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Combined effects of SAQ and PETTLEP imagery training: A study on the learning process of new skills among novice tennis players

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Abstract
The study was aimed to enhance the learning of the new skills among the novice tennis players through three different training interventions (SAQ training, PETTLEP imagery and combined PETTLEP imagery and SAQ training). A total of 40 novice tennis players were admitted based on the MIQ-R (Movement Imagery Questionnaire- Revised) scores and participated the entire training programs. The investigator made four different groups based on training programs which included a control group and subjects were equally (n=10) divided in to all. After 12 weeks training all subjects had tested their ground stoke and volley performance according to AAHPERD Tennis Test manual. The statistical procedure of ANOVA reveals that, all the experimental groups had improved significantly from pre-test to post-test and combined group had improved more significantly ($p<0.05$) than the PETTLEP imagery and SAQ group. However, there was no significant difference found among the PETTLEP imagery and control group during volley performance. Hence, the study suggests that combined group is more beneficial to novice tennis players during skill learning phase.

Keywords: PETTLEP imagery, SAQ training, Tennis

1. Introduction
Tennis is a wide popular sport among the variety of players. Learning skills and techniques of tennis are essential in the development of a player's game. The tennis ground stroke and volley are one of the main skill and techniques for beginner players to professional tennis players. In tennis Ground stroke is considered as the most natural stroke. Nowadays many athletes trained specially for different varieties of physical and mental training.

Imagery is a cognitive process and also mental technique which can be sophisticated and utilized among the practitioners in several ways. It is widely used in applied fields, especially sports and exercise psychology [1, 2, 3]. Imagery is mainly functioned for the characteristics of successful performers and also aid self-regulation of behaviors, thoughts and feelings [4,5]. According to Vealey and Greenleaf imagery is "using all the senses to recreate or create an experience in the mind" [6]. Imagery is an effective method to improve motor skill performance in tennis. A number of studies put forwarded that, imagery intervention can make positive effects on sport performances [7, 8].

PETTLEP model introduced by Homes and Collins (2001) is a motor-based imagery which comprises by the components of physical, task, environmental, learning, timing, emotion and perspective. All these components reveals about the implementation of motor based imagery intervention. PETTLEP model imagery would enhance the functionally equivalent mental stimulation among the performers. The component "Physical" is allied to the physical responses in the sports situation. The "environment" denotes to the environment conditions in which the imagery practice happens. "Timing" is always a deciding factor of sports skill performance; it means the "real time". "Task" is a highly task-oriented component, with the performer need to focus on the same actions, thoughts, and feeling at the time of performance. "Learning" aspect speak of to the adaptation of imagery content with respect to the phase of learning. The "emotion" is an optimal functional equivalence; during the performance all the players must have to experience all kind of emotions. "Perspective" component denotes whether the player concludes the imagery from external or and internal perspective [9, 10].

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Speed, agility and quickness (SAQ) training is become an important training method which can make up the whole spectrum of training intensity, from low to high, to trained athletes especially in tennis. Programming and integral planning is essential to development of fundamental movement patterns to highly positional specific movements [11]. Therefore, the main part of the SAQ training session is composed of seven components (Flexibility, mechanics, innervation, accumulation of potential, Explosion, Expression of potential and cool down) are combinations of random and programmed conditioning. Training intensity must be dissimilar from individual to individual as their level of training, physical and physiological abilities varies. But, quickness, agility, and speed drills with low intensity can use for various applications to athletes.

The aim of the study was to enhance the learning of the new skills among the novice tennis players through three different training interventions (SAQ training, PETTLEP imagery and combined PETTLEP imagery and SAQ training. In the beginning, the study was hypothesized that the combination of PETTLEP imagery and SAQ training would be the best in the phase of learning of new skills than the SAQ training, or PETTLEP imagery training alone.

2. Methods
2.1 Participants
Forty male tennis players, specifically novice in tennis with one to two years playing experience from Ramanadan Krishnan Tennis academy Thiruvananthapuram, Kerala, India were selected as the participants of the study with the age group of 10 to 12 years.

