

Effect of Training Method on Serve Skill Improvement for Amateur Tennis Beginners

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(Received August 26, 2011, accepted September 9, 2011)

Abstract. Ten university man students were divided into experimental group and comparative group. This study measure and analyzed serve posture, accuracy of ball and speed of the two groups according to training duration (pre, mid, post). There were significant differences in ready position, back swing, forward swing 1 stage, forward swing 2 stage, impact, follow throw, finish, total score, and accuracy and speed of served ball except for toss, a specific item of accuracy variables in serve posture. The interaction effect between group and training duration showed a slight difference except for ready position and impact a specific item of accuracy variables in serve posture.

These results were proven effective to perform serve training by expanding gap from serve line to base line including the ball throw than ordinary method for beginners. Accordingly, if tennis coaches and instructors adopt this method in teaching serve, it shall be beneficial to beginners to improve their serve skill.

Keywords: Tennis, serve skill, beginners, swing, stroke, impact, follow throw

1. Introduction

“Sports for all” means all effort to fulfill sports demand generated by voluntary participation in a leisure time. It will become a more important part of life, and health shall be a strong force in leading happier life. The interest for tennis in “Sports for all” is far more increasing. Tennis skills consists of ground stroke, volley, smash, and serve. Among these, serve is the only attacking skills initiated by a player’s intention [1]. Thus, service is a focal factor to win a game regardless of professionals or amateurs in the contemporary tennis. The contemporary tennis seeks an active style beyond passive depending on the other side’s mistake. In particular, the power of serve is a determining tool to decide the result of game [2]. Therefore, it is very important to learn accurate serve skill for beginners.

Serve is a means to help earning score by making receive as difficult as it can using accuracy and power of a ball, acuity and variety of landing spot, and spin. Linear motion and angular motion should be mixed to have an effective serve. The former is a linear motion like a weight motion from hind leg to front leg, and the latter means a movement of each part of body due to body rotation [3]. To induce strong power and good form, shoulder movement, weight transfer from hind leg to front leg, clockwise rotation of hip and shoulder in backswing, anticlockwise rotation of hip and shoulder in forward swing, wrist exercise and elbow exercise shall be considered [4]. For arm movement, suitable timing and rhythm is important to harmonize between body and lower limb [5-6], and forces generated from ground reaction force should be transferred to leg, hip, body and upper body [7]. In fact, it is not eligible for applying these explains in the actual match.

The serve capacity of beginners is subject to accuracy of toss, back swing attitude, grip and forward swing. As this is a single connected motion, it tends to be taught as a connected motion rather than a divided motion. Such teaching method makes it difficult to find a cause of serve fault, and takes much time for beginners to successfully acquire serve skills of high level of difficulty.

So far, majority studies on serve were targeted to intermediate level players with relatively few on beginners. Thus this study was carried out to develop effective serve teaching method, and to offer fundamental date for beginners to equip scientific and effective training. This study set two groups: experiment group (EG) and comparative group (CG). The EG performed serve training by expanding gap

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from serve line to base line including the ball throw. And the CG practiced usual serve training method of connected motions from the first. And, the effect on the posture of serve, accuracy of ball and speed shall be examined according to pre, mid and post test to develop teaching method on serve, one of the most important skills in tennis.

2. Research methods

2.1. Subject

Research subjects were some of 10 college male students of M university who have no experience of play tennis. They were divided into two type of groups (5 each for EG and CG). The physical characters of subjects are in the Table 1.

Table 1 Physical characteristics of the each group members. Height and weight values are mean and standard deviations (mean \pm SD).

Athletes group	Number of persons	Average age	Average height (cm)	Average weight (kg)
Experimental group(EG)	5	20	179.4 \pm 2.93	68.2 \pm 5.99
Comparative group(CG)	5	20	178.2 \pm 2.93	68.4 \pm 5.99
Total/Average	10	20	178.8 \pm 3.25	68.3 \pm 4.75

2.2. Training program and teaching contents

The EG performed serve training by expanding gap from serve line to base line including the ball throw. And the CG practiced usual serve training method of connected motions from the first. Total three tests were conducted per week with 1 hour per day. No extra tennis exercise is permitted for effectiveness of training and reliability.

