Int J Pharm Bio Sci 2016 Jan; 7(1): (B) 425 - 431

Original Research Article **Allied Science**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

VISUOMOTOR BEHAVIOUR REHEARSAL IN ENHANCING MOTOR ABILITY IN SOCCER PERFORMERS

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ABSTRACT

The study was conceived to identify the integral processes involved in Visuomotor behavior rehearsal (VMBR), which involves the psychological aspect of configuration of mental image along with feedback from the performance of the physical skill. Altogether eighty-five young male high performing soccer players volunteered as participants, who were subjected to evaluation of motor skills and abilities pertaining to bidirectional and bilateral coordination and dexterity; inner psychobiological status (autonomic indices of phasic skin conductance response habituation paradigm components). At first participants were subjected to evaluation of psychomotor; psychobiological and soccer skill performance parameters. Thereafter they were introduced to audio-visual analyses of their movement errors. The ideomotor motions characterized by proprioceptive kinesthetic actions in the athletes were monitored and those were clarified to them. Psychobiological evaluations revealed inner core emotional processes substantiating unconscious fear of apprehension related to catastrophic athletic performance. Simultaneous training of VMBR consisted of enhancement in autonomic adaptation followed by the revelation of errors and development of guided imageries to rectify the erroneous components. Outcomes revealed that enhancement in autonomic recovery helped the players to remain more task-focused and to perform optimally at par with the desired standards of psychomotor performance, which evidentially helped them to display enhanced soccer skill performance.

KEY WORDS: **VMBR, Motor ability; Soccer performance**

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1. INTRODUCTION

In performance psychology and in performance research in general, visualization technique has been widely popularized, which could be considered as one significant component of Visuo-motor behavior rehearsal (VMBR), one of the most equipped therapeutic techniques, which involves the psychological aspect of configuration of mental image along with feedback from the performance of the physical skill[1]. This method was first delineated and detailed before 1980s[2], which in current researches[3] have been used successfully, especially with closed motor skills, in a number of sports and ball games including tae-kwon-do, karate[4], basketball[5,6], racquet ball[7], tennis[8], and cricket[9] cross-country running, golf, track and field, gymnastics, and diving[10]. Elite performers all over the world have a favored training of VMBR as a part of their pre-game psychological skill training. VMBR training technique comprises of three phases, first, an initial relaxation phase to get accommodated for mental imagery, second, visualizing performance through various imagery techniques, which should be planned and detailed as close as the real situation, and finally, performing the actual skill under realistic conditions. By repeating this process along with the practice of actual skill during training, obtained mental feedback ensures coordination between the visualization and imagery component with actual performance, so that in actual situation performance occurs in a flow. But in real situation, this may not be an obvious success, as the perceptual-cognitive process involved in formation of imagery within the context of performance if not gets adequately familiarized by the athletes, VMBR training can also be detrimental to the motor skill activity[3, 11]. As they pointed out, athletes by and large tend to ignore the importance of relaxation training, which[12,13,14&15] hinted upon as the delayed recovery from autonomic stress. Similar problem was also observed amongst Malaysian soccer players[16], while in other South-Asian contexts; these problems were emphasized[17,18]. Further to that owing to lack in arousal modulation and related somatised anxiety, they tend to overlook the earnestly required cognitive schema related to the motor skill and also related to performance error[13,15,19]. Previous research attempts[4] reported to observe beneficial impacts of VMBR in Karate sparring only and not in other performance parameters assessed, and also the outcomes could not be ascertained since self-reported dispositional anxiety and pre-competitive anxiety were evaluated within an interval of 6 weeks only. Since self-report indices could be fairly biased[20] and dispositional anxiety was not supposed to show any modification[17,18], outcomes of the research could not be generalