Static and Dynamic Warm-up in Upper Extremity Functional Activities

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Abstract.

Considerable research has explored stretching the lower extremity prior to activities; limited literature examined the upper extremity (UE). The purpose of this study is to determine whether a static or dynamic stretch will increase the functional capacity of the UE. Students between the age of 21-35 were randomly assigned to a static or dynamic stretching group. Regardless of initial assignment, subjects served as their own control and performed both warm-ups. The dominant arm was tested during the following: concentric IR and ER strength testing, proprioception, softball throw and a closed-kinetic chain upper extremity stability test (CKCST). Paired t-tests revealed no significant difference between proprioception, isokinetic, and softball throw. However, there was a significant difference between dynamic warm-up and the CKCST.

Introduction

Considerable research has discussed pre-activity warm-up before functional use of the lower extremity**;** however, limited evidence exists for the UE, and no research comparing static warm-up (SWU) to dynamic warm-up (DWU) in the UE. Maintaining muscle flexibility, increasing proprioception and maximal muscle performance, injury prevention, and sustaining biomechanical movement are all reasons to perform a warm-up prior to any functional activity. Muscle flexibility can be preserved or increased with stretching. Identifying the best method to warm-up the UE prior to functional activities can enhance rehabilitation, training, and testing outcomes. Therefore, the purpose of this study is to determine whether a SWU or DWU prior to functional activity will improve the functional performance of the UE.

Experiment, Results, Discussion, and Significance

Tests chosen to evaluate functional performance of the UE included: concentric IR and ER isokinetic strength testing, proprioception, distance of softball throw and a closed-kinetic chain upper extremity stability test (CKCST). Prior to each test, a coin toss determined the subject's warm-up method. All stretches were performed once with a 30-second hold. Following warm-up, participants lay supine on LIDO isokinetic dynamometer to test proprioception[2,6] . The dominant arm was abducted to 90° with elbow flexed 90° and taken through a range of motion (ROM). Pre-determined angles for joint replication were 60° and 30° of external rotation (ER) and 15° and 40° of internal rotation (IR). The researcher held the subject's arm in place for 10 seconds and then moved the arm back to neutral[2,6]. The subjects were asked to return their arm to the previously held position.

Following proprioception testing, subjects rested for 10min and warmed-up prior to strength testing. Subjects performed an interval warm-up of 25%, 50%, 75%, and 100% of maximal internal and external rotation against 180° per/sec[4]. Subjects performed 10 consecutive IR and ER maximal repetitions. Average peak torque and work was calculated. The subject repeated interval warm-up and testing for 300° per/sec[5]. Testing was repeated a week later with the opposite warm-up.

The third test day, subjects reported to WSU Cessna stadium for softball throw. Following warm-up subjects were given a softball and instructed to take one step and throw[1]. Three maximal throws with distance recorded were allowed. One week later the other warm-up protocol was performed.

The last test was a closed-kinetic chain upper extremity stability test (CKCST)[3]. Following warm-up males assumed the push-up position and females the modified push-up position. One hand was moved from the floor, touched the opposite hand and then returned to the original position[3]. Testing lasted 15 seconds and touches were

counted[3]. Three trials were allowed with 45 seconds rest between[3]. One week later the other series of warm-up stretches and the same procedure was performed.

The Statistical results represent the performance on each dependent variable based on warm up conditions. A paired T-test was used for all analysis of variables. Internal rotation total work @ 180 (deg/sec) revealed that subjects scored better after the DWU than SWU ($p<.05$). No differences existed between the DWU and SWU for all other strength testing. Analysis of proprioception testing revealed no difference between SWU and DWU at all four loci. Softball throw scores revealed no difference between SWU and DWU during all 3 trials. Dynamic stability testing via CKCUE test revealed subjects scored better after the DWU than SWU in Trial 1($p<.05$), and Trial 2($p<.05$), while no difference was found in Trial 3.

Table: 1
Closed Kinetic Chain Upper Extremity Stability Test

Type of warm-up	Mean	Standard Dev.	Significance
Static trial 1	**31.53**	**6.03**	**0.01**
Dynamic trial 1	**32.50**	**6.88**	
Static trial 2	**32.77**	**7.27**	**0.00**
Dynamic trial 2	**33.80**	**6.97**	
Static trial 3	33.27	7.23	0.21
Dynamic trial 3	33.77	7.69	

The results of the study suggest that a DWU might offer performance benefits not found with SWU. Performing a DWU with similar movement of the following activity will increase performance compared to a SWU. Future investigations should evaluate the subjects conditioned; thus eliminating the element of fatigue. In addition, choosing a warm-up more specific to the activity may change the results. Fatigue and using a sample of convenience may be a limitation of this study. Decreasing the number of repetitions and increasing the recovery time between velocities may eliminate the element of fatigue. Fatigue also may have been a factor during the CKCUE activity and the softball throw.

Conclusions

DWU might offer performance benefits not found with SWU prior to performance of selected strength testing and functional closed kinetic chain activity in the UE.

Acknowledgements

Thanks to our advisor Robert Manske for his leadership and to the College of Health Professions for testing supplies and facilities. In addition, thank you to first and second year physical therapy students for volunteering as subjects and to Papa John's Pizza for providing complimentary pizza.

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