For the first 1 week, both groups were given instruction for serve posture by the researcher's demonstration. Stance, ball toss, swing, impact and follow throw were taught in divided motion and connected motion with theoretical teaching on terms of serve. Light swing was encouraged to relax arms with no more than 60% force. If ball toss is too high, accurate timing is difficult in impact due to high velocity, and if it is too low, it causes an awkward movement and makes weight transfer hard. For both groups, it was taught to toss the ball 10cm higher than the maximum hitting point to improve accurate toss.

Ball throw in the contents of training was given to the EG only. To acquire smooth serve form, ball toss, impact, wrist motion and follow throw, they threw ball as far away as possible while taking serve form standing face to face with net in the middle as shown in Figure 1. In full scale serve training, the EG was exercising serve in sub-line between week 2 and week 9, and in base-line between week 10 and week 12. The CG was instructed to exercise serve in base-line from the first for 12 weeks. Both groups were taught to impact a ball on 12 o'clock direction accurately. Before serve, they had serve swing for 50 times, and were instructed to serve while relaxing shoulders and arms with no more than 80% of full power.

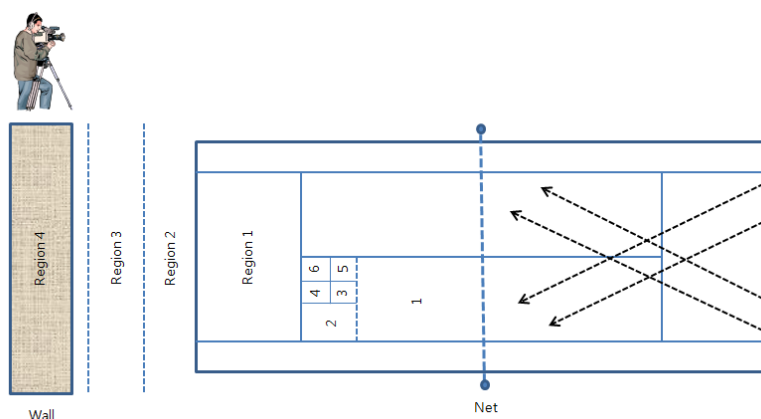


Figure1. Drawing of minimized tennis court, ball throwing positions and directions (black line), and positions of point and regions.

2.3. Measurement tools and method

The tests were carried out in three times: before (pre), intermediate (mid, week 6) and after (post, week 12). Warm-up and cool-down were performed to prevent injury during the test. 3 minutes rest were given in measuring tennis serve, and 5 minutes rests were give in measuring accuracy and speed of a ball. And exercise (pre, mid and post) measurements were carried out equally.

Video recording was taken as in Figure 1 to measure serve posture. The shooting was made by installing a tripod by keeping 45° with right motion direction at the 9m spot with 1m height of lens. Motions were recorded 10 times each after 5 minutes warm-up and 5 minutes serve exercise for an accurate motion and prevention injury. To assess accurate posture, specialists confirmed validity of contents and structure. It was measured using measurement scale in Table 2 which was verified its reliability by 8 divided motions. 5 specialists from professor, director and coach of elite players and instructors of amateur groups evaluated posture. The characters of measurement scale were explained, followed by marking of evaluators on each serve motion by subjects through video-tape in 5 stage Likert scale. The collected scales were analyzed by adding 5 specialists' score by sectional score and total score (connected motion). Table 2 is a serve measurement scale by items.

