# Effects of Supramaximal Anderson Quarter-squats As A Potentiating Stimulus on Discus Performance In Division I Throwers

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## ABSTRACT

The use of warm-up strategies with heavy stimuli to stimulate the post-activation potentiation (PAP) phenomenon has been shown to be useful in many explosive sport settings, such as sprinting, jumping, and throwing. One common method for a potentiating stimulus is to use heavy (~85-100% 1RM) back squats to enhance subsequent explosive performance variables. Further, to our knowledge, only one study has used supramaximal (over 100% 1RM) back squats and found jumping performance to be enhanced in resistance trained men. However, no study has assessed supramaximal back squat variations as a potentiating stimulus in collegiate throwers. **PURPOSE**: To test the hypothesis that, compared to a dynamic warm-up alone, a supramaximal Anderson quarter squat potentiating stimulus would improve discus throw performance in Division I throwers. **METHODS**: Nine NCAA division I thrower athletes (age: 20.1±1.4 years; 1RM back squat/body weight: 2.5±0.4 lbs.) randomly completed two sessions separated by at least 72 hours with a standardized dynamic warm-up with and without a supramaximal (105% 1RM) Anderson (bottom-up) quarter-squat set of 5 repetitions followed by three trials of maximal discus throwing. Regardless of warm-up strategy, all throwers attempted their first discus throw at 8 minutes, second discus throw at 11 minutes, and third discus throw at 14 minutes. For each time point a paired samples t-test was used for analyses, with significance set at p<0.05. **RESULTS:** There were no significant (p>0.05) differences between dynamic warm-up alone versus dynamic warm-up with PAP stimulus for discus throw distances at either 8 minutes (1247.3±218.8 vs 1206.1±255.6 inches, respectively) or 14 minutes (1344.3±153.5 vs 1272.3±206.9 inches, respectively) post warm-up. However, there was a significantly (p=0.038) shorter distance at 11 minutes post warm-up in dynamic warm-up with PAP compared to dynamic warm-up alone (1316.0±140.5 vs 1230.7±185.7, respectively). Further, there was on average a decrease in discus throw distance at 8 minutes (-3.5± 10.1%), 11 minutes (-6.7±8.7%), and 14 minutes (-4.9±14.3%) in dynamic warm-up with PAP stimulus versus dynamic warm-up alone. **CONCLUSIONS:** Compared to a dynamic warm-up alone, supramaximal Anderson quarter-squats following a dynamic warm-up had detrimental effects on discus throw performance between 8-14 minutes post stimuli in Division I trained throwers, likely due to excess fatigue. **PRACTICAL APPLICATIONS**: For either training or pre-competition warm-up purposes in collegiate throwers, supramaximal PAP stimuli should be avoided to minimize negative discus throwing outcomes and time constraint issues related to the amount of fatigue present following such stimuli.

## INTRODUCTION

- One method of complex training is using strength-power-potentiation complexes. A maximal or near-maximal conditioning activity is paired with a subsequent strength/power exercise to enhance the subsequent exercise's performance (1).
- Recent research has highlighted differences between classical post-activation potentiation (PAP) and post-activation performance enhancement (PAPE). Voluntary conditioning contractions tend to elicit PAPE, and thus was the focus of this study (2).
- A resistance training exercise conditioning activity with a heavy intensity (>85% 1RM) has been shown to work for PAPE/PAP (1), better than moderate intensity (30-84% 1RM), even though some evidence (3) suggests moderate intensity resistance exercise (80% 1RM) can enhance collegiate throwing performance.
- Further, only one study (4) has used supramaximal (~150% 1RM) concentric loads in a back squat variation and found to have PAPE enhancement in trained individuals only.
- No study has examined a back squat variation conditioning activity with a supramaximal load on throwing performance.

## PURPOSE AND HYPOTHESIS

- **PURPOSE**: To test the hypothesis that, compared to a dynamic warm-up alone, a supramaximal Anderson quarter squat potentiating stimulus would improve discus throw performance in Division I throwers.

## METHODS

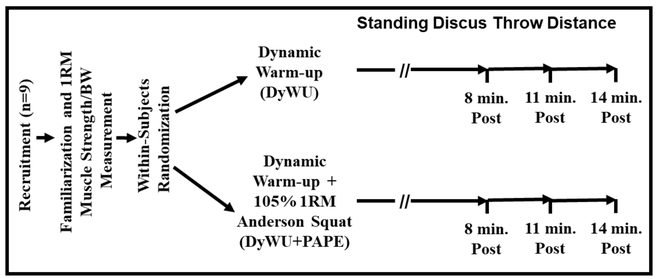


**Figure 1.** Overview of experimental within-subjects design. NCAA Division I thrower athletes (n=9 total; n=6 women, n=3 men) randomly performed a dynamic warm-up only (DyWU) and a dynamic warm-up with post-activation performance enhancement (DyWU+PAPE) stimulus using a supramaximal (105% of 1 repetition maximum; 1RM) Anderson (bottom-up) quarter squat set. Regardless of warm-up strategy, maximal standing discus throws were attempted at 8, 11, and 14 min. post warm-up. Warm-up sessions were separated by at least 72 hours.