2.2 selections of subjects
MIQ-R Questionnaire was administrated to a total of 48 novice tennis players as screening test and from the calculated MIQ-R scores, only 40 tennis players who got 16 and more scores were selected as subjects of the study. The students were equally divided by ten (n=10) into 3 experimental groups and a control group.

2.2 Experimental Design
Purposive sampling design has been employed in this study to select the subjects. All the subjects as well as the experimental treatments were randomly assigned to the three experimental groups and one control group; consisted of 10 subjects each. All the players in each group were tested and compared their ground stoke and volley performance outcomes in pre and post training sessions. The E1, E2 and E3 groups were given SAQ Training, PETTLEP Imagery Training and Combination of both PETTLEP Imagery and SAQ Training respectively for 12 weeks and three days per week. The workout series are for 45 to 60 minutes. The experimental treatment had found to be effective in the group which shown improvements in results. The regular physical training, history of the player and malnutrition are such factors which can affect the results that might have affected in the changes which occur in the study.

2.3 Measures
2.3.1 Movement Imagery Questionnaire- Revised
MIQ-R (Revised version of Movement Imagery Questionnaire) was revised and validated by Hall and Martin (1997) is an eight-item inventory that measures a person's ability to perform visual and kinesthetic imagery. They found the acceptable concurrent validity when correlated with its earlier version, the MIQ, with r values of -.77, -.77 and -.87 for the visual and kinesthetic subscale, and overall score respectively [12]. Participants who scores lower than 16 (the mid-point), which indicates moderate imagery ability on either MIQ-R subscales or overall score were left out from the study due to an ostensible lack of ability to image [2]. The same screening procedure was followed in the study also.

2.3.2 AAHPERD Tennis Skills Test
Ground Stroke Test: it measures player's power, depth and control. Players will get Double Points if the second bounce is beyond the Bonus Line and they will get points only if they hit the balls in to singles playing area. The players have to hits 20 balls that are fed to both sides with one forehand and one backhand alternatively. The players will be awarded point based on the first and second bounce landing of the ball. The player will get point if the ball lands anywhere in the service box area, 2 points will be awarded if the ball lands in the front part of the back court, likewise 3 and 4 points will be awarded if the ball lands in the middle part of the back court and last part of the back court respectively. Additionally, the player will get 2 bonus point if the second bounce lands second power zone and will get 3 bonus points if the second bounce lands third power zone. The players will get a score of Zero if they hits the balls long, wide, or hit into the net.

Volley Test: This measure the ability to volley the ball accurately from a position near the net. The players have to hits 12 balls that are fed to both sides with one forehand and one backhand alternatively. The score is based on perfection of landing like where the ball lands in the target area. If the shots are sharply angled to near the net or deep in to the corners, it will be awarded higher scores. If a player hits the balls long, wide, or hits into the net, will get a score of Zero [13].

2.4 Procedure
Forty novice boys' tennis players with one to two year playing experience were randomly assigned to 3 experimental groups and 1 control group. The researchers provided participants within the PETTLEP imagery and combined groups with script which include seven elements of PETTLEP imagery to control for imagery perspective, agency and modality.

The PETTLEP group members viewed script of PETTLEP imagery, before then imaging themselves performing the tennis ground strokes (forehand and backhand) and volley. They were instructed to do this in a tennis court of their convenience. Participants performed their imagery in the appropriate sportswear, including footwear, and were instructed to image themselves executing the tennis ground strokes and volley perfectly. This was repeated for a period of 12 weeks with three times a week. Participants were encouraged to incorporate any of their usual tennis ground strokes and volley routines into their imagery to replicate the real tennis ground strokes and volley scenario as much as possible.

SAQ training group participants too were required to take training 12 weeks with three times a week. The SAQ continuum is the sequence and progression of components that make up an SAQ training session. The progressive elements include tennis-specific skill trainings, running and drills including ball work. Participants undertook their practice on a synthetic tennis court.

