The Effect of Non-Dominant Shoulder Exercises on Non-Dominant and Dominant Shoulder Range of Motion in Collegiate Volleyball Players

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Abstract

Context: Janda's Upper-Crossed Syndrome (UCS) is characterized by alternating patterns of tightness and weakness, which is indicative of muscle imbalances and movement dysfunction usually seen in unilateral athletes. These muscle imbalances can cause abnormal movement patterns and sometimes manifest as pain. Anecdotal evidence seen in the athletic training clinic also supported the use of non-dominant side movement patterns to improve dominant side functioning and decrease pain. **Objective**: Based on the UCS, application of non-dominant shoulder exercises may decrease muscle imbalances and movement dysfunction. We hypothesized that there would be an increase in internal rotation of the dominant shoulder demonstrating increased movement pattern function. **Design:** Randomized control trial. **Setting**: Small Midwest NAIA athletic training clinic. **Participants**: Women collegiate volleyball players (22) with the age range of 18-21. **Interventions**: Participants were randomly assigned into two groups, a treatment and control group. The treatment group performed 15 overhand serves with their non-dominant arm three times a week for four weeks. Baseline, midpoint, and final measurements were taken. **Main Outcome Measures**: External and internal rotation of the dominant and non-dominant shoulder were taken using a clinometer app on a clinician's smartphone. **Results**: Results were calculated using repeated measures ANOVA. With a large effect size (0.87 and 1.19), significant increase was found in external rotation ROM in the non-dominant shoulder from baseline to mid-point measurement (mean difference=10°), and from baseline to final measurement (mean differences=14°). **Conclusions**: Based on the differences in range of motion of the dominant and non-dominant shoulder, we speculate that muscle imbalances were present between shoulders. Non-dominant shoulder exercises significantly increased external rotation of non-dominant shoulder, therefore equalizing the muscular imbalance.

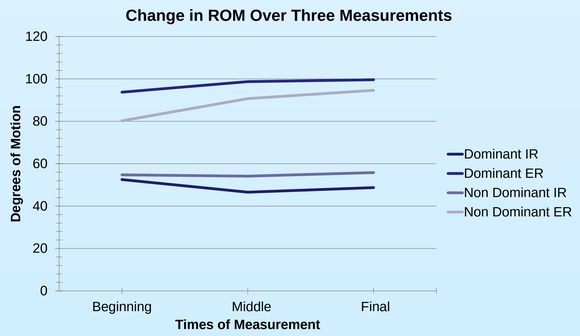
Clinometer

Background

Normal passive external rotation (ER) at 90 degrees of abduction is 58.91±14.04 in the dominant arm and 62.43±12.80 in the non-dominant arm.[1] Passive internal rotation (IR) is 104.64±10.83 in the dominant arm and 100.55±9.81 in the non-dominant arm.[1] Shoulder imbalances can be present even when athletes have normal ratio ranges for their ROM.[2] Individuals with more than 18° of internal range of motion loss and 5° difference in total range of motion between the dominant and non-dominant shoulder are at a higher risk for shoulder injury and Glenohumeral Internal Rotation Deficiency (GIRD).[3] According to Janda's Upper Cross Syndrome, alternating sides of inhibition and facilitation in the upper quarter, can also indicate alternating patterns of tightness and weakness, represented in ROM variances.[8]

Results

A one way repeated measures ANOVA was calculated comparing the degrees of motion of female collegiate volleyball players at three separate times: baseline, middle, and final. A significant effect was found ($F(2,34) = 7.735$, $p<0.002$). Protected *t* tests were performed as a follow up and revealed significant increase in degrees of external rotation in the non-dominant shoulder between baseline ($\mu = 80.23$, $sd = 10.10$) and final ($\mu = 94.61$, $sd = 11.78$)



	Dominant IR	Dominant ER	Non Dominant IR	Non Dominant ER
Beginning	52.51	93.75	54.75	80.23
Middle	46.54	98.7	54.1	90.68
Final	48.7	99.59	55.8	94.61

Methods

Collegiate volleyball players at Northwestern College participated for four weeks during the fall season of 2017. All players were informed about the study at the beginning of their season in a mandatory meeting. The players then received an email asking for their participation with an online sign-up sheet. Twenty-two members of the team volunteered and consented to participate. Baseline evaluation of the participants was taken one month after their season had begun, with measurements taken two weeks later, and at the conclusion of four weeks from the first measurement. This study was approved by Northwestern College's Institutional Review Board.

Glenohumeral range of motion of the non-dominant and dominant shoulders were evaluated with the athlete positioned in a hook lying supine position on a 27 x 71 x 31 cushioned treatment table. The table was used to stabilize the athlete's scapula, with the shoulder at 90°of abduction, elbow at 90° of flexion and forearm in neutral position.

A clinometer app on a smartphone was used for all measurements. Range of motion of both internal and external rotation was performed passively with one examiner stabilizing the athlete's glenohumeral joint and the other measuring the ROM. The final ROM was measured after reaching a firm endpoint and no observable accessory motion. Both passive internal and external rotations were measured each time by the same clinician. Three measurements were taken for each ROM then averaged to ensure accuracy.

Before the baseline measurement was taken, the twenty-two participants were randomly divided into two groups. The control group would participate in team lifting, stretching, and regular practice. The treatment group would participate in the same activities as the control with the addition of fifteen full speed overhand serves with the non-dominant arm three times a week for the duration of the four weeks. Results were calculated using a repeated measures ANOVA on SPSS.

Discussion

We hypothesized an increase in dominant internal rotation after incorporating non-dominant shoulder exercises after practice three times a week for four weeks. However, internal rotation was not significantly impacted on either shoulder. At baseline, we observed a disparity in non-dominant versus dominant shoulder external rotation. After our intervention, we found a significant increase in external rotation that brought the non-dominant and dominant ER ROM closer to symmetry.

This evidence suggests that non-dominant exercises should be incorporated into practices to combat the muscle imbalances often seen in one-sided sports, like volleyball. These practices could have the potential to limit future injury and imbalances. Furthermore, this evidence could be extended to one-side dominant lower extremity sports as well.

Limitations to this study included the number of athletic exposures (both in practice and games) as our study groups were randomly assigned from Northwestern's varsity and junior varsity collegiate volleyball team. To improve this study, we recommend conducting the study during the offseason when practices are more comparable for all members, regardless of varsity or junior varsity status. Furthermore, observed large standard deviations, which we attribute to measurement inconsistency. We had one clinician position and passively move the participant's shoulder every time, and another who took every measurement in order to maintain consistency; however, this still may have contributed to error.

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