

## COMPARATIVE STUDIES BETWEEN THE TECHNIQUES OF SINGAPORE AND THAILAND MALE ELITE TABLE TENNIS PLAYERS FOR SEA GAMES 2001

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Singapore and Thailand Table Tennis players often compete with each other during the finals of major events. As such, an experimental study was done to compare the differences between the types of styles adopted by these national athletes during the SEA Games 2001. The scope includes the players' techniques, arm movements, ball speed and ball contact position. Video recordings from the actual competition were transferred to Peak Motion analysis system and the data was processed to obtain the required kinematic quantities. Two distinctive types of styles were observed when the players return the ball; one with fully stretched arms while the other with arms kept close to the body. In terms of ball contact position, all players contacted the ball higher and produced more ball speed when they stood further away from the table showing an emphasis in the drive technique.

**KEY WORDS:** table tennis, technique, analysis.

**INTRODUCTION:** Singapore and Thailand Table Tennis players often meet during the finals in various competitions and coaches have always been interested to find out the differences in the players' styles between the two countries. An analysis was thus carried out to determine these differences for the SEA Games men's finals. The scope includes the elite players' techniques, arm movements, ball speed and ball contact position. Video recordings from two camera views were processed using Peak Motus motion analysis system and the kinematic data obtained was analysed. An independent t-test was also performed to obtain group differences between the two countries. The results showed that all players contacted the ball at a higher position when standing far away from the table with a corresponding higher ball speed as they have ample preparation time to hit the ball compared to near table positions. It was also observed that Thailand players used several serve-and-attacks, a tactic well adopted by Chinese players (Cai & Tang, 2001). Finally, an analysis of limb angles showed that Thailand players kept their arms much closer to their body throughout the swinging of their bat as compared to Singapore players. This style of play was used regardless of their standing position when hitting the ball.

**METHOD:** Four players, all right handed, who reached the final session of the competitions including the champion and runner-up, were chosen for this study. All of them are elite national players aged between 18 to 27 years of age in the year 2001. In the competition arena, a total of six PEAK HSC-200 (50/200 fields/sec) high speed video cameras and VCRs were used to record videos of the matches on two courts, at the rate of 200 fields/sec and shuttle speed of 1/2000 sec. The setup for one of the courts is displayed in Figure 1.

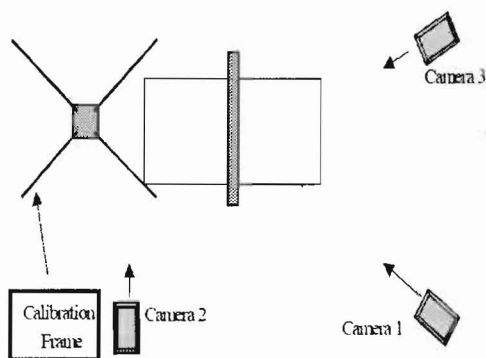


Figure 1: Experimental Setup.

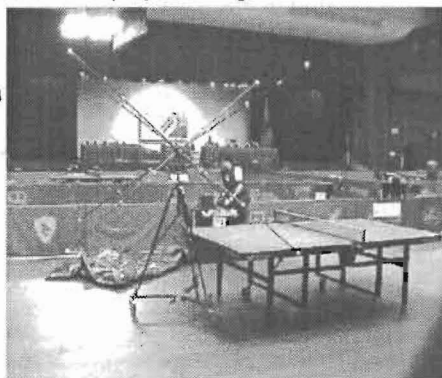


Figure 2: Calibration Frame.

The calibration frame was positioned as shown in Figure 2 for video recording from all camera views in order to do a three-dimensional motion analysis. There are altogether eight long rods and one short rod on the frame holding 25 control points. The angle between the optical axes of the cameras was between 70 to 120 degrees. Precautionary measures were taken to ensure that the location of the cameras remained unchanged throughout the video recording of the matches. Thirteen body landmarks on the player, one point on the ball, one point on the bat and one point on the center of table edge were also digitized using Peak Motus motion analysis system. The three-dimensional co-ordinates were reconstructed by the DLT method. Each trial consists of two camera views, which showed the player executing a forehand attack from his maximum back swing till a few video frames after ball contact. Camera 1 and 2 views were synchronized, cropped to the required length (about 8~12 frames, 0.04~0.06sec) and digitized to obtain the required kinematic data. The information considered were ball speed, ball contact position and the three body angles as shown in the Table 1 and Figure 3. Around six trials were selected for each player.