Achievement test was used to measure accuracy of serve and speed [8]. This test aims to measure ability to serve tennis ball over net to the marked spot of the other part's court accurately and powerfully as in Figure 1, the score was marked on the tennis court from 1 to 6, and the test places were prepared inside and outside tennis court in 1, 2, 3 and 4 spot. Rope in 1/4 inch thick was installed in 7 feet high over net horizontally from both poles. The subject made 10 serves outside right end line as set in the rules after ten minutes warm up together with watching a demonstration of serve. The scores on the spot and spot where ball was bound were added, but balls that did not pass net or rope were excluded in the score.

Table 2 Evaluation sheets for each athletes name. Total points were given according to result of detail actions of five different descriptions

Athletes name	Detail action	Evaluation point				
		Very bad	Bad	Normal	Good	Very good
Preparation pose	Foot stance same as shoulder width	(1)	(2)	(3)	(4)	(5)
	Hand without racket indicate target					
Back swing	Weight move to left foot following racket	(1)	(2)	(3)	(4)	(5)
	Racket raise from back and bottom to up					
Toss	Arms do not bend	(1)	(2)	(3)	(4)	(5)
	Begin his knee weight at the front knee					
Forward swing (1st step)	Weight move to forward same time knee bend	(1)	(2)	(3)	(4)	(5)
	Upper body twisted enough					
Forward swing (2st step)	Begin upright bent knee and comeback twisted upper body	(1)	(2)	(3)	(4)	(5)
	Racket head on shoulder toward down from back of head					
Impact	Body toward front and knee stretch enough	(1)	(2)	(3)	(4)	(5)
	Racket toward up and sight fix on the impact					
Follow through	After impact wrist snap twist	(1)	(2)	(3)	(4)	(5)
	Land foot during racket forward enough					
Finish	Upper body move following racket	(1)	(2)	(3)	(4)	(5)
	Catch landing position of ball					

2.4. Resource processing

SPSS Windows 14.0 program [9] was used to chase the differences of the two groups in serve posture, accuracy of ball and speed. Independent variables are groups (EG-CG), training duration (pre-mid-post), and serve posture(divided motion; ready position, back swing, toss, forward swing 1 stage, forward swing 2 stages, impact, follow through, finish, total score; connected motions), accuracy and speed were dependent

variables. Two-way mixed ANOVA [10] with repeated measure were used to assess effect by training period of both groups, and posteriori test (multiple comparison) for training duration (pre, mid, post) were executed, and every level of significance was $\alpha=0.05$.

3. Results

3.1. Effect of training on preparation pose

As to ready position, an accuracy variable with standard deviation (SD) of serve posture (divided and connected motions), the EG and CG were Pre 13.00 ± 1.41 and 13.00 ± 1.22 , Mid 17.40 ± 1.95 and 12.80 ± 1.30 , and Post 19.40 ± 0.55 and 18.00 ± 1.22 , which demonstrated an increase of 6.40 (49%) and 5.00 (38%) respectively as shown in Figure 2a. The groups showed significant differences ($p < 0.05$), and a significant difference was shown according to training duration ($p < 0.001$). Specifically, there were significant differences in pre –mid ($p < 0.001$), pre-post ($p < 0.001$) and mid-post ($p < 0.001$), but no interaction effect between groups and training duration was shown.

3.2. Effect of training on back swing

As to back swing, the EG and CG were Pre 13.40 ± 1.52 and 12.80 ± 1.10 , Mid 14.40 ± 2.07 and 13.40 ± 8.9 , and Post 17.40 ± 1.14 and 13.80 ± 8.4 , which demonstrated an increase of 4.00 (29%) and 1.00 (7%) respectively as shown in Figure 2b. The groups showed no significant difference, but a significant difference was shown according to training duration ($p < 0.01$) in case of EG. Specifically, there were no significant differences in pre-post ($p < 0.01$) and mid-post ($p < 0.05$) in case of CG, and an interaction effect between groups and training duration was shown.

