KINEMATIC ANALYSIS IN TEAM-HANDBALL JUMP THROW

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INTRODUCTION: The purposes of our study were to determine the proximal-to-distal sequence of the linear joint and angular velocities and to measure the influence of maximal angular velocities and performance level to ball release speed of the jump throw, which is the most applied throwing technique in team-handball (Wagner et al., 2008).

METHODS: 3-D kinematic data were analyzed via the Vicon MX 13 (8 cameras, 250 fps) from 26 male team-handball players of different performance levels (body height: 181.2 ± 7.6cm; body weight: 76.9 ± 11.3 kg; age: 21.2 ± 5.0 years; training experience: 6.8 ± 5.2 years). The performance level of the participants based on their experience and performance in competition and was rated from one (elite) to level six (novice) (level 1 [n=5], 2 [n=4], 3 [n=3], 4 [n=4], 5 [n=4], 6 [n=6]). The participants were instructed to throw the ball onto a target at 8m distance, and to hit a square of 0.5×0.5m at about eye level (1.75m), with maximum ball release speed and throwing precision. To calculate joint center positions, linear joint velocities, joint angular velocities and ball release speed, we used a three-dimensional model (Plug-In Gait Model, Vicon Peak, Oxford, UK). The measurement accuracy of our model is described in Tilp et al. (2008). For statistical analysis a one-way ANOVA were used to calculate the differences in the proximal-to-distal sequence and Pearson Product Moment correlation coefficient tests (two tailed tests) were calculated to determine association between ball release speed and maximal angular velocity, angular velocity at ball release and performance level.

RESULTS: Two different proximal-to-distal sequencings of the joints were found, separated into a classical and team-handball specific technique. We found correlation between ball release speed (20.0 ± 2.8m/s) and maximal trunk forward tilt angular velocity (392 ± 128°/s, r=0.62, P<0.01), the trunk forward tilt angular velocity (188 ± 109°/s, r=0.53, P<0.01), the trunk side tilt angular velocity (115 ± 139°/s, r=-0.52, P<0.01), the shoulder internal rotation angular velocity at ball release (3919 ± 1258°/s, r=0.53, P<0.01), the maximal elbow extension angular velocity (1537 ± 283°/s, r=0.51, P<0.01) and performance level (3.6 ± 1.9, r= -0.80, P<0.001).

DISCUSSION: Results of our study suggest that experienced team-handball players execute throws with better efficiency and movement coordination, trunk positioning, and arm movement velocity compared to less experienced players. Most team-handball players use both classical (complete proximal-to-distal sequence) and team-handball specific technique (incomplete proximal-to-distal sequence) depending on the game situation. The incomplete proximal-to-distal sequence described in our study were also found in team-handball standing throw by Fradet et al. (2004) and baseball throw by Hong et al. (2001).

CONCLUSION: We conclude that team-handball players need optimal movement coordination and the ability to produce greater force to perform jump throws with high ball release speed. The results of this study and those of recent studies in team-handball (Gorostiaga et al., 2005) suggest that specific strength and coordination training may increase ball release speed in the team-handball jump throw; however, additional training studies in team-handball players are warranted.

REFERENCES:

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