DESIGNING SPECIFIC TESTS TO PROFILE SEPAK TAKRAW PLAYERS:

A WIRELESS ACCELEROMETER FOR THE ASSESSMENT OF THE SERVICE KICK IN SEPAKTAKRAW

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INTRODUCTION

Sepaktakraw (Kick Volleyball), or Takraw for short, is one of the fastest growing games in Asia. It has attained an impressive level of international popularity, particularly after its introduction in the 10th Asian Games in Beijing in 1990 and as a demonstration sport in the 1998 Commonwealth Games in Kuala Lumpur. It has now spread to over 20 countries including Argentina, Australia, Brazil, Canada, Korea, Germany, England, India, Japan, Puerto Rico, Spain, and USA (Takraw World, 2003). The game is played on an area the size of a doubles badminton court, with three players on each side of a 5-foot high net (Figure 1).

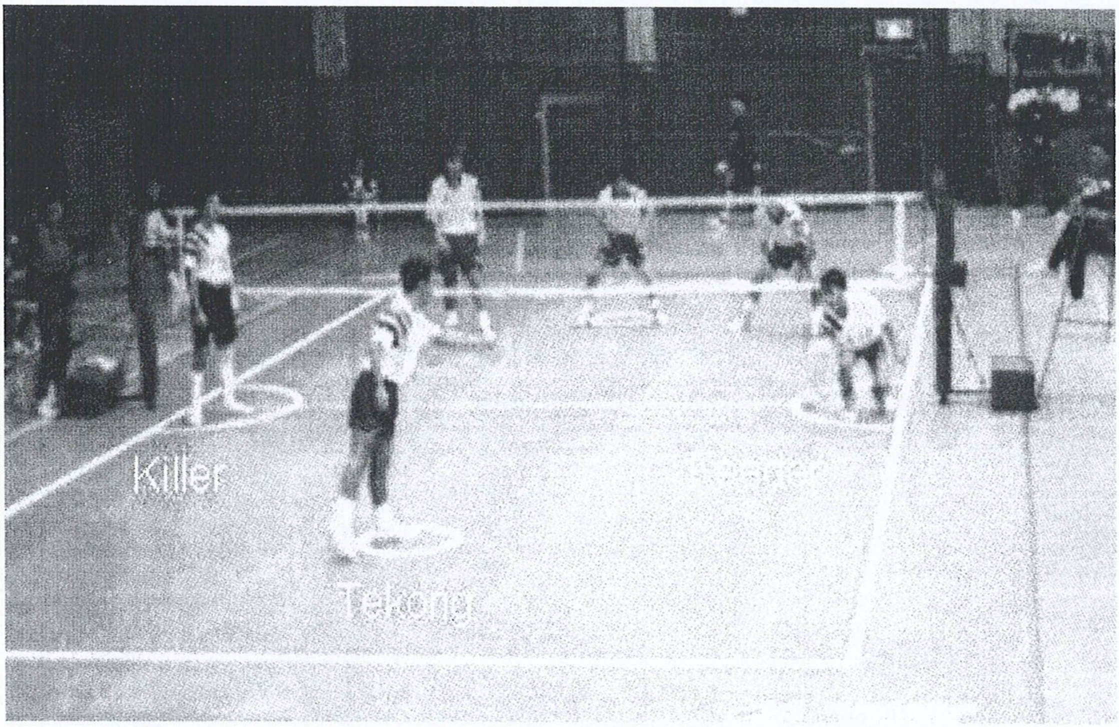

Fig 1: Positions in sepaktakraw game before the start of a rally

Sepaktakraw combines ball skills (kicking & juggling), with and the acrobatic moves, agility and strength of gymnastics (see Fig. 2). It is also described as an acrobatic volleyball but in which the use of hands is prohibited. Like in volleyball, there are passes, sets and spikes but all without the use of hands or arms. The players are allowed the use of head, chest, feet and thighs to propel the ball over the net. Both setting and spiking is done with the feet and numerous forms of the spikes are used to kill a rally.

Fig 2: Blocking and spiking between two players in action

However, to enhance performance in sports not only the physiological parameters and nutritional aspects of the athletes are important but also the mechanical component or, the technical execution of a particular skill. These skills, which enhance performance in certain sports are the service in tennis, the kick of a football, the service in sepaktakraw or the spike in volleyball. Although biomechanical analysis have been used for these analysis, but to out knowledge no acceleration of the service has been measured especially so in the service kick of sepaktakraw.

