**THE EFFECTS OF THREE AND FIVE SECOND ISOMETRIC CONTRACTIONS ON UPPER BODY POSTACTIVATION POTENTIATION**

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**ABSTRACT**

Postactivation potentiation (PAP) has been shown to occur in both the upper and lower body when one or multiple sets of a resistance exercise are executed at a high intensity before an explosive movement of similar nature. The type and size of exercise required to generate postactivation potentiation have not been thoroughly investigated. The purpose of this study was to examine the effects of three and five second isometric contractions on upper body postactivation potentiation. Twenty males who were strength and power trained and had a minimum of four years of training experience completed two testing sessions (T1 & T2) separated by a minimum of 48 hours. All subjects completed three sets of a three and five second isometric isometric bench press contractions over the course of the testing session. Reliability test–reliability test was used to ensure that the three second contractions during T1, and the five second contractions during T2. The remaining two subjects performed the five second contractions during T1 and the three second contractions during T2. Those sets of single, explosive push-ups separated by 90 seconds were completed before and after the respective bench press contractions. Maximum vertical ground reaction force and rate of force development data were collected before and after the respective testing sessions. Results: A one-way ANOVA identified no significant main or peak force or rate of force development for either contraction time compared to pre-contraction values. CONCLUSION: The results of the current investigation suggest that isometric contractions of three and five seconds do not elicit postactivation potentiation. Further research is needed to determine the best treatment contractions and the time allowed between treatment contractions and the execution of the explosive exercise. Practical Application: It future investigation determines the ideal conditions necessary to elicit upper body postactivation potentiation to elicit enhanced performance of athletes competing in strength/power based sports. Specifically, short duration and fewer repetitions, which may allow athletes to generate large amounts of force in short periods of time, will benefit greatly from even a slight increase in force production.

**INTRODUCTION**

- Postactivation potentiation (PAP) is the augmentation of explosive force that occurs when a heavy loaded exercise is executed before an explosive movement of similar nature.
- The physiological and neurological rationale behind the potentiating effect is not yet fully understood.
- Most of the research investigating PAP has focused on isotonic heavy loaded exercises such as the squat and bench press followed by vertical jumps or explosive pushups
- Few studies examined the effects of isometric exercises to elicit PAP

**PURPOSE**

To investigate the effects of three and five second isometric contractions on upper body postactivation potentiation measured by rate of force development and total force output in a group of strength and power trained athletes.

**DESCRIPTIVES**

Participants n = 20 males

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-contraction</th>
<th>Post-contraction</th>
<th>Change</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force (N)</td>
<td>881 (223)</td>
<td>880 (249)</td>
<td>-1 (76)</td>
<td>0.96</td>
</tr>
<tr>
<td>Total RFD (N*s)</td>
<td>4788 (2672)</td>
<td>4744 (2802)</td>
<td>-44 (1487)</td>
<td>0.96</td>
</tr>
<tr>
<td>5ms RFD (N*s)</td>
<td>1255 (8092)</td>
<td>13949 (10326)</td>
<td>+1153 (4561)</td>
<td>0.72</td>
</tr>
<tr>
<td>30ms RFD (N*s)</td>
<td>10323 (5007)</td>
<td>10640 (6101)</td>
<td>+317 (2434)</td>
<td>0.86</td>
</tr>
</tbody>
</table>

**RESULTS**

- A one-way ANOVA found no significant increases (p > 0.05) in mean or peak force or rate of force development for either treatment condition compared to pre-treatment conditions.
- Relative force values (force/body weight) displayed no significant increases.
- 2x2 ANOVA with repeated measures identified no significant main effects or interactions between the treatment groups.

**METHODS**

- Subjects completed two testing sessions (T1 & T2) separated by 48 hours.
- All subjects completed a five second contraction trial and a three second contraction trial.
- Study design: Test ➔ Treatment ➔ Test
- Test: 3 explosive push-ups, 90s rest
- Treatment: 3 isometric contractions, 3 min rest
- Subjects served as own control
- Peak and mean force (N), total rate of force development (N*s), and greatest rate of force development (N*s^2) over 5 ms and 30 ms were measured for each subject and compared to pre-contraction performance values.

**EFFECTIVE PUSH-UP MEAN (SD) FORCE PLATE DATA BEFORE AND AFTER THREE SETS OF THREE SECOND ISOMETRIC CONTRACTIONS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-contraction</th>
<th>Post-contraction</th>
<th>Change</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force (N)</td>
<td>886 (273)</td>
<td>856 (260)</td>
<td>-29 (95)</td>
<td>0.73</td>
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<tr>
<td>Total RFD (N*s)</td>
<td>4912 (3705)</td>
<td>4811 (2898)</td>
<td>-101 (1756)</td>
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<tr>
<td>5ms RFD (N*s)</td>
<td>13379 (10424)</td>
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<td>-540 (4356)</td>
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<tr>
<td>30ms RFD (N*s)</td>
<td>10729 (7208)</td>
<td>10028 (5506)</td>
<td>-701 (3620)</td>
<td>0.73</td>
</tr>
</tbody>
</table>

**CONCLUSION**

- The results of the investigation concluded that three sets of three and five second isometric contractions does not produce postactivation potentiation.
- Further research is needed to determine the proper treatment protocol for use with isometric contractions.

**PRACTICAL APPLICATION**

- Even slight increases in force production may greatly benefit athletes competing in strength/power sports.
- Further investigation is necessary to determine if upper body PAP is attainable via isometric contractions

**ACKNOWLEDGEMENTS**

Supported by the University of Texas at El Paso graduate enhancement funds of the College of Health Sciences.