure 3). Kicking velocity improved in five of six subjects in the ERT group (range, 5%–17%) but in only one of six subjects in the control group (6%).

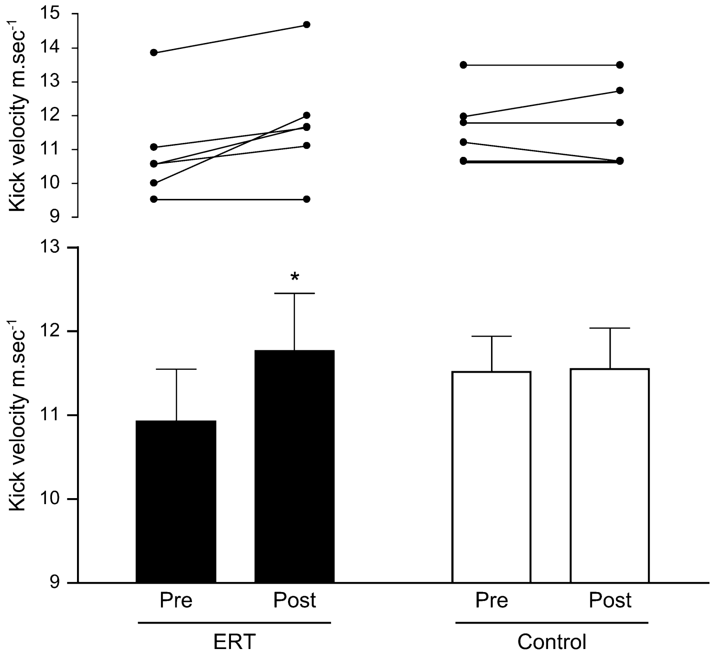

Figure 3. Individual (lines graph) and collective (bar graph; mean ± *SD*) measures of Taekwondo turning kick velocity recorded before (Pre) and after (Post) a 4-week period of either elastic resisted kick training plus usual training (ERT) or usual training only (Control). The lowest control data on the individual data graph represent two superimposed data sets. The change in kick velocity in the ERT group was significantly greater than that in the control group (* $p < 0.05$).

Discussion

This study suggests that 4 weeks of ERT can be a) feasible, TKD-specific, individualized, and progressive; and b) can significantly increase the velocity of the turning kick in male TKD competitors above that expected from usual TKD training.

Our 7% improvement in average kick velocity closely mirrors the 7.9% improvement in the average serving velocity of tennis players after 4 weeks of ERT (14). These are the only other sport-specific ERT data available, and together with our data, they suggest that ERT may be beneficial even during a short program. Other short programs (4–5 weeks) of strength and power training are known to be beneficial (4,9); however, it is plausible that further benefits may be gained from a longer period of ERT.

The only ERT participant not to improve in performance was also the only athlete not to progress the resistance of his training; this reinforces the idea that the benefits observed were related to a physiological training effect. The mechanism of benefit within this simple study cannot be determined. However, the short duration of the program suggests neuromuscular rather than structural changes would be a possible candidate. Elastic resistance may offer a simple, safe way of applying resistance during very fast, sport-specific movements, which would be difficult to achieve using traditional resistance training methods. However, elastic-resisted kicking may not be as specific as it looks; the pulling force remains unidirectional and increases consistently through the range of the kick. Such a resistance pattern is not seen when kicking during a fight, where a kick starts as an explosive unloaded movement of the body with the distal point accelerating continually until it collides with the target to produce a forceful impact. Hence, it is paramount that, in ERT for TKD, elastic resistance is light enough that no deceleration occurs in the kicking movement or velocity training will be compromised.

Practical Applications

These data suggest that supplementing usual TKD training with an elastic-resisted kick training program can improve the velocity of the TKD attacking turning kick. It is up to the coaches to decide whether the potential magnitude of improvement we report is worth the effort and the time taken from other aspects of a fighter's training. Further research should attempt to replicate these findings and examine whether a longer period of intervention could yield further benefits. Trained fighters can use ERT as a means to increase variety in the resistance training methods occupying their training schedule. Considering the cost-effectiveness, portability, and simplicity of elastic devices, they are a reasonable strength and conditioning training mode for athletes of any standard who are either financially or geographically restricted in their choices of resistance training modes.

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