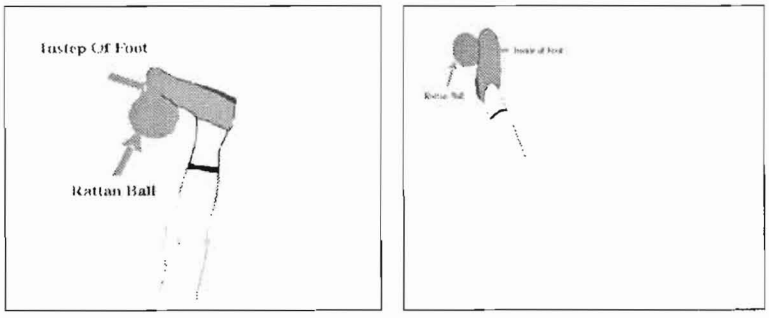
A COMPARATIVE ANALYSIS ON SELECTED KINEMATICS PARAMETERS BETWEEN THE "SEPAK KUDA" SERVE AND THE "SEPAK SILA" SERVE IN SEPAK TAKRAW

Juliana Usman, Wan Abu Bakar Wan Abas
Department of Biomedical Engineering,
Faculty of Engineering, University of Malaya, Kuala Lumpur, Malaysia

The purpose of this study is to compare selected kinematics parameters between the "Sepak Kuda" and the "Sepak Sila" serves technique in the game of Sepak Takraw. Four international players were videotaped while performing both serves during the 21st SEA Games. Two of the players used the "Sepak Kuda" serve technique while the other two players used the "Sepak Sila". Six synchronized video cameras with a speed of 50 Hz were used. Data was collected using the Peak Motus 2000 System software. Results indicate that the "Sepak Kuda" serve gives a higher post-contact ball velocity compared to that achieved the "Sepak Sila".

KEYWORDS: sepak kuda, sepak sila, velocity.

INTRODUCTION: Sepak takraw is a court game of tossing a rattan ball over a net by two opposing teams of three players each, using any part of the body except the hands. Earlier on in the history of the game, the spiking movement was considered the most important maneuver since it was the most important point-gainer beside the fact that the maneuver is attractive to the spectators because of its acrobatic-like movement. However, since the introduction of the "Sepak Kuda" (instep of foot) serve technique during the 18th SEA Game in Chiang Mai in 1995, those involved in the game had shifted their focus to this new serve technique as a reliable and fast point-gainer. In this new service kick, the "tekong" (the player performing the serve kick) uses the instep of the foot instead of the inside of the foot as in the orthodox "sepak sila" serve kick (Figure 1).



(a) (b)

Figure 1: (a) The "Sepak Kuda" Service Technique; (b) The "Sepak Sila" Service Technique (adapted from Juliana et. al, 2003).

Historically, Sepak Takraw is a game dominated by countries from the ASEAN region where the game originated, especially Thailand and Malaysia. Over the course of the years, the game has gained popularity and amassed followers from countries outside Asian. However. little interest has been shown in scientific study of any aspect of the game, unlike other sports such as soccer and badminton. Lately, a couple of publications on the serving techniques in Sepak Takraw can be found. Suwat Sidhitlaw did a study on the sepak takraw serves in 2000. The study was conducted during the 13th Asian Games. He recorded a range of foot velocities of 8.57 - 11.07 m/s at impact for players from six different countries. He found that the foot velocity at impact of a "tekong" who used the instep of the foot was greater than that obtained by a "tekong" using the inside of the foot. Mohd. Khairi Zawi (2001) in his study also confirmed

the superiority of the sepak kuda service compared to the sepak sila service in terms of the post-contact linear ball velocities. He recorded a mean post-contact ball velocity of 16.4 m/s for the sepak kuda service and 14.42 m/s for the orthodox sepak sila service. Meanwhile, Juliana et al (2002) reported a slightly higher mean post-contact ball linear velocity of 19.33 m/s for the sepak kuda service and 17.44 m/s for the sepak sila service. In soccer, the skill that uses similar technique to the sepak kuda serve is the instep kick where a research by Zernicke & Roberts (1978) reported that the release velocity of the ball in the maximal instep kick for skilled soccer player is in the range of 17 - 28 m/s. From research reports and on the court observations, it is obvious that the most powerful winning maneuver in the game of Sepak Takraw is the serve, especially the sepak kuda serve. The current research was conducted to study both the sepak kuda and the sepak sila serve and to compare them.

