Biomechanical Analysis on Shooting Capability of an Elite Japanese Junior Female Team Handball Athlete

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It is well-known that Team Handball had its origin as early as 1900 in Germany, and that Japanese Team Handball was introduced in 1926, and became part of school education.

But, in Japan, we are more familiar with Baseball rather than Team Handball. For example, numerous number of Baseball population has existed in Japan, many elite athletes of Baseball are growing up and Japanese Baseball level closed to the World level, so far.

On the other hand, Japanese Team Handball doesn't reach the World level. At Los Angeles Olympic in 1984, Male National Team won only the tenth place. Female National Team vied with China and Korea for the title of Olympic, but in vain. For example, as far the maximal oxygen uptake as one of the best criteria of endurance capability in Sports and exercise. Kobayashi, et al. (1979) reported that maximal oxygen uptake in Female National Team Handball Team in Japan was 3.14 l/min. And

also, there are many of studies conducted on Team Handball Athlete. But there have been only few scientific studies dealing with Female High School Athlete. A top level High School Team got successive 16 times Japan Inter High School Championship since its foundation so far, and this Team also won the championship last year.

The purpose of this study was to investigate shooting capability of subject Tomoe Hayashi (T.H.), an extremely excellent and elite Japanese Junior Female Team Handball Athlete from physiological and kinesiological aspect.

METHOD

The subject T.H. of this investigation is 17 years old, height is 173.5 cm, weight is 63.0 kg, preferred hand is left and a member of the Komatsu Women's High School Team Handball Team, and also a member of Japanese National Team. In order to obtain the physiological data, the physical fitness variables were measured and maximal aerobic power test with bicycle ergometer. Expired gas was collected by Douglas bag method, and gas samples were analyzed according to the scholander technique. On the other hand, in order to obtain the kinesiological data, 4 types jumping free throw movement pattern of Team Handball were analyzed. (see Fig. 1).

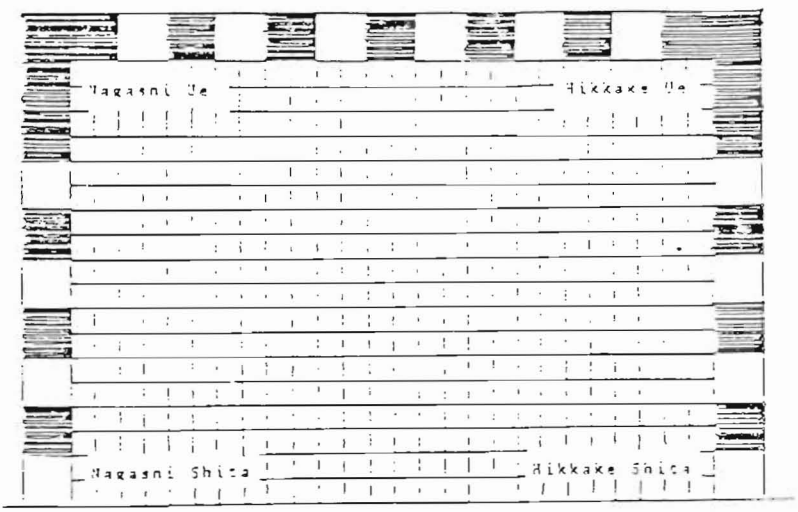

Fig. 1 Directions of Jumping Shoots in Free Throw.

Jumping Free Throw Movement was filmed by 16 mm high speed camera positioned at 20 m from the subject. The film speed was 64 frs/sec. Kinematic data was calculated by utilising NAC motion analyzer with digitizer. Ball velocity was measured by Cds cell system.

RESULTS AND DISCUSSION

As the result of measuring physical fitness of subject T.H., back strength was 107 kg, grip strength of the right hand was 39.0 kg. the left hand was 38.5 kg, Sargent jump was 53 cm, distance of handball throwing was 29 m and maximal oxygen uptake was 43.2 ml/kg/min.

As for jumping free throw shoot on 4 types, Hikkake Shita was 21.2 m/sec, Nagashi Shita was 21.0 m/sec, Hikkake Ue was 19.4 m/sec and Nagashi Ue was 17.4 m/sec for the ball velocity at release. (see Fig. 2) Jōris et al. (1985) reported that the ball velocity at release for female athlete in Holland was 17.2 ± 1.4 m/sec. A significant difference was found between subject T.H. and female athlete in Holland at the ball velocity. ($p < 0.01$) Ohnishi, et al. (1979) reported that the ball velocity at release for male varsity athlete in Japan was 19.4 ± 1.2 m/sec. No significant difference was found between subject T.H. and male varsity athlete in Japan at the ball velocity. Therefore, subject T.H. might have the ball velocity as much as that of male varsity athlete.

TABLE 1

Velocities at the take-off in Free Throw of Handball Jumping Shoot

Direction	Velocity-X (m/sec)	Velocity-Y (m/sec)	Angle of the take-off (deg)
Hikkake Shita	2.5	1.4	29.5
Nagashi Shita	3.2	1.3	22.5
Hikkake Ue	3.0	1.4	25.0
Nagashi Ue	2.9	1.3	24.5
Mean	2.90	1.35	25.8
S.D.	0.27	0.07	—

The horizontal velocity was 2.9 ± 0.3 m/sec and vertical velocity was 1.4 ± 0.1 m/sec at take-off angle of jumping free throw shoot. As a result

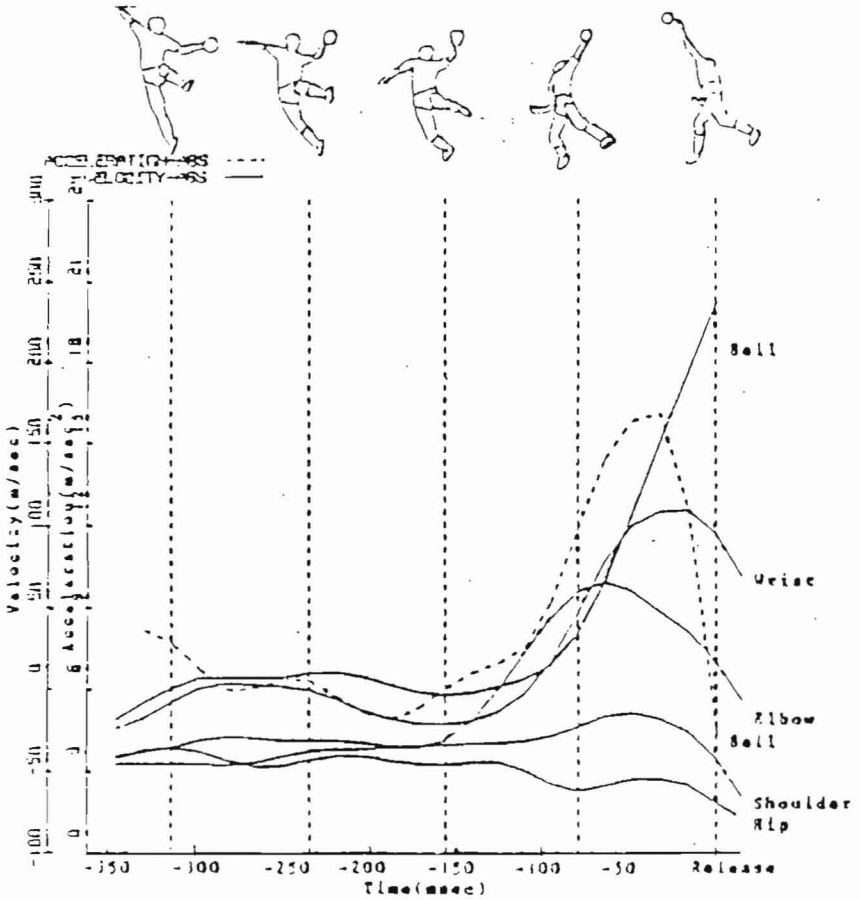

Fig. 2 Changes of Velocities and Acceleration in Free Throw, called «Hikkake Shita», of Handball Jumping Shoot.