Objectives

Therefore the objective of this study was to design a wireless accelerometer to measure the service kick of the tekong in sepaktakraw (see Fig. 1).

Methodology

A wireless accelerometer named '***Sports Accel'*** (Fig. 3) was designed to assess the pattern of movement during any sports activities which will not interfere during the game.

This miniature wireless accelerometer sensor (Entran, USA) that was designed can be attached to any active limb, which can then detect acceleration up to ±250 g (each g 9.81 m/s). The sensor is connected to transmitter, which has a 24-bit Analog to Digital (A/D) with a sampling rate of 70 samples/sec. Through a microcontroller the transmitter can transfer data to a computer via an antenna at a rate of 9 Kbit/sec with a radio transmitter distance of up to 200 meters. Special software was designed to save and show all the parameters obtained during any activity. The transmitter can sends information of the accelerometer to the receiver device at a rate of 70 samples/second via an antenna (Figs. 4 & 5).

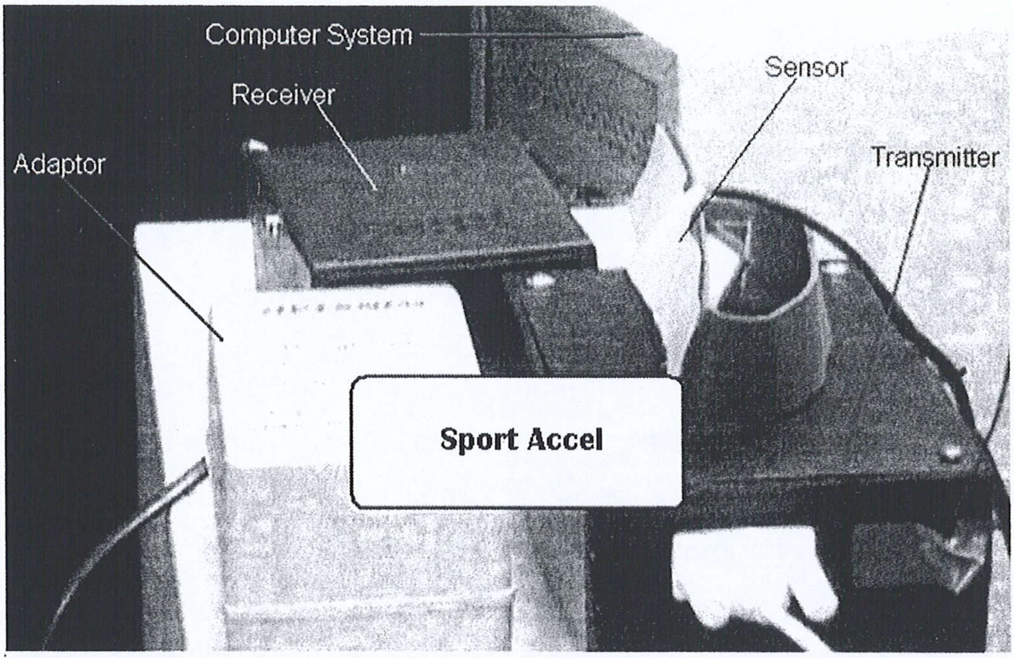

Fig. 3: The "***SPORTS ACCEL"*** equipment

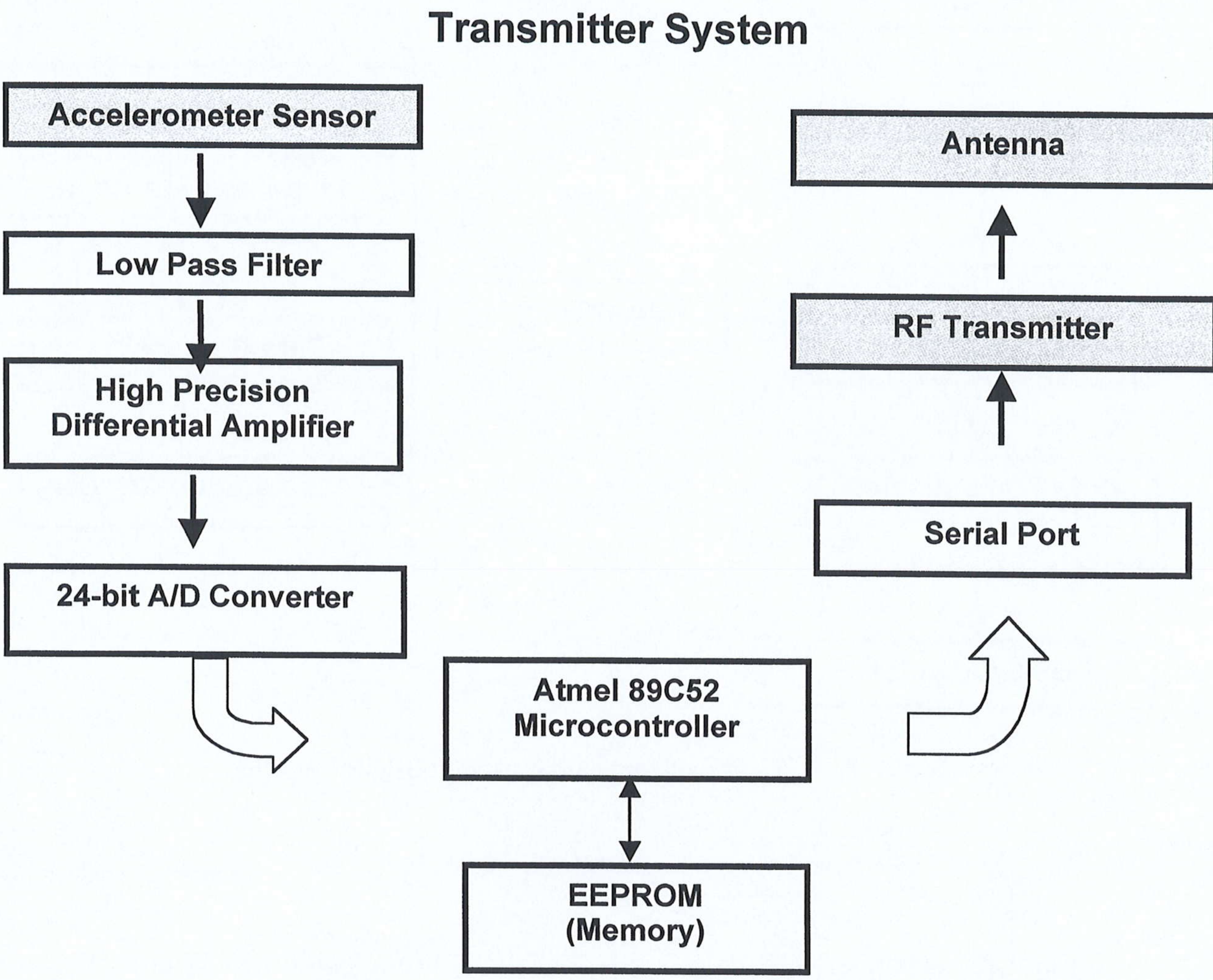

Fig 4: Transmitter system used in the design of SPORTS ACCEL

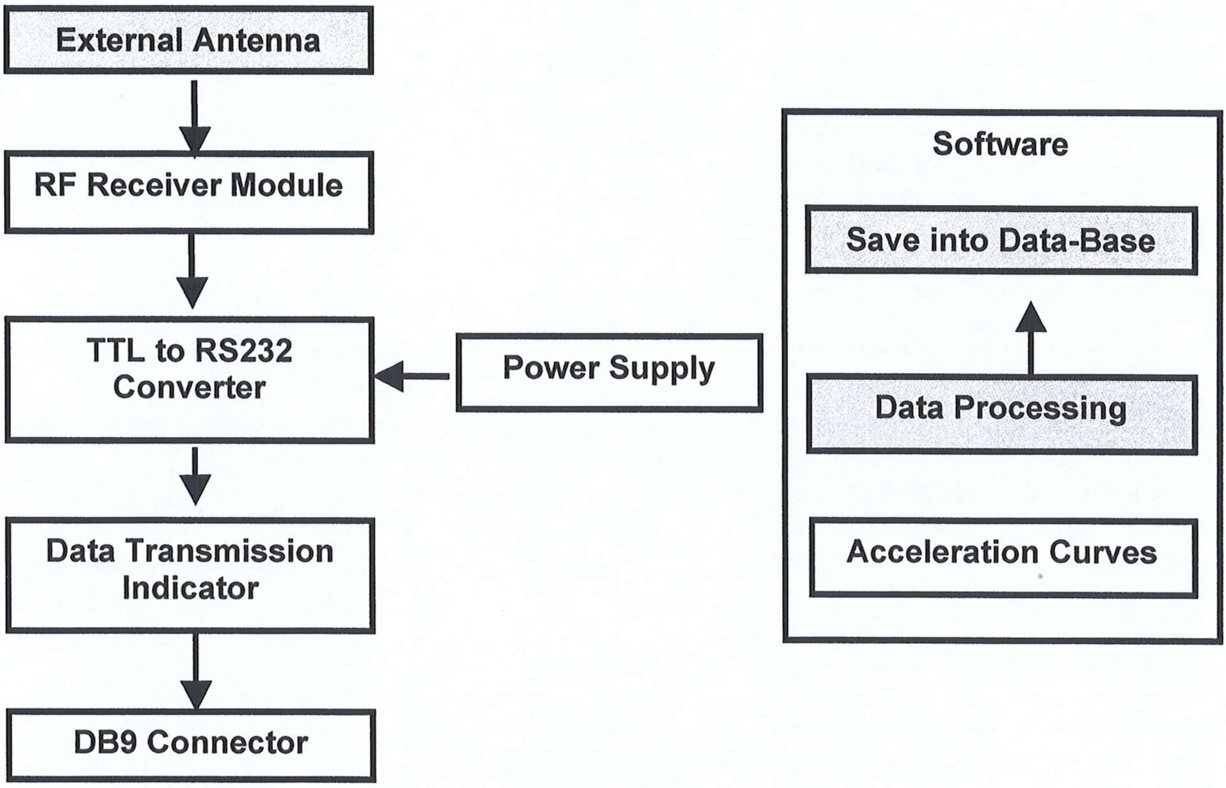

Fig 5: The receiver system layout used in SPORT ACCEL

Eight (8) tekongs (age range 18 – 21 years) participated in this preliminary trial to determine the acceleration and velocity of the service leg. The service leg length (Iliac crest to calcaneus) was also measured in cm using a measuring tape.

The accelerometer sensor was then fitted to the service leg of the tekong. The sensor was mounted on to a elastic band which was then placed on the service leg about 10 cm above the ankle joint (Fig. 6). The sensor was then connected to a transmitter via a cable, which was secured/fitted at the back of the tekong at the waist (Fig. 6). The transmitter is capable of sending information of the accelerometer to the receiver device at a rate of 70 samples/second via an antenna (Figs. 5, 6).

By the court, a receiver device was set up which was then connected to the computer via a serial port. A special software (written using Turbo Pascal software) was designed to show the accelerometer curves (Fig 7) which were then saved. After the trial the saved data was transformed to Excel data sheet

(Microsoft Co.) for statistical analysis. The data obtained were then averaged over 10 trials by each tekong.

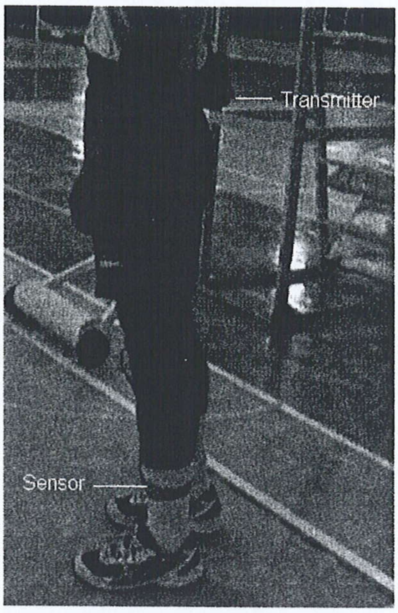

Fig 6: Attachment of sensor & transmitter

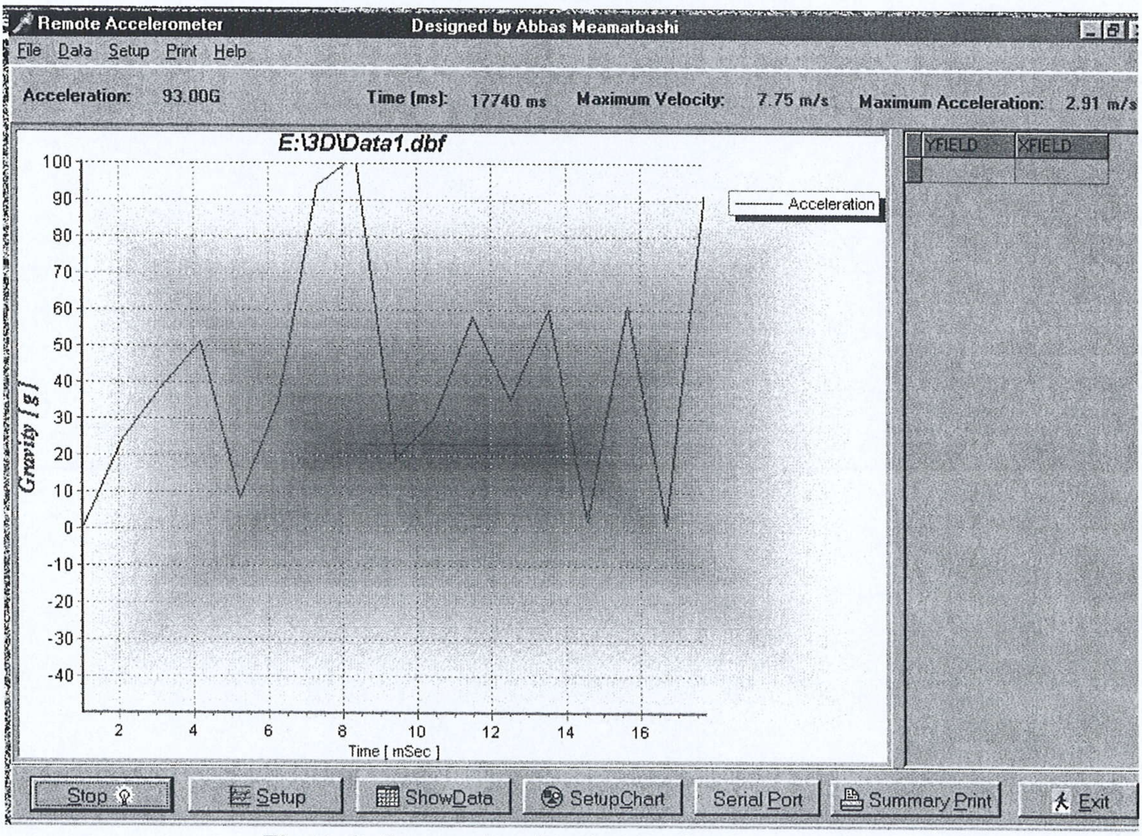

Fig 7: Software showing the service acceleration

Results

Leg length, peak tibia acceleration, duration of a service kick, maximum acceleration and maximum velocity are shown in Table 1. The kicking pattern obtained via these measuring devices is shown in Fig. 8.

Table 1: Leg length and kicking parameters obtained during a service kick of the tekongs

Leg length (cm)	Peak tibia acceleration (g)	Duration of the service kick (msec)	Maximum acceleration (g/sec^2)	Maximum velocity ($msec^2$)
101.4 ± 5.4	7.0 ± 2.8	187.2 ± 9.9	41.6 ± 22.4	407.6 ± 21.9

