THE EFFECT OF DIRECT VIDEO FEEDBACK ON PERFORMANCE OF TENNIS SERVE

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The purpose of this study was to examine if junior tennis players could improve their speed and accuracy of the serve by using direct video feedback. Ten intermediate junior tennis players completed 50 acceptable maximum effort serves, aiming to land the ball within a 1 m square area adjacent to the service box T-area. Time series design was used in the study as part of the analysis of the data. The results showed that when video feedback was given on test day 3, the accuracy of the serve improved on test day 4. Additionally more accurate services and more "acceptable" services were completed in the square. The implication of these findings is that direct video feedback is a good tool to use to enhance technique execution of the serve.

KEYWORD: video feedback, accuracy, tennis serve.

INTRODUCTON: Feedback from coaches to the athletes on their technique is crucial in getting athletes to achieve high performance. Due to advances in technology, the feedback given has evolved from the conventional to the more sophisticated. The importance of doing this study is to investigate whether the direct video feedback improves the tennis services or not. This is because previous studies have found that feedback on other systems such as delayed video tape feedback and verbal feedback (KP and KR) have improved performances (Magill, 1993). The use of video feedback was found to be beneficial for both female and male in the skill of soccer juggling by physical education students compared with the traditional and verbal feedback (Taylor, 2006). With the combination of the direct video feedback software SiliconCoach-TimeWarp and with technique alteration by the coach, we will measure the effect of using the direct video feedback. The direct feedback is expected to be effective because it gives the instant view of the correction needed for the athletes. The system benefits athletes because they can view themselves directly and make adjustments according to the coach's instruction within the same session.

METHODS: Participants: Ten junior tennis players between the age of 14 and 15 volunteered to participate in this study. Players were free from any injury that would have prevented them from using maximum effort. All players had at least three years experience in playing tennis and had been involved in national junior competition.
Data collection: Participants attended one pre-test session (to determine their baseline service speed). Following a Test 1 session, and a retest Test 2 session, an intervention session was held where the direct video feedback is given. Follow-up testing was conducted in Test 4 with a retest in Test 5 (Figure 1).

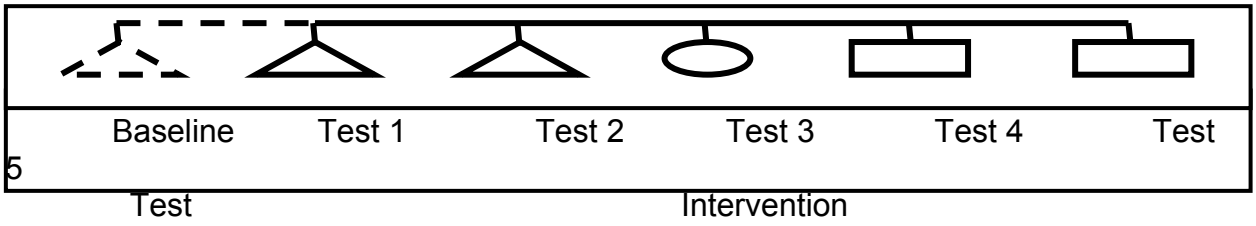


Figure 1: Time series design for test sessions.

Following a warm up, each test required the player to complete fifty serves to the T-area on the Deuce sides of the court. A 1.0 x 1.0 m area was marked (Figure 1) in the T-area of the court to assist in measuring serve accuracy. The participants were not aware of the scores of

accuracy, as they were only asked to target the T line. Serves were to be hit as hard as possible using a flat serve with the aim of landing in the service box as close as possible to the T line. The accuracy of the serve was measured in 4 separate boxes within the 1.0 x 1.0 m area. Services landing in the marked area were scored as 1, 2, 3 or 4, where the nearest to the T will give the highest score (Figure 1). In the Intervention Test 3, the player served ten sets of five serves receiving feedback immediately after each set of five serves. The feedback was given using SiliconCoach-TimeWarp. The feedbacks with specific reference to service accuracy and speed was given with respect to three technical aspects, which are (i) under carriage (ii) trunk action (iii) racket arm (Elliott, 2008). Service speed was measured using a radar speed gun (StalkerPro,Stalker USA) placed in line with the intended direction of the serve (4 m behind baseline). A Sony Digital DSR-PD170P video camera, was used to get the video for SiliconCoach-TImeWarp. The camera was positioned at a 45° angle between the frontal and sagittal view.