of horizontal and vertical velocities, take-off angle of jumping free throw shoot was 25.8 degree. (see Table 1). Therefore, the jumping of subject T.H. is to be stressed forward rather than upward. In this form, body flow at forward and the release point is lower. If subject T.H. made an effort to improvement of jump, the release point would be higher and the ball velocity would be increased.

There are two factors in shooting technique. The first factor is that quicker at ball velocity of shoot, and it is a second factor that no forecast direction or timing of shoot for goal keeper. Therefore, this further

research concerning to variance of joint angle, ball velocities and ball movements in free throw shooting in conjunction with the second factor is recomended. As variance at the release of 4 types. (see Fig. 3). The

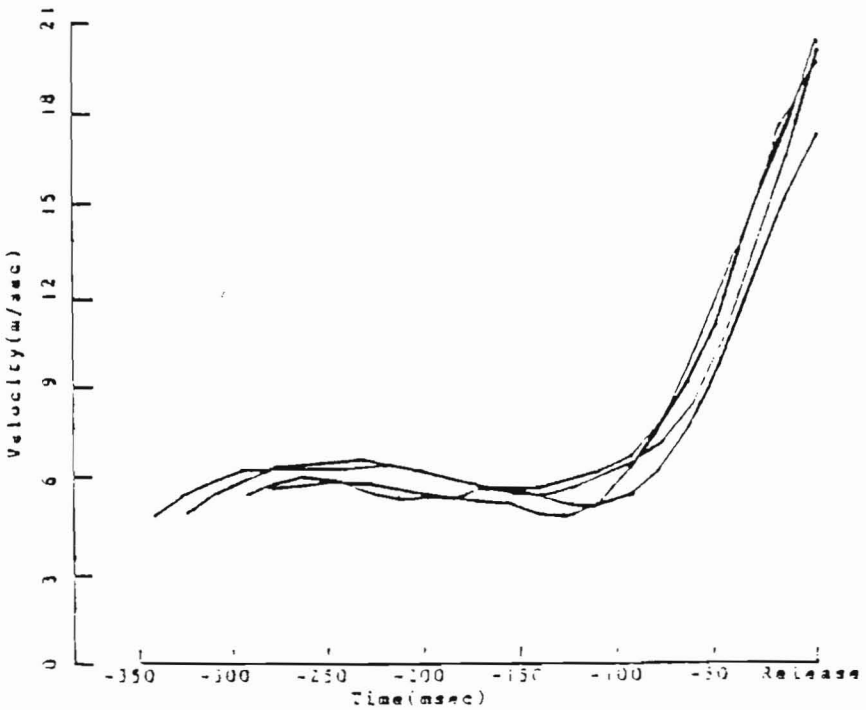

Fig. 3 Changes of Velocities in Free Throw of 4 types, called «Hikkake Shita», «Nagachi Shita», «Hikkake Ue» and «Nagashi Ue», of Handball Jumping Shoot.

variance of ball movements were nearly constant, but there were different from upward and downward at release point. (see Fig. 4).

CONCLUSION

Subject T.H., an elite Japanese Junior Female Team Handball Player, might have the ball velocity as much as that of male varsity athlete in

Fig. 4 Movements of ball in Free Throw of 4 types, called «Hikkakc Shita», «Nagashi Shita», «Hikkake Ue» and «Nagashi Ue», of Handball Jumping Shoot.

Japan. If this Young Japanese Team Handball Athlete, T.H. made an effort to improvement of shooting from in near future, subject T.H. might have shooting potentials of ball velocity itself in the World from both the physiological and kinesiolosical aspect.

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