PEAK POWER ASSESSMENT USING ISOKINETIC AND VERTICAL JUMP TESTS

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Introduction

Recently, contradictory results were presented using four numerical methods to calculate isokinetic peak power during concentric knee extension (1). The differences became more evident at higher angular velocities. Previous studies also presented contradictory results concerning the relationship between isokinetic tests and vertical jump test (2,3,4,5). The purpose of this study was to examine the differences between i) the power produced in isokinetic testing at concentric knee joint extension and ii) the squat vertical jump test.

Methods

The isokinetic power was calculated using four different methods. Five subjects performed concentric knee extensions at 0.52, 1.57, 3.14 and 5.23 rad.s⁻¹ on a Lido isokinetic dynamometer. The squat vertical jump test was performed over a Kistler force plate. Kinematic data from both test were collected and analysed using an optoelectronic system (ELITE). An inverse dynamics model was applied to measure knee joint moment for squat vertical jump test. Knee angular position data derived from the kinematic analysis in the isokinetic test were used to derive the actual knee angular velocity and acceleration, which in turn, was used to correct the dynamometer moment for inertial effects. Power was measured as the product of angular velocity and moment at the knee joint in both tests.

Results

Significant differences were found between peak power produced at the two tests (SVJ: 2255±434 W, IT: 771±81W). Rank order correlations revealed that there was no relationship between peak power output of the knee joint during the two tests (Table 1).

<table>
<thead>
<tr>
<th>Velocity</th>
<th>Method I</th>
<th>Method II</th>
<th>Method III</th>
<th>Method IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.52 rad/s</td>
<td>0.45</td>
<td>0.50</td>
<td>0.64</td>
<td>0.33</td>
</tr>
<tr>
<td>1.57 rad/s</td>
<td>0.59</td>
<td>0.55</td>
<td>0.67</td>
<td>0.48</td>
</tr>
<tr>
<td>3.14 rad/s</td>
<td>0.65</td>
<td>0.74</td>
<td>0.73</td>
<td>0.74</td>
</tr>
<tr>
<td>5.23 rad/s</td>
<td>0.80*</td>
<td>0.65</td>
<td>0.60</td>
<td>0.91*</td>
</tr>
</tbody>
</table>

Table 1 Rank order correlations between peak power produced at the four velocities using the four methods (IT) and the SVJ power. (*: significant correlation, p<0.05)

Discussion / Conclusions

The isokinetic test involves one segment and one joint, it is an open chain exercise, it limits the knee angular velocity and biarticular muscles (e.g. rectus femoris) are affected only by one joint (knee) since there is no simultaneous movement of adjacent joints. In contrast, the squat vertical jump test involves both legs, it is a closed chain exercise, the knee angular velocity is not limited and there is a transfer of energy from other joints. It was concluded that isolated joint isokinetic tests can not be used to predict functional performance due to differences in muscle and joint function characteristics during the different movements.

References