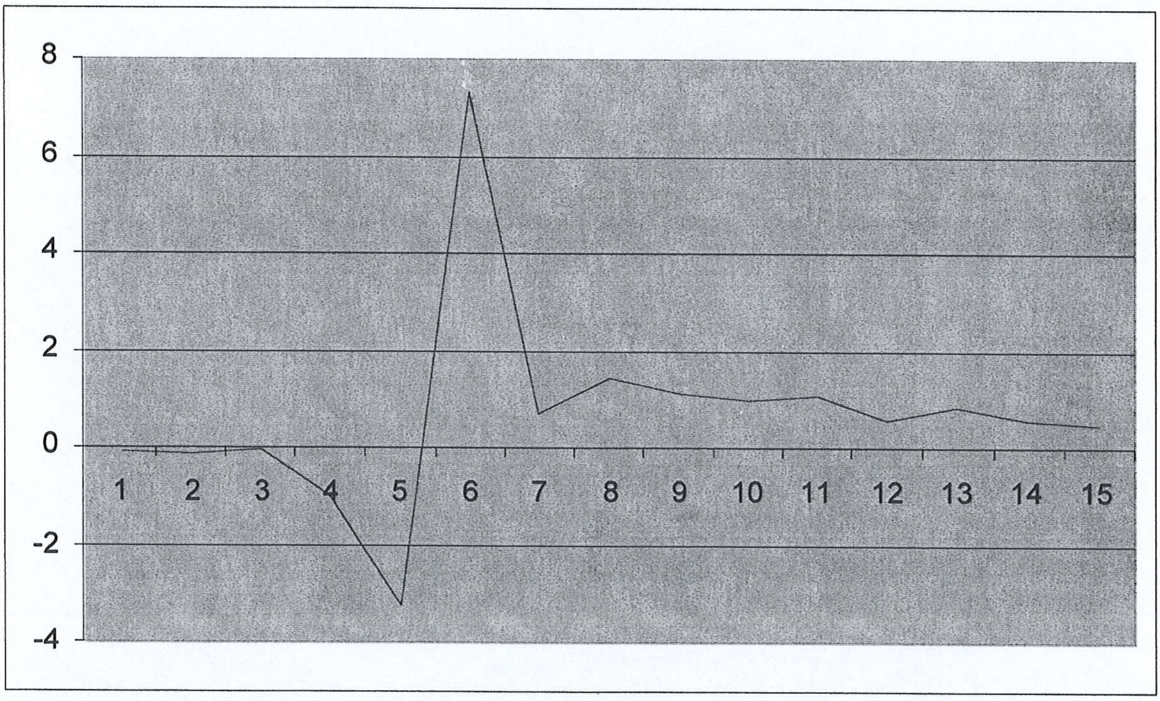

Fig 8: A kicking pattern of a service by a tekong

Table 2: Correlations between leg length, peak tibial acceleration (PTA), maximum acceleration and velocity in a serve by the tekongs

	Leg length	Peak tibia acceleration	Duration of the service kick	Maximum acceleration	Maximum velocity
Leg length		-0.18	-0.41	0.26	0.26
Sig (2-tailed)		ns	p<0.01	p<0.05	p<0.05
Peak tibia acceleration	-0.18		0.20	0.57	0.57
Sig (2-tailed)	ns		ns	p<0.001	p<0.001
Duration of the service kick	-0.41	0.20		-0.44	-0.44
Sig (2-tailed)	p<0.01	ns		p<0.01	p<0.01
Maximum acceleration	0.26	0.57	-0.44		1.00
Sig (2-tailed)	P<0.05	p<0.001	p<0.01		p<0.001

The results showed there was a significant and positive correlation ($r=0.26$, $p<0.05$) but however there was a negative correlation between peak tibia acceleration and duration of a service kick.

Peak tibia acceleration significantly correlated with max acceleration ($r=0.57$, $p<0.001$), are there was a strong correlation between maximum acceleration and velocity ($r=1.00$, $p<0.001$). However, there was a negative but significant correlation between maximum acceleration and kicking duration of a service (-0.44, $p<0.01$) (Table 2).

Discussion

The positive and significant correlation between tibia acceleration and maximum acceleration ($r=0.57$, $p<0.001$) in sepaktakraw kick service is similar to that obtained by Rodano and Tavana (1993) for soccer kick. Similarly Zernicke and Roberts (1976) also found a close relationship between peak tibia acceleration and ball speed when tested on skilled soccer players.

It is postulated that leg length may have an effect on the serve by the tekong which was never measured in sepaktakraw.

However, in this study, a low but negative correlation was seen with leg length and duration of kick ($r=-0.41$, $p<0.001$). This may indicate that there might be other important factors other than leg length which is essential in producing a greatest kicking velocity in the sepaktakraw service.

However, further study is need to elucidate the service of the tekong.

Acknowledgement

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