3.3. Effect of training on toss

As to toss, the EG and CG were Pre 11.40 ± 2.41 and 12.60 ± 1.34 , Mid 12.40 ± 1.34 and 12.00 ± 1.22 , and Post 14.60 ± 2.07 and 13.00 ± 1.41 , which demonstrated an increase of 3.20 (28%) and 0.40 (3%) respectively as shown in Figure 2c. The groups showed significant differences ($p < 0.05$), and a significant difference was shown according to training duration ($p < 0.01$). Specifically, there were significant differences in pre-post ($p < 0.01$) and mid-post ($p < 0.05$), and an interaction effect between groups and training duration was shown ($p < 0.05$).

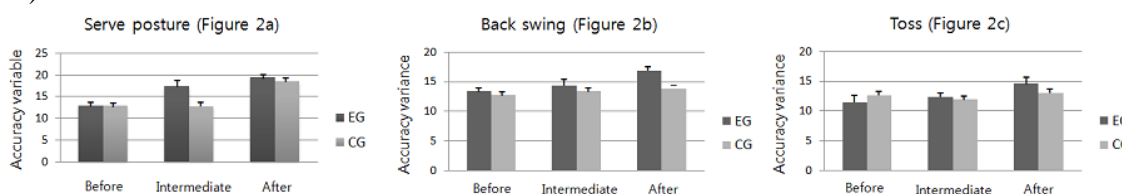


Figure 2. Effect of training on preparation pose (2a), back swing (2b), and toss (2c) of EG and CG athletes group, respectively. Each values represent mean \pm SD. In each vertical column means accuracy variance.

3.4. Effect of training on 1st step forward swing

As to forward swing 1 stage, the EG and CG were Pre 11.80 ± 1.30 and 11.60 ± 1.14 , Mid 12.80 ± 1.30 and 11.40 ± 1.14 , and Post 15.40 ± 1.14 and 12.00 ± 7.1 , which demonstrated an increase of 3.60 (30%) and 0.40 (3%) respectively as shown in Figure 3a. The groups showed significant differences ($p < 0.05$), and a significant difference was shown according to training duration ($p < 0.001$). Specifically, there were significant differences in pre-post ($p < 0.001$) and mid-post ($p < 0.01$), and an interaction effect between groups and training duration was shown ($p < 0.01$).

3.5. Effect of training on 2nd step forward swing

As to forward swing 2 stage, the EG and CG were Pre 11.00 ± 1.22 and 11.40 ± 5.5 , Mid 12.00 ± 1.22 and 11.00 ± 7.1 , and Post 14.80 ± 1.79 and 11.40 ± 1.14 , which demonstrated an increase of 3.80 (35%) and 0 (0%) respectively as shown in Figure 3b. The groups showed significant differences ($p < 0.05$), and a significant difference was shown according to training duration ($p < 0.01$). Specifically, there were significant differences in pre-post ($p < 0.01$) and mid-post ($p < 0.05$), and an interaction effect between groups and training duration was shown ($p < 0.01$).

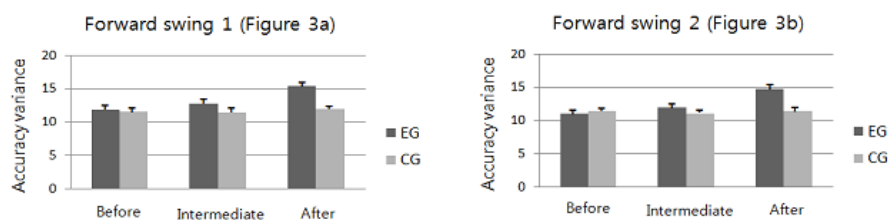


Figure 3. Effect of training on 1st step forward swing (3a) and 2nd step forward swing (3b) of EG and CG athletes group, respectively. Each values represent mean \pm SD.

3.6. Effect of training on impact

As to impact, the EG and CG were Pre 12.40 \pm 5.5 and 11.40 \pm 8.9, Mid 12.00 \pm 1.00 and 11.20 \pm 8.4, and Post 13.00 \pm 1.00 and 12.00 \pm 1.22, which demonstrated an increase of 0.6 (4.8%) and 0.6 (5%) respectively as shown in Figure 4a. The groups showed significant differences ($p < 0.05$), but no significant difference was shown according to training duration. And no interaction effect between groups and training duration was shown.