METHODS AND PROCEDURES: Four international male players, two using the sepak kuda serve technique and the other two using the sepak sila serve technique, were videotaped during the Final event of the Men's team at the 21st SEA Games in Kuala Lumpur in 2001. Six video cameras with a speed of 50 Hz were used for this purpose. The cameras were gen-locked for synchronization. Cameras were placed in strategic locations around the stadium where the game took place. Three cameras were focused on half of the sepak takraw court and the other three on the other half. Each set of three cameras was positioned with each camera capturing the front, side and back view of the players. The calibration employed a pole system, which involved four poles with five control points mounted on each poles. One pole was placed on each corner of half of the court for the purpose of calibration. Dimension between the poles and control points were calculated for the three-dimensional poles coordinates. The same procedure was carried out for the other half court. Body segment parameter data from the Dempster Model (1955) were adjusted to include the sepak takraw ball and used to determine the center of mass of the whole body. The Direct Linear Transformation (DLT) method (Abdel-Aziz and Karara, 1971) was used to collect the three-dimensional (3-D) coordinates of 21 body landmarks and the center of the sepak takraw ball for each subject in each trial. Since data acquisition was made during an open game, the use of reflective markers to represents the body segments and joints were not possible. Therefore, digitizing was done manually. Video images of selected serves executed by each tekong were digitized and calculated using the Peak Motus 2000 System software. Subsequent to digitizing, the raw data were smoothened using the Butterworth filter with the cut-off frequency of 7 Hz.

RESULTS AND DISCUSSION: The linear post-contact ball velocities were calculated as well as the linear velocities of the joints of the serving leg. The after-impact ball velocity is used as the measure of a kicking success. The mean maximum linear post-contact ball velocity recorded for the sepak kuda service is in the range of 18 - 21 m/s. For the sepak sila service, a slightly lower range of maximum post-contact ball velocity of 16 - 18 m/s was obtained. During the execution of the serves, the foot is in a plantar-flexed position for optimal contact with the ball, either using the instep or inside of the foot. For that, the toes of the foot reach a greater speed than the ankle joint. Consequently, the relationship of the serving leg linear joint velocities can be represented as hip < knee < ankle < toe as shown in Figure 2. This is true for both the sepak kuda and the sepak sila services.

However, only the toe velocity of the sepak kuda was higher than that achieved by the sepak sila serve. For other joints, the sepak sila serve gave higher velocities than what were recorded for the sepak kuda serve. Table 1 showed the mean linear velocity of each joint at impact and its correlation coefficient with the maximum post-contact linear ball velocity.

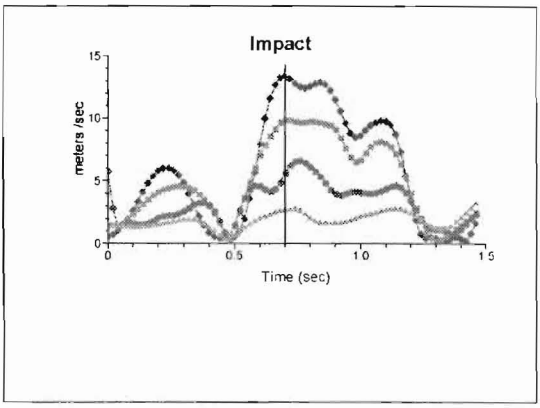


Figure 2: A typical linear joint velocity showing the sequencing of joint action.

Table 1 The mean linear velocity of each joint at impact and its correlation coefficient with the maximum post-contact linear ball velocity.

Joints	Mean Linear Velocity at Impact (m/s)		Correlation Coefficient (r) with Maximum Ball Velocity	
	Kuda	Sila	Kuda	Sila
Toe	11.62	10.10	0.66**	0.70**
Ankle	8.62	9.05	0.50**	0.25
Knee	3.91	4.02	0.29	-0.11
Hip	1.12	2.31	0.13	0.38

