Body position and technique effects on displacement in the dyno maneuver in rock climbing

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Introduction

- Dyno = Dynamic Movement
- Popular Performance Recommendations:
  - Obtain the goal hold at the apex of upward movement, known to climbers as the “dead point”
  - Body position... [1,2,3]
  - Jump technique... [1,2,3,4]
- Starting position - highest vertical displacement of the hand (VDH) ?
- Jump technique - highest VDH at each starting position?
Methods

• Thirteen recreational rock climbers: Mean ± SD = 22 ± 5.2 y; 65.5 ± 8.2 kg; 172.5 ± 5.2 cm

• Mean climbing ability: 5.11 YDS/VII+ UIAA/6c French/22 Ewbank
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- Foot hold: block of wood protruding 3.8 cm from the wall
- Hand hold: 1 large feature (Jug)
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• Foot position – shoulder width
• Rock climbing shoes worn by all participants
Methods

- 15 minute warm up / 5 minutes rest
- Two dynos per technique at each starting position, randomized order
- Video analysis
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• 2X3 Repeated Measures ANOVA (jump technique X starting position)
Results

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Middle</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squat Jump</td>
<td>245.8 ± 12.8</td>
<td>250.9 ± 13.7</td>
<td>256.2 ± 15.2</td>
</tr>
<tr>
<td>Counter-movement</td>
<td>246.2 ± 15.2</td>
<td>250.2 ± 14.3</td>
<td>253.6 ± 14.6</td>
</tr>
</tbody>
</table>

\( a \) Significantly different from Middle and High conditions

\( b \) Significantly different from Low and High conditions
Discussion – Body Position

• Optimal starting position of close hands and feet?
  As the hands and feet became closer, VDH significantly decreased

• Range of motion (ROM)?
  Standing jump: full ROM is available for the arms and legs
  Dyno: ROM is determined by the distance between the hand and foot holds
  ROM is further affected by climbing surface near the knees

• Decrease in VDH from the high to medium to low starting position
  is likely caused by the subsequent decreases in ROM
Discussion – Jump Technique

• No significant differences between VDH achieved between jump techniques

• Biomechanical complexity?
  CM technique allows an increase in number of degrees of freedom theoretically allowing it to be executed in a variety of ways \[^5\]

• Non-elite rock climbers?
  Actual performance involves the reliance on optimal control and recruitment of motor units \[^6\]
  Elite rock climbers may be better able to utilize the benefits of a CM technique
Conclusion

• How to maximize VDH at three different starting positions on a vertical wall while considering jump technique
  Relatively large distance between hand and foot holds
  Jump technique should be based on personal preference or experience

• Suggested future studies:
  Inclination of the wall
  Size and shape of the hand and foot holds
  Surface roughness of the holds
  Body position and technique when performed by elite rock climbers
References