3.7. Effect of training on follow through

As to follow throw, the EG and CG were Pre 8.00 \pm 1.00 and 8.20 \pm 8.4, Mid 9.80 \pm 1.79 and 8.00 \pm .71, and Post 12.20 \pm 1.30 and 8.60 \pm 1.14, which demonstrated an increase of 4.20 (53%) and 0.40 (5%) respectively as shown in Figure 4b. The groups showed significant differences ($p < 0.05$), and a significant difference was shown according to training duration ($p < 0.01$). Specifically, there were significant differences in pre-post ($p < 0.01$) and mid-post ($p < 0.01$), and an interaction effect between groups and training duration was shown ($p < 0.01$).

3.8. Effect of training on finish

As to finish, the EG and CG were Pre 7.20 \pm .84 and 8.60 \pm .89, Mid 10.40 \pm .55 and 8.80 \pm 8.4, and Post 13.80 \pm .84 and 11.40 \pm 1.41, which demonstrated an increase of 6.60 (92%) and 2.80 (33%) respectively as shown in Figure 4c. The groups showed significant differences ($p < 0.05$), and a significant difference was shown according to training duration ($p < 0.001$). Specifically, there were significant differences in pre-mid ($p < .01$) pre-post ($p < 0.001$) and mid-post ($p < 0.001$), and an interaction effect between groups and training duration was shown ($p < 0.001$).

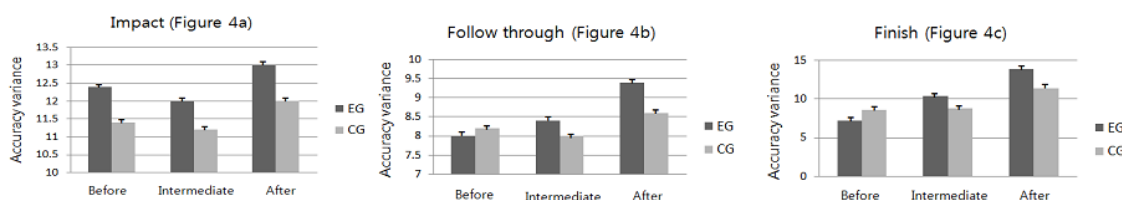


Figure 4. Effect of training on impact (4a), follow through (4b), and finish (4c) of EG and CG athletes group, respectively. Each values represent mean \pm SD.

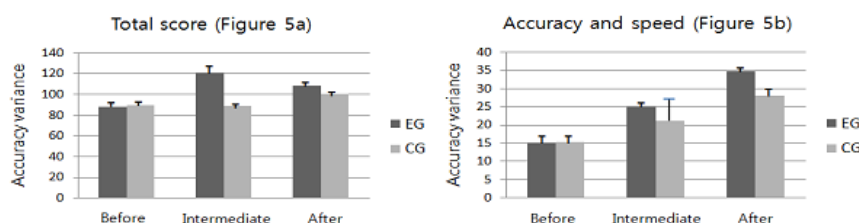


Figure 5. Effect of training on total score (5a), accuracy of ball and speed (5b) of EG and CG athletes group, respectively. Each values represent mean \pm SD.

3.9. Effect of training on total score

As to total divided motion score (connection motion), the EG and CG were Pre 88.20 \pm 7.66 and 89.60 \pm 4.56, Mid 101.20 \pm 9.15 and 88.60 \pm 2.61, and Post 120.60 \pm 4.83 and 100.20 \pm 4.15, which demonstrated an increase of 32.40 (37%) and 10.60 (12%) respectively as shown in Figure 5a. The groups showed significant differences ($p < 0.05$), and a significant difference was shown according to training duration

($p<0.001$). Specifically, there were significant differences in pre-mid ($p<0.01$) pre-post ($p<0.001$) and mid-post ($p<0.001$), and an interaction effect between groups and training duration was shown ($p<0.001$).