The combined group completed PETTLEP imagery and SAQ training for a period of 12 weeks with three times a week. The

training programs were same as described above, and given alternative days. Control group participants were underwent through their regular training program and not involved to any specified training program.

2.5 Data Analysis
The analysis of variance (ANOVA) was used to analyze the significant difference if any, between the groups on each selected variables separately. The confidence interval was fixed at $P<.05$ in all cases.

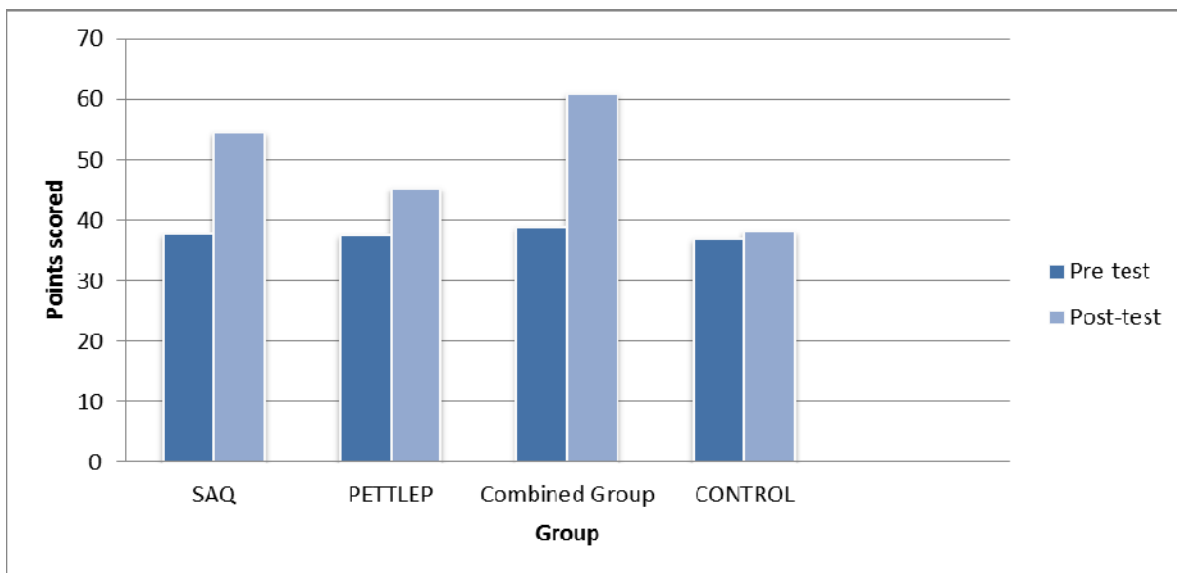### 3. Results
The analysis in table 1 showed after checking the pre-test differences using a one-way ANOVA, no significant difference between in the pre-test were revealed, F $(3,36)$ = 0.310, $p<0.05$. However, a repeated measures ANOVA was conducted and revealed a significant interaction effect, F $(3, 36)$ = 47.78, $p<0.05$. Scheffe post-hoc tests combined (M=60.90, SD=4.04), SAQ (M=54.00, SD=5.29), PETTLEP imagery (M=44.90, SD=4.58) groups improved significantly from pre to post-test ($p<0.05$). The control group (M=38.10, SD=4.33) did not improve significantly from pre to post-test ($p>0.05$).

Table 1: Analysis of Variance of four groups on ground stroke performance

	SAQ	PETTLEP	Combined group	Control Group	S OV	Sum of Squares	df	Mean Squares	'F' ratio	Sig.
Pre test Mean	37.40	37.80	38.90	36.90	B	21.70	3	7.233	.310	.818
SD	5.61	4.72	5.04	3.90	W	839.80	36	23.32		
Post test Mean	54.00	44.90	60.90	38.10	B	3013.27	3	1004.25	47.78	.000*
SD	5.41	4.61	4.04	4.33	W	756.70	36	21.01		

*significant at the 0.05 level

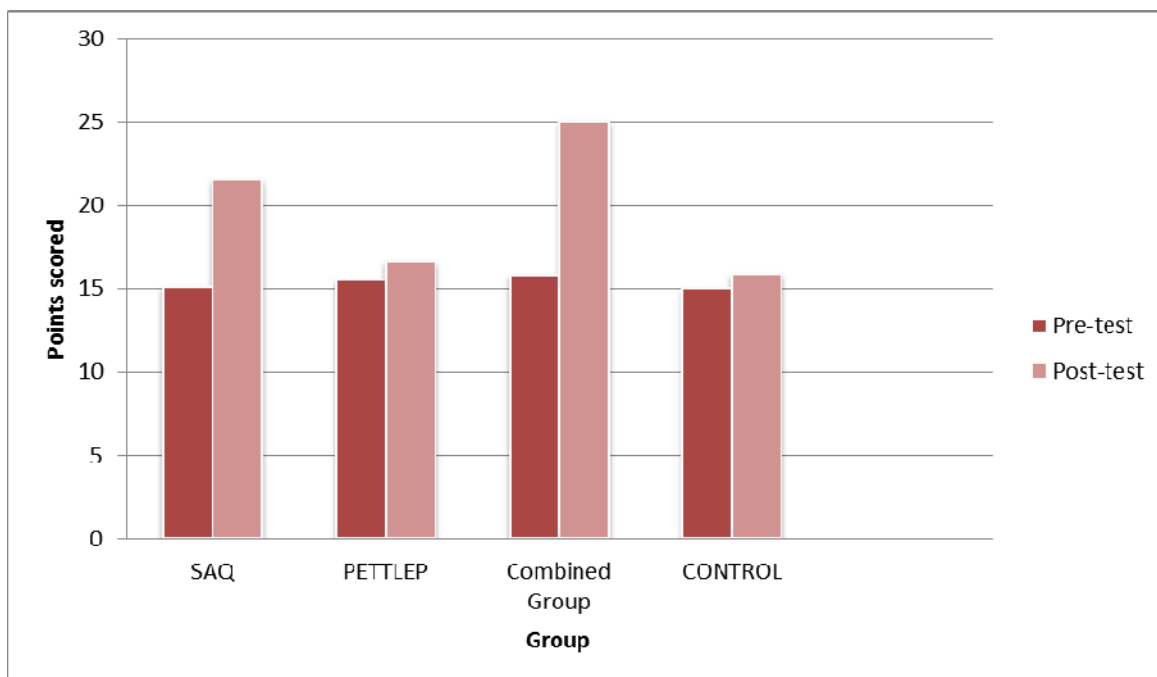**Fig 1:** Mean Pre-test and Post-test scores of ground stroke performance

The table 2 showed after checking the pre-test differences using a one-way ANOVA, no significant difference between in the pre-test were revealed, F (3.36) = 0.092, $p<0.05$. However, a repeated measures ANOVA was conducted and revealed a significant interaction effect, F (3.36) = 18.36, $p<0.05$. Scheffe post-hoc tests combined (M=25.00, SD=4.05), and SAQ (M=21.50, SD=2.06) groups improved significantly from pre to post-test ($p<0.05$). There was no significant difference in the magnitude of improvement showed by the PETTLEP imagery (M=16.60, SD=3.16) group, but the combined group improved significantly greater than the SAQ and PETTLEP imagery groups ($p<0.05$). The control group (M=15.90, SD=3.07) did not improved significantly from pre to post-test ($p>0.05$).

Table 2: Analysis of Variance of four groups on volley performance

	SAQ	PETTLEP	Combined group	Control Group	S OV	Sum of Squares	df	Mean Squares	'F' ratio	Sig.
Pre test Mean	15.10	15.50	15.80	15.00	B	4.10	3	1.36	.092	.964
SD	2.51	1.95	6.28	3.12	W	535.00	36	14.86		
Post test Mean	21.50	16.60	25.00	15.90	B	553.70	3	184.56	18.36	.000*
SD	2.06	3.16	4.05	3.07	W	361.80	36	10.05		

*significant at the 0.05 level

Fig 2: Mean Pre-test and Post-test scores of volley performance

4. Discussion

This study has shown that 12 weeks of SAQ training, PETTLEP imagery and combined PETTLEP imagery and SAQ training were combined with control group had significant improvement on ground stroke and volley in novice tennis players. Players in the experimental group improved than the control group, especially combined group had more significant effect than the other experimental groups. These results of the study strongly supported that combined PETTLEP imagery and SAQ training can be considered as a useful training method for the improvement of ground stroke and volley among the novice tennis players.

