INFLUENCE OF RUNNING SPEED ON OVERARM THROWING MOVEMENTS WITH RUNNING

1Ti-Yu Chen, 1Wen-Hsin Hsu, 1Zhi-Yong Lin, 1Jong-Her Yang and 2Chung-Yu Chen
1Graduate Institute of Applied Sports Science, National Changhua University of Education, Changhua, Taiwan; email: chentiyu@yahoo.com.tw
2Graduate Institute of Physical Education, National Taiwan College of Physical Education, Taichung, Taiwan

INTRODUCTION

Many forms of movements were combined with several motor skills, example for catching and passing skills of baseball infields. From the viewpoint of dynamic system theory, these motor skills might be affected by each motor (Newell & Corcos, 1993). For handball players, the skill of moving body and passing the ball were very important. One of the abilities in passing ball was related to the sequence of overarm throwing movement which was the key for maximizing ball velocity. However, some papers had been reported the results which were not the same conclusion in proximal-to-distal sequence. Fradet, Botcazou, Durocher, Cretual, Multon, & Prioux (2004) and van den Tillaar & Ettema (2009) found overarm throwing sequence of handball players in several joints of the upper extremity that were not in proximal-to-distal. The aim of the present study was to investigate the influence of running speed on overarm throwing movements with running.

METHODS

A. Participants
Ten experienced male team handball players (mean age: 20.0 ± 0.6 years; height: 176.5 ± 5.7 cm; body mass: 78.1 ± 11.1 kg) volunteered for this study, all of them were asked to perform the overarm throwing movement as fast as possible at the target under the treadmill speed of 0 km/hr, 7 km/hr, 13.5 km/hr, and 20 km/hr.

B. Apparatus and Procedure
The Vicon MX-F40 motion analysis system with ten cameras (200 Hz) were used to record and to analyze the kinematic parameters for upper extremity. They were included angle velocity of shoulder horizontal adduction, elbow flexion, wrist flexion, shoulder internal rotation and wrist radial deviation. The repeated measure one-way ANOVA was adopted to analyze the statistical difference with an alpha level of .05.

RESULTS AND DISCUSSION

A. Shoulder

Figure 2: The angular velocity of shoulder, elbow and wrist at treadmill speed of 0 km/hr, 7 km/hr, 13.5 km/hr, and 20 km/hr. Line 2 showed the time of ball release.

Table 1 showed Means and SD of maximum angular velocity of upper extremity joints before ball release under the treadmill speed of 0 km/hr, 7 km/hr, 13.5 km/hr, and 20 km/hr. The results showed that the maximum angular velocity of shoulder horizontal adduction, elbow flexion, wrist flexion and shoulder internal rotation before ball release were no significant differences in four running speed (p > .05). Only

Figure 1: Experimental set-up. The participants performed overarm throwing with running as fast as possible at the target.
the maximum angular velocity of the wrist radial deviation in overarm throwing with standing (2110 ± 593 deg/s; F_{13, 27} = 4.93, p<.05, η² = .35, power = 87) was significantly higher than 7 km/hr (1620 ± 419 deg/s).

According to the results, in order to perform the overarm throwing movement with the fast running speed, the handball players should finish the throwing movements quickly. But the maximum angular velocity of upper extremity joints movements were not affected by any running speed. On the contrary, the more movement of wrist radial deviation occurred significantly in standing throw than that with running, because it had enough time to finish the whole motion. Therefore, it performed higher angular velocity formed with the momentum of trunk and lower extremity. This results were similar to Fradet et al. (2004) and van den Tillaar et al. (2009), which found overarm throwing sequence of handball players in several joints of the upper extremity that were not in proximal-to-distal.

Table 1: Means ± SD (deg/s) of maximum angular velocity of upper extremity joints before ball release under the treadmill speed of 0 km/hr, 7 km/hr, 13.5 km/hr, and 20 km/hr.

<table>
<thead>
<tr>
<th>Joint Movement (deg/s)</th>
<th>Treadmill Speed (km/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Shoulder Hor Add</td>
<td>1010 ± 285</td>
</tr>
<tr>
<td>Elbow Flex</td>
<td>1379 ± 286</td>
</tr>
<tr>
<td>Wrist Flex</td>
<td>2381 ± 634</td>
</tr>
<tr>
<td>Shoulder Adduction</td>
<td>993 ± 227</td>
</tr>
<tr>
<td>Wrist Radial Deviation</td>
<td>2110 ± 593</td>
</tr>
<tr>
<td>Shoulder Internal Rotation</td>
<td>4179 ± 1118</td>
</tr>
</tbody>
</table>

CONCLUSIONS
This study was to investigate the influence of running speed on overarm throwing movements with running. Results demonstrated that the maximum angular velocity of upper extremity joints of handball players were not affected by any running speed. This results were on the same wavelength with Fradet et al. (2004) and van den Tillaar et al. (2009).

REFERENCES