**Table 1 Points Definition.**

Point/Angle	Definition
1	Neck
2	Right shoulder
3	Right hip
4	Right elbow
5	Right wrist
1-2-4	Shoulder angle
3-2-4	Underarm angle
2-4-5	Elbow angle

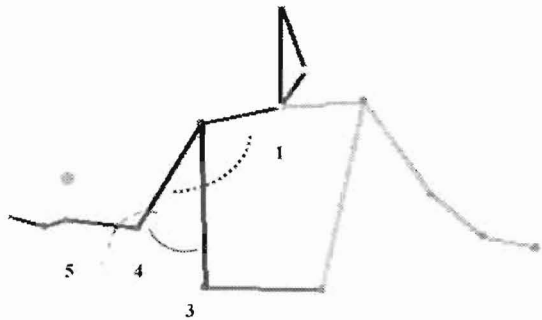


Figure 3: Human Stick Figure.

The height of ball (z-hgt) is the distance from its center to the level plane of the table's edge as shown in Figure 4. The distance (x-dist) is the projection in the horizontal plane measured from the ball center to the table's edge as illustrated in Figure 4 and 5. Ball contact position is divided into two groups namely 'Near' and 'Far' according to the ball's relative position to the table edge. For near ball contact position, at least 6 trials were selected from each player's nearest to table ball contact position. For far ball contact position, another 6 trials were selected from each player's furthest away from table ball contact position.

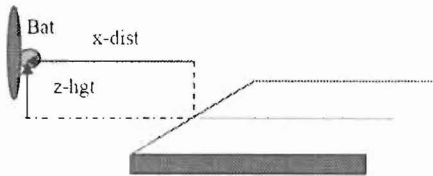


Figure 4: Ball Contact.

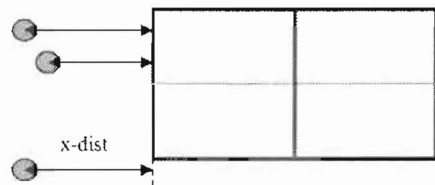


Figure 5: Ball Contact Distance (Top view).

**RESULTS AND DISCUSSION:** Ball speed: Drive is a technique emphasizing on more ball speed than spin while loop is a skill characterized by high ball spin with lower speed. From Table 2, the ball speeds were higher when they stood further away from the table because of ample preparation time to hit the ball as compared to when they were near the table. For far table position, both Singapore players A&B produced a higher ball speed as compared to the Thai players C&D. Player B produced the highest ball speed at 21.3m/s for far table position indicating that he placed more emphasis in drive than loop. When standing near the table, the

Singapore players still deliver a higher ball speed on the average. The ability to deliver a high ball velocity despite standing near the table indicates the players' fast reflexes and good preparation when tackling the ball. All the athletes discussed here are non-defensive players.

**Table 2 Trial Summary of Average Ball Contact Position, Speed and Limb angles.**

Player	X-dis	Z-hgt	Speed	UE			Underarm			Elbow			Shoulder			
				Ini	Fin	[%Δ]	Ini	Fin	[%Δ]	Ini	Fin	[%Δ]	Ini	Fin	[%Δ]	
A	N	-0.15	0.22	17.9	207	235	14	56	80	54	151	149	1	162	146	9
	F	1.70	0.23	18.6	174	146	16	72	37	49	102	109	7	123	122	0
B	N	0.30	0.20	15.7	Data unavailable/excluded											
	F	1.08	0.31	21.3	188	172	9	42	53	26	146	119	19	113	121	7
C	N	0.13	0.09	12.6	144	141	2	33	38	15	111	103	7	109	111	1
	F	1.01	0.21	17.5	146	135	11	44	37	16	102	98	4	138	148	7
D	N	0.61	0.16	16.8	148	136	8	34	51	50	114	85	26	121	116	4
	F	0.97	0.24	18.3	158	137	13	37	58	57	121	79	35	139	144	4

\*N:Near, F:Far, Ini:Initial angle at max back swing, Fin:Final angle during ball contact

**Ball contact position:** The ball contact distance of both Singapore players' furthest position is more than that of the Thais. From the results in Table 2, Player A's near table position during ball contact averaged out to minus 0.15m while his far table position is furthest at 1.7m. His standing position varies widely indicating that he has to cover a wider angle and area when competing with his opponent in order to return the ball. On the other hand, both Thai players' furthest position from the table averaged out to only about 1m showing less angle coverage required. Thai player D's near and far ball contact positions were 0.61m and 0.97m respectively. The little difference between these two standing positions indicates less area coverage required during competition and this may conserve energy for him to last for a longer match. Furthermore, his ability in forcing his opponent, Player A, to cover a greater area and angle shows his superior skills in controlling the game. This observation is consistent with the final outcome of the match whereby player D won. Both Thai players also adopted a tactic frequently used by China players; Serve-and-attack. Previous research by Cai & Tang (2001) on comparison between China and Sweden players showed that the percentage of winning serve-and-attacks for Chinese team (67%) was higher than the Swedish (58.1%). Another two papers by Wu (1996) and Zhang (2001) also highlighted on the value of attack after service. In terms of ball contact height, all players contacted the ball at a higher position when they stood further away from the table. Singapore player A's ball contact height differs little regardless of standing position. Thai player C's ball contact height is very low at 0.09m when near the table showing that he emphasized on high loop which produces ball characterized by high spin but lower speed. If he used drive at such a low height, the ball would likely hit the net. Since loops contain higher spin with lower speed, his low average speed of 12.6m/s further affirms this finding.