In the case of ground stroke, the combined group, SAQ training and PETTLEP imagery groups improved significantly from pre-test to post-test and it also improved than the control group. The study hypothesized that the combined group had more significant than the other groups (SAQ training, PETTLEP imagery and control groups). However, these results were supported with study proved by Smith *et al.* (2008) [14] who found combination of PETTLEP imagery with physical practice to be more effective than the other experimental groups. While comparing the SAQ training and PETTLEP imagery group, SAQ training group showed significant than the PETTLEP imagery group. Previous studies were supported with this contrasts which found physical practice is more effective than imagery (Driskell *et al.*, 1994; Feltz & Landers, 1983; Hinshaw, 1991) [15, 16, 17]. However, these studies did not use the PETTLEP imagery; therefore this finding would helpful to increase the intervention of PETTLEP. According to Smith *et al.* (2007) [18], PETTLEP imagery is more effective than the traditional imagery.

This study examined the effects of SAQ training, and combination of PETTLEP imagery and SAQ training were significantly improved in volley performance from the pre-test to post test. However there is no significant difference were showed in the results of PETTLEP imagery while compared with control group. Results of the study demonstrated that combined PETTLEP imagery and SAQ training group had significantly improved than the other groups. This outcome was supported with previous researchers (Smith *et al.*, 2006) [19] who describes that a combination of PETTLEP imagery and physical practice can have a significant improvement on the gaining of specific sports skills. These results were fully supported with the hypothesis of this study. While comparing PETTLEP imagery group with SAQ training group the results showed that SAQ training group had more significant than the group which performed PETTLEP imagery. According to Wright and Smith (2009) [20] describes that physical group had significantly increased than the PETTLEP imagery group in strength performance and also results from this study was not supporting with researchers (Smith and Holmes, 2004; Smith and Collins, 2004; Smith *et al.*, 2007) [19, 21, 22] who have reported PETTLEP-based imagery only have a significant impact on attainment of sport-specific skills. Moreover these result showed significant impact on the learning of skills through SAQ training. This study denotes that than the SAQ training, combination of PETTLEP imagery with SAQ training had showed better impact on the sports specific skills. Kohl *et al.*, (1992) [23] also describes about the effects of combining physical practice with imagery practice.

There are possible explanation for the success of the combined group in statistically improving ground stroke and volley while the SAQ training and PETTLEP imagery groups didn't show difference in performance. Among the participants in the combined group had more energetic during their performance, it's because they are attaining different varieties of intervention during the training period. During training, imagery is carried out as a starting session, followed by SAQ training and specific skill practices were performed. Because of these training schedules all the athletes had concentrated in the training without any restlessness. These training schedules may decrease their mental stress as well.

5. Conclusion

The study concludes that, the combined group (PETTLEP imagery and SAQ) is an effective method to improve the tennis skills among novice tennis players. The result indicates that the PETTLEP imagery and SAQ training has an important implication for the fields of sports training and sports psychology. When coaches and athletes are needed to use imagery intervention, they should perform functionally equivalent imagery for greatest positive effect on performers. Imagery is not only useful for the athletes, it also helpful to increase different skills of the performer. In this study, skills such as ground stroke and volley performance had a great significant impact showed in combined group. But also while comparing the SAQ training group and PETTLEP imagery group, both skill showed significant improvement in SAQ training. In the case of volley performance there is no significant among the PETTLEP imagery group. This study suggests that PETTLEP imagery with SAQ training had great impact in the performance. So, this combination could be useful for the researches in the various fields of sports.

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