**Table 1**. NCAA Division I Collegiate Thrower Participant Characteristics (n=9).

| Variable | Mean ± SD |
|---|---|
| Age (yrs) | 20.1 ± 1.4 |
| Height (m) | 1.8 ± 0.1 |
| Body Weight (kg) | 94.4 ± 18.7 |
| Discus Experience (yrs) | 6.0 ± 2.0 |
| Resistance Training Experience (yrs) | 4.6 ± 3.1 |
| Back Squat 3RM (kg) | 202.6 ± 67.7 |
| Estimated 1RM (kg) | 236.0 ± 74.0 |
| 1RM/Body Weight (kg) | 2.5 ± 0.4 |
| Discus Throw Personal Record in Competition (m) | 42.7 ± 4.5 |

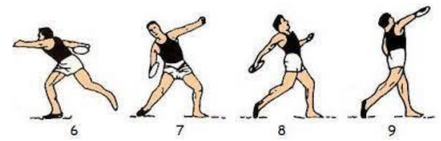


**Figure 2.** Overview of standing discus throw technique. Used to test PAPE.


**Figure 3.** Overview of Hatfield squat. Exercise movement used in the first two PAPE conditioning sets.

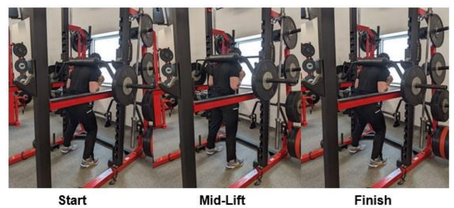


**Figure 4.** Overview of Anderson quarter squat. Exercise used in final set of PAPE conditioning.

## RESULTS

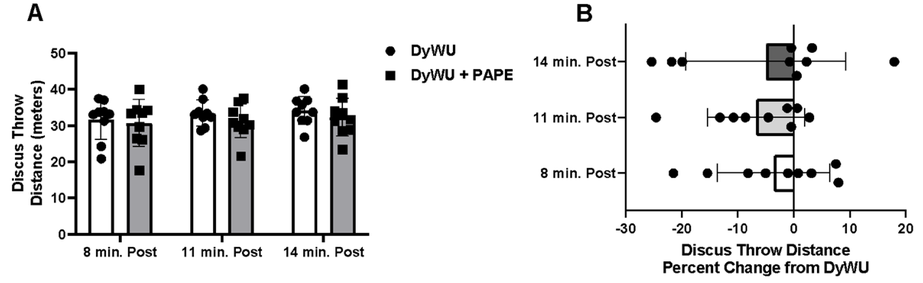


**Figure 5. A**) Discus throw distance by time point following a standardized dynamic warm-up (DyWU) or DyWU with a supramaximal Anderson squat set post-activation potentiation enhancement stimulus (DyWU + PAEP), and **B**) discus throw distance percent (%) change from DyWU following DyWU + PAPE in NCAA Division I thrower athletes by time point (n=9). Values are mean ± SD. A two-way ANOVA (warm-up x time, with repeated measures for time) was used. Post-hoc comparisons were accomplished via Sidak test, with sign significance set at $p < 0.05$.

## CONCLUSIONS AND PRACTICAL APPLICATIONS

**CONCLUSIONS**:

- Data from the current study demonstrates that compared to a dynamic warm-up alone, supramaximal concentric Anderson quarter squats following a dynamic warm-up conditioning activity (CA) negatively effects the distance of maximal standing discus throws at 8-14 min. post CA in NCAA Division I well-trained and strong throwers.
- The lack of potentiating effects observed between 8 and 14 minutes is potentially due to the supramaximal CA itself causing too much fatigue/inhibition and blocking potentiation, the timing of when the throw measurements were made did not capture potentiation, or the thrower sample used herein requiring a more individualized approach (i.e., using more or less intensity and/or determining optimal individual rest intervals post CA).

**PRACTICAL APPLICATIONS**:

- For either training or pre-competition warm-up purposes in well-trained and strong collegiate throwers, a supramaximal back squat variation CA should be avoided as their may be negative discus throwing outcomes.

## REFERENCES

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