3.10. Effect of training on accuracy of ball and speed

As to accuracy of ball and speed, the EG and CG were Pre 15.20 ± 3.11 and 15.40 ± 3.05 , Mid 24.80 ± 1.30 and 21.20 ± 5.40 , and Post 24.80 ± 1.48 and 28.00 ± 3.08 , which demonstrated an increase of 19.60 (129%) and 12.60 (82%) respectively as shown in Figure 5b. The groups showed significant differences ($p<0.05$), and a significant difference was shown according to training duration ($p<0.001$). Specifically, there were significant differences in pre-mid ($p<0.01$) pre-post ($p<0.001$) and mid-post ($p<0.001$), and an interaction effect between groups and training duration was shown ($p<0.01$).

Figure 6 shows plot of increasing rate in percent of each athlete name. Increasing rate in percent was calculated by (after-before)/after $\times 100$. On the whole, significant differences (after-before) of EG values were shown compare to CG. Table 3 was summary of the test result in serve posture, accuracy of ball and speed according to training duration (pre, mid, post) in two groups (EG, CG). The homogeneity test result showed no significant pre-difference in every variable.

Table 3. Analysis results of ten athletes names of the two groups during training before, intermediate, and after. Points of increasing rate were calculated by (after-before) points. And increasing rate in percent were calculated by (after-before)/after $\times 100$.

Athletes name	Group	Before	Intermediate	After	Increasing rate	
					Points	Percent (%)
Preparation pose(2a)	EG	13.00 ± 1.41	17.40 ± 1.95	$19.40\pm.55$	6.4	49
	CG	13.00 ± 1.22	12.80 ± 1.30	18.00 ± 1.22	5.0	38
Back swing(2b)	EG	13.40 ± 1.52	14.40 ± 2.07	17.40 ± 1.14	4.0	29
	CG	12.80 ± 1.10	$13.40\pm.89$	$13.80\pm.84$	1.0	7
Toss(2c)	EG	11.40 ± 2.41	12.40 ± 1.34	14.60 ± 2.07	3.2	28
	CG	12.60 ± 1.34	12.00 ± 1.22	13.00 ± 1.44	0.4	3
Forward swing (1 st step, 3a)	EG	11.80 ± 1.30	12.80 ± 1.30	15.40 ± 1.14	3.6	30
	CG	11.60 ± 1.14	11.40 ± 1.14	$12.00\pm.71$	0.4	3.0
Forward swing (2 nd step, 3b)	EG	11.00 ± 1.22	12.00 ± 1.22	14.80 ± 1.79	3.8	35
	CG	$11.40\pm.55$	$11.00\pm.71$	11.40 ± 1.14	0	0
Impact(4a)	EG	$12.40\pm.55$	12.00 ± 1.00	13.00 ± 1.00	0.6	4.8
	CG	$11.40\pm.89$	$11.20\pm.84$	12.00 ± 1.22	0.6	5.0
Follow through(4b)	EG	8.00 ± 1.00	9.80 ± 1.79	12.20 ± 1.30	4.2	53
	CG	$8.20\pm.84$	$8.00\pm.71$	8.60 ± 1.14	0.4	5.0
Finish(4c)	EG	$7.20\pm.84$	$10.40\pm.55$	$13.80\pm.84$	6.6	92
	CG	$8.60\pm.89$	$8.80\pm.84$	11.40 ± 1.41	2.8	33
Total score (5a)	EG	88.20 ± 7.66	101.20 ± 9.15	120.60 ± 4.83	32.4	37
	CG	89.60 ± 4.56	24.80 ± 1.30	34.80 ± 1.48	10.6	12
Accuracy and speed(5b)	EG	15.20 ± 3.11	24.80 ± 1.30	34.80 ± 1.48	19.6	129
	CG	15.40 ± 3.05	21.20 ± 5.40	28.00 ± 3.08	12.6	82

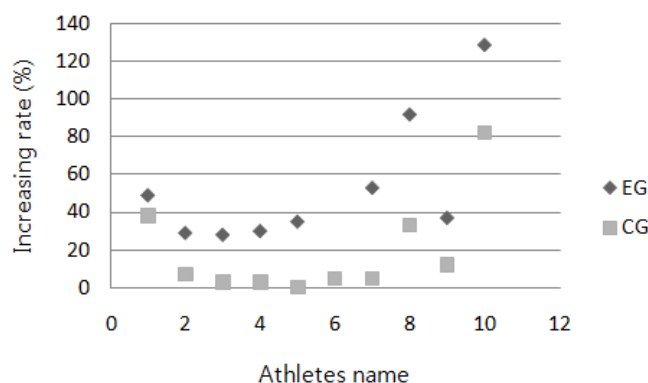


Figure 6. Plot of increasing rate in percent of each athletes name. Increasing rate (%) = (after-before)/after x 100. In general, differences of EG were bigger than CG.

4. Discussion

Previous researches in effective teaching method on serve for beginners are follows. There is “an effective teaching plan for improving tennis skill” to beginners in universities in terms of connected (current connected skill method) and divided motions (teaching method by stage in divided section) [9]. For a research for effective training method to improve tennis skill, the difference of connected and divided method was analyzed including serve skill, and it showed that divided method was more efficient [10]. A test was carried out to high school female students in the EG and CG groups, stage 1 and 2, both groups took same training, and from stage 3 on, the CG adopted connected exercise in serve, while the EG took divided exercise. As a result the EG group showed much improvement than the other in serve [11]. Such researches are different perspective to this research in terms of the EG, although the CG is similar as in this study the EG performed serve training by expanding gap from serve line to base line including the ball throw. And the CG practiced usual serve training method of connected motions from the first.

This research was made on 10 college man students of M university who have no experience of play tennis to analyze serve posture, accuracy of ball and speed by dividing them into the EG and CG group during the training period (Pre, Mid, Post). As a result, the EG had apparent improvement than the CG except for toss which was sub-item of accuracy variable in serve posture. This was because a different training method and it can be classified in to two.

First, catch ball training in between net in taking serve form standing face to face with net in the middle enabled to subjects to acquire natural serve form, toss, impact, wrist motion, and follow throw. Second, an exercise to serve while expanding gaps from sub-line to base-line reduced burden of serve to beginners who were not used to serve in the far way place like base-line. It helps beginners to grow adaptability by stage so that it enabled them to make an accurate and speedy serve in an accurate posture

5. Conclusion

This study measure and analyzed serve posture, accuracy of ball and speed of the two groups (EG, CG) according to training duration (pre, mid, post) and the results are as follows. There were significant differences in ready position, back swing, forward swing 1 stage, forward swing 2 stage, impact; contact, follow throw, finish, total score, and accuracy and speed of served ball except for toss, a specific item of accuracy variables in serve posture. According to the training duration, there were significant differences in ready position, back swing, forward swing 1 stage, forward swing 2 stage, follow throw, finish, total score; connected motions and accuracy and speed of served ball except for impact a specific item of accuracy variables in serve posture. The interaction effect between group and training duration showed a slight difference in back swing, forward swing 1 stage, forward swing 2 stage, follow throw, finish, total score, and accuracy and speed of served ball except for ready position and impact a specific item of accuracy variables in serve posture.

In conclusion, it was proven effective to perform serve training by expanding gap from serve line to base line including the ball throw than ordinary method for beginners. Accordingly, if tennis coaches and instructors adopt this method in teaching serve, it shall be beneficial to beginners to improve their serve skill.

6. Acknowledgement

The authors are grateful to Mr. S. H. Kim and Mr. Y. K. Yu for their collaboration in the organization of the experimental tests and results analysis.

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