REST PERIOD FOR STRENGTH RECOVERY DURING ISOKINETIC TESTING

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The purpose of this study was to replicate the testing protocol used by Parcell, Sawyer, Valmor, Tricoli and Chinevere (2002) with a female population to determine whether females had the same recovery responses as males when performing isokinetic tests. Eleven female subjects were recruited and tested on 4 separate occasions. A 4 X 5 repeated measures ANOVA was used to analyze the data ($p < .05$). There were no significant findings. The conclusions were that the females in the study did not understand maximal force production, peak torque averages don't provide the same information as the highest peak torque per set, or the females need more time to become attenuated to the testing apparatus.

KEY WORDS: isokinetic, peak torque.

INTRODUCTION: Numerous studies have looked at isokinetic strength testing to assess muscle function in various populations (Bilcheck, Kraemer, Maresh, & Zito, 1993; Perrine & Edgerton, 1978), to assess changes which occur as a result of strength training (Coyle, Feiring, Rotkis, et al., 1981), and to evaluate changes associated with lack of activity (Greenleaf, Bernauer, Ertl, Bulbulian, & Bond, 1994). In spite of the abundance of literature on isokinetic testing, there has been no standardization in number of repetitions, velocities, or the rest duration. However, in reviewing studies reporting isokinetic testing, the subjects typically performed two to four repetitions, and were tested at three to five different velocities administered in ascending order (Parcell, Sawyer, Valmor, Tricoli, & Chinevere, 2002). But, the rest period during testing protocols has been inconsistent. A study by Bilcheck, Kraemer, Maresh & Zito (1993) indicated that a 2.5 minute rest period between concentric/eccentric testing protocols assured adequate recovery for force production in a female population. A recent study by Parcell, Sawyer, Valmor, Tricoli and Chinevere (2002) found that a 60 second rest period between sets of concentric isokinetic strength testing was sufficient for recovery in a male population. The purpose of this study was to replicate the testing protocol used by Parcell, Sawyer, Valmor, Tricoli and Chinevere (2002) with a female population to determine whether females had the same recovery responses as males when performing isokinetic tests.

METHOD: Eleven female college students were recruited as subjects. The study was approved by the university human subjects review board. Subjects reported to the lab on six separate occasions. Two were familiarization sessions and four were experimental testing sessions, which included a required warm up on a bicycle ergometer at 100 W for 5 min. The familiarization sessions were to minimize effects of learning on torque production during isokinetic testing. During the familiarization sessions, subjects were fitted on the CYBEX NORM isokinetic system for a knee extension protocol and settings recorded to ensure the same positioning for all four experimental tests. The subjects performed four maximal contractions at isokinetic velocities of 60, 180, and 300o?s-1 with a 3-min rest between sets. When experimental testing began, subjects were requested to abstain from exercise 24 hours prior to each session and were tested with a minimum of 48 hours between testing sessions. Each testing session included three to four submaximal knee extension repetitions at 60, 120, 180, 240 and 300o's-1 for warm-up and four maximal contractions at those same velocities during experimental testing with rest periods of either 15, 60, 180, or 300 s between sets. The order of the rest periods was counterbalanced. For example the first data collection the subject had 180 s, 15 s, 60 s, and 300 s of rest between sets of 60, 120, 180, 240 and 300o's-1 velocities, the second session had rest of 15 s, 300 s. 180 s, and 60 s, the third session had rest of 60 s, 180s, 300 s, 15 s, and the fourth session had rest of 300 s, 60 s, 15 s, and 180 s. Subjects were instructed to contract maximally during knee extension, while flexion velocity was set at 300o's-1, which offered no resistance. Each velocity tested was considered a set and the average torque value for each set was used for analysis.

The data were analyzed using a 4 X 5 design with rest periods and velocities as the independent variables. The dependent variable was peak torque for each condition. A repeated measures ANOVA was used to analyze the data with the level of significance set at $p < .05$.

RESULTS: The peak torque of all subjects was tested at velocities in the order of 60, 120, 180, 240 and 300 o?s-1. Rest periods of 15, 60, 180, or 300 s were counterbalanced for each subject. Analysis of the data revealed no significant interaction. Main effects of rest and velocities were also not significant (Fig. 1).

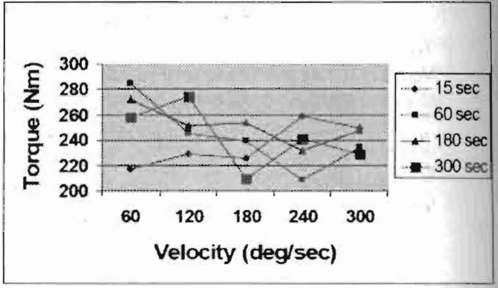

Figure 1: Torque-velocity curves from average peak torque isokinetic knee extension contractions with four different rest periods. ($p<.05$).

DISCUSSION: The results of this study were dissimilar to the results reported by Parcell, Sawyer, Valmor, Tricoli and Chinevere (2002) who used a male population, and found a significant main effect of velocity on torque production regardless of the length of rest period, a significant main effect of rest, and a significant interaction of velocity and rest. Additionally, the results were dissimilar to the findings of Bilcheck, Kraemer, Maresh & Zito (1993) who looked at rest periods in females who were performing isokinetic contractions and found that 150 s of rest was sufficient recovery for force production. In this study there were no significant differences in peak torque values when looking at rest periods or velocities. Even though it may appear that there was an interaction at 300 o?s-1, there was no significant interaction. Suggestions as to the reasons for the present results are numerous but could include the following: (1) females tend to need more practice bouts to achieve attenuation to the isokinetic apparatus; (2) since most of the females tested were not athletes, they may have difficulty understanding maximal effort; and (3) this study used an average of the peak torque per set rather than the greatest peak torque of the trial as was reported by Parcell, Sawyer, Valmor, Tricoli and Chinevere (2002).

CONCLUSION: This study attempted to replicate the findings of a study by Parcell, Sawyer, Valmor, Tricoli and Chinevere (2002). The differences were that females were used as subjects and the average peak torque of each velocity set was used. The results were dissimilar in all data analysis results. Future research should include more subjects, whether male or female, longer attenuation practice sessions, and investigating use of average peak torque should be compared to use of maximal peak torque per velocity set.

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