Note: (**) denotes significant at $p < 0.01$

Based on Table 1, the toe velocity had a very significant correlation to the maximum post-contact ball velocity where the measure of a successful kicking or serve movement was considered. The correlation between ball and toe joint velocity were generally high, suggesting that foot speed is a significant factor in the mechanics of foot-to-ball impact. In football instep kicking, Asami and Nolte (1983) reported significant correlation of 0.74 for professional soccer players while Isokawa and Lees (1988) reported significant correlation of 0.52 but with an approach angle of 0 to 30 degrees. The ankle velocity also had a very significant correlation to the after-impact parameters but only for the sepak kuda serve. However, if we look back to the earlier explanation on how each serves were executed, it is obvious that, in the sepak kuda serve technique, the toe would provide the most contribution to the ball velocity after impact (where the instep of foot was used) compared to the contribution of other joints. On the other hand, the use of the inside of foot to execute the sepak sila service could explain why the difference between the contribution of the toe and ankle were a mere 1 m/s. The ball heights at impact for both serves were also calculated. The contact height for the sepak kuda was recorded as 2.20 m (mean) while for the sepak sila, a mean height of 1.97 m at impact was recorded. A higher height at impact resulted in a steeper trajectory of the ball compared to the trajectory achieved by the sepak sila serve. The sepak kuda maneuver thus narrowed the receiving angle of the opponents.

CONCLUSION: This study was carried out to define the characteristics of the serve techniques

in the game of Sepak Takraw and to make a comparison between the sepak kuda serve and the sepak sila serve. The results confirm previous quantitative observations that the sepak kuda serve is indeed more superior to the traditional sepak sila. Additionally, a very significant correlation was found for the contribution of the toe to the ball velocity after impact. Thus, players should adopt the serve technique of sepak kuda and recognize the contribution of the toe for achieving the desired maximum ball velocity after impact. Further study into other characteristics of the sepak kuda serve technique would give a better picture on its effectiveness as well as give players a chance to learn how to implement it successfully.

REFERENCES:

Abdel-Aziz, Y.I. and Karara, H.M. (1971). Direct Linear Transformation From Comparator Coordinates Into Object Space Coordinates in Close-range Photogrammetry. In Proceedings of the Symposium on Close Range Photogrammetry, Falls Church, VA: American Society of Photogrammetry, pp 1 - 18.

Asami, T and Nolte, V. (1983). Analysis of Powerful Ball Kicking. In Biomechanics VIII-B (edited by H. Matsui and K Kobayashi) Champaign, IL: Human Kinetics, pp 695 - 700.

Dempster, W. T. (1955). Space Requirements of the Seated Operator. WADC Technical Report . Wright-Patterson, Air Force Base, OH, pp 55-159.

Isokawa, M. and Lees, A. (1988). A Biomechanical Analysis of the Instep Kick Motion in Soccer. In Science and Football (edited by T.Reilly, A. Lees, K. Davids and W.J. Murphy). London: E & FN Spon, pp 449 - 455.

Juliana Usman, Wan Abu Bakar Wan Abas, Azmin Sham Rambely, and Noor Azuan Abu Osman (2002). A Comparative Study on Kinematics Parameters Between the Sepak Kuda Serve and the Sepak Sila Serve in Sepak Takraw. In XXth International Symposium on Biomechanics in Sports - ISBS, Caceres, Spain; July 2002, pg.191.

Juliana Usman, Wan Abu Bakar Wan Abas, Mohd Razali Abdullah and Mohd. Safrusahar Yusoff (2003). A Kinematic Evaluation on the Execution of the Sepak Kuda Serve and the Sepak Sila Serve in the Game of Sepak Takraw. In Proceedings of the 2nd Technical Postgraduate Symposium 2003, Petaling Jaya, Malaysia, pp 561 - 563.

Mohd. Khairi Zawi (2001). Potency Of The Kuda Service In Sepak Takraw: A Case Of Superior Biomechanics Vs Oppositions' Perceptual Deficiency. In "Jurulatih", Buletin Lembaga Kejurulatihan Kebangsaan, Malaysia, Vol. 1/2001, pp 19 - 22.

Suwat Sidthilaw (2000). Three Dimensional Kinematic Analysis of the Sepak Takraw Serve In 13th Asian Games. In Proceedings of the National Conference on Biomedical Engineering Kuala Lumpur 2000, pp 4 - 5.

Zernicke, R. and Roberts, E.M. (1978). Lower Extremity Forces and Torques During Systematic Variation of Non-Weight Bearing Motion. Medicine and Science in Sports, 10, 21 - 26.

Acknowledgements

The first author would like to thank the University of Malaya, Malaysia for funding her post-graduate study. The involvement of the Biomechanics Unit of the National Sports Council, Malaysia in the study is acknowledged.