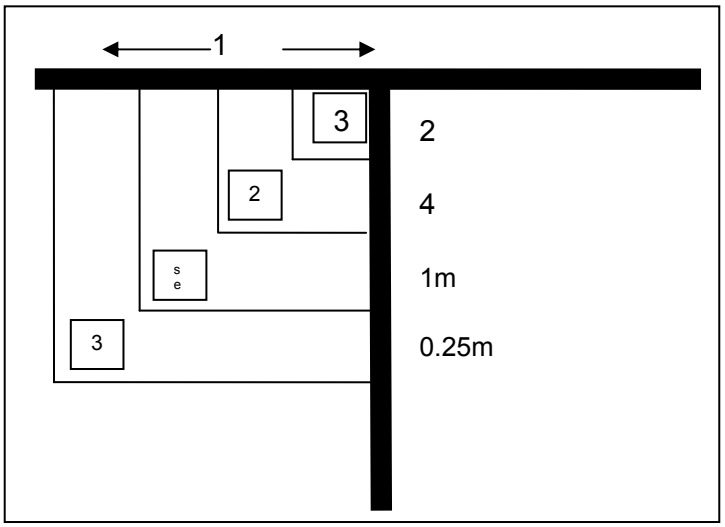


Figure 2: Accuracy scores in the service box.

Data analysis: The score for the mean accuracy was taken on the values of accuracy (1, 2, 3, 4) divided by the completed serves that went in to the designated area. The serves that were not within the area were excluded from the analysis.

Statistical analysis: A one way within subject ANOVA were conducted to evaluate pair wise differences among the adjusted means for the effectiveness of video feedback. The Bonferonni procedure was used to control for the Type I error across the four pair wise comparisons ($\alpha = 0.05/4 = 0.0125$). Four tests were done to compare paired test days for the significance.

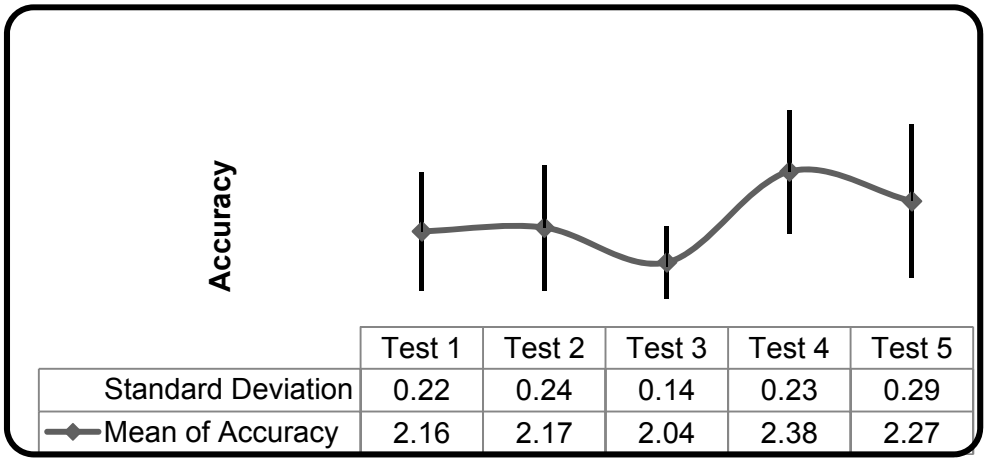
RESULTS: The ANOVA paired test results showed that there was no significant difference in the mean accuracy scores for Test 1 and Test 2 ($\bar{x} = 0.014$, $p > 0.0125$) or the scores for Test 2 and Test 3 ($\bar{x} = 0.130$, $p > 0.0125$). There was a significant difference between the scores for Test 3 and Test 4 ($\bar{x} = -0.0340$, $P < 0.0125$). The fourth paired test indicated that there was no significant difference in the scores for Test 4 and Test 5 ($\bar{x} = 0.109$, $p > 0.0125$). Test 4 had significantly higher accuracy than the intervention Test 3. Specifically, the results suggest that when video feedback was given on Test 3, the accuracy of the serve improved on the following day (Test 4).