Table 3 shows the combined data of the players according to their countries. The mean ball speeds of local players are higher than Thai for both near and far table positions. In terms of ball contact position, Singapore players have a higher ball contact position than the Thais. The average contact distance of local players is from 0~1.47m but the range for Thais is smaller (0.28m~1.06m) showing a lesser area and angle coverage required. In order to ascertain the significance of group differences between local and Thailand players in terms of ball speed and contact position, an independent t-test was carried out at  $p < 0.05$  significance level (2-tailed). Results showed that there is a significant difference in ball contact distance (Far) between Thailand and Singapore players indicating that they differ considerably in this aspect. No significant difference, however, was observed among other comparisons.

**Table 3 Statistics on Ball Contact Position and Speed.**

Location	Country	X-dist.			Z-hgt			Ball Speed		
		Mean	Std.D	<i>p</i>	Mean	Std.D	<i>p</i>	Mean	Std.D	<i>p</i>
Near	S'pore	0	0.41	0.131	0.22	0.13	0.153	17.33	6.70	0.266
	Thai	0.28	0.31		0.14	0.10		14.42	3.27	
Far	S'pore	1.47	0.37	*0.010	0.25	0.16	0.607	19.30	3.33	0.524
	Thai	1.06	0.18		0.22	0.08		18.30	3.40	

**Limb Angles:** The angles taken into account were Underarm, Elbow and Shoulder. From the results in Table 2, the percentage variations in Underarm and Elbow (UE) angles were much more substantial than that of the shoulder angles. The slight variation in shoulder angles from maximum back swing to the point of ball contact indicates its minimal contribution to ball speed. Both Thai athletes have smaller underarm and elbow angles as compared to the two Singapore ones on the whole. The Thais tend to keep their arms closer to their body throughout the whole movement in hitting the ball as shown in Figure 6. UE angles were considered together because both determine the extent in which the player stretched his arm out. By having a larger underarm and elbow angle, local players are able to make use of the advantage in producing a higher ball speed as  $v=r\omega$  whereby  $r$  is the swinging arm's length. If a player has large UE angles, this means that he stretched out almost the whole arm when hitting the ball. In contrast, Thailand players had small underarm and elbow angles wherever they stood.

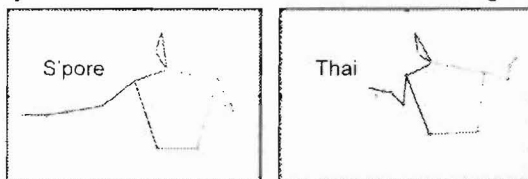


Figure 6: Two Styles of Play.

Referring to Table 2 far table position, the ball speed for each player varies positively with the magnitude in percentage change in UE. Player A had a substantial percentage change in his Underarm angle but not much for his elbow angle. Thai player D showed an obvious application of forehand high loop wherever he stood. As shown in Table 2, he began with a small underarm angle and this angle increased by over 50% at point of ball contact. At the same time, his elbow angle reduced by around 30% indicating the use of his lower arm strength to execute the high loop. He was also the player with most considerable change in elbow angles. Despite using high loops, his ball speeds are still substantially high showing his superiority in skills over the others.

**CONCLUSION:** The differences in techniques adopted by the athletes from the two countries had substantial influence on their performance. The standing position is important in determining the area and angle of coverage required. A player who stands far away has to cover a wider area and angle when returning the ball and this might place them in an unfavorable position. It is obvious that Players A and D differs greatly in this aspect. It was also found that the ball contact height was higher when players stood further away from the table. Thailand players contacted the ball at a lower position than local players showing an emphasis on the technique of loop. They are also well aware of the value of serve-and-attack tactic. A comparison between the mean ball speeds and contact position showed that there are statistical significant differences between Thai and Singapore players in terms of ball contact distance. Finally, the ball speed produced by the players is dependant on their underarm and elbow angles with minimal contribution from the shoulder angles.

#### REFERENCES:

- Bartlett, R. (1999). Sports Biomechanics. London: E & FN Spon, 99-103.  
 Carr, G. (1997). Mechanics of Sport. USA: Human Kinetics, 113-117.  
 Ellen, K., & Katherine, M.B. (1996). Biomechanics. USA: Allyn & Bacon, 345-348.  
 Hosford, G.T. (1993). Sports Biomechanics. Australia: B.I.P.E. Publications, 56-57.  
 Hall, S.J. (1999). Basic Biomechanics. New York: McGraw Hill.  
 Wu, X. (1996). Analysis of service techniques of top-level Chinese attacking table tennis players. International Journal of Table Tennis Sciences, 111-115.