Table 1: Accuracy by score.

		Accuracy				Total
		1	2	3	4	
Test 1	Count	57	45	32	26	160
	% within	24.80%	20.50%	23.20%	21.80%	22.60%
Test 2	Count	44	48	26	21	139
	% within	19.10%	21.80%	18.80%	17.60%	19.70%
Test 3	Count	43	41	19	14	117
	% within	18.70%	18.60%	13.80%	11.80%	16.50%
Test 4	Count	37	37	33	27	134
	% within	16.10%	16.80%	23.90%	22.70%	19.00%
Test 5	Count	49	49	28	31	157
	% within	21.30%	22.30%	20.30%	26.10%	22.20%

Table 1 shows that the accuracy scores within the score of 1, 2, 3 and 4. It can be seen that the percentage of the most accurate serve was improved on Test 5 by 26.1% which was the highest percentage. The average speed over all tests was very similar 112.3 ±4.4 km / hr.

DISCUSSION: The improvement for the treatment showed a greater increase when combining the direct video feedback and also techniques alteration (Williams & Tannehill, 1999). They based their conclusion on a study on the effectiveness of a multimedia performance principle approach in training physical activity specialists to analyze and diagnose over-arm throwing movements. The current study shows the impact of the direct video feedback combined with specific techniques cues. The results shows that consistent with earlier study that the use of verbal coaching added to direct visual feedback is possibly the most promising way of learning motor skills. However, while the accuracy results have improved the speed has not changed over the test occasions. As a general rule, the accuracy might be decreased with the existence of an increase of speed and vice versa. By referring to the results analyzed, it can be said that the accuracy of the serve starts to decrease on Test 2 and intervention day (Test 3). Participants reported their service effectiveness on accuracy decreased on the day of intervention because of the feedback provided to them during the intervention and techniques alterations from the coach on the intervention day. However improved accuracy was seen after the intervention day on Test 4 and Test 5. The improvement of the accuracy, though not convincing, shows that the more precise serves were able to be done on the post intervention days. Participants were able to hit more '4' scores on Test 5 compared with other days. A possible reason for the decreased performance on the intervention day is that the instantaneous KR may have degraded learning because it degraded the development of error detection capabilities and learning of movement control. However, the effect of the learning on the intervention day can be seen on the next day (Test 4) where improvements in service accuracy were recorded. One such negative effect involves the finding that, at least frequent feedback encourages the subject to change behavior frequently in an attempt to eliminate errors. Some of these corrections are for relatively large errors in performance. This will reduce the accuracy results of the test, as was the case on the intervention day (Test 3). When feedback was given in summary form after a series of no feedback trials, the learner's capability to detect their own errors is improved (Schmidt, Lange & Young, 1990). Instead of informing subjects instantaneously, it may be advantageous to allow time for processing the features of performance that lead to overall outcome, perhaps even encouraging the subjects to estimate their own errors before giving the feedback.



	Test 1	Test 2	Test 3	Test 4	Test 5
Standard Deviation	0.22	0.24	0.14	0.23	0.29
Mean of Accuracy	2.16	2.17	2.04	2.38	2.27

Figure 3: Serves accuracy for test.

CONCLUSION: From the evidence of this study, it seems that it may be useful to use video assisted feedback for the learning of tennis serves in addition to their use as a tool for stroke analysis. The possibilities for use of video for coaching are extensive. Video systems (camera plus computer) especially the direct video feedback should be readily available to most coaches. The challenge for the coach is to make best use of the systems to develop the athlete and team performance. For the sport scientist, the challenge is to determine smart systems that help the coach analyze and assess player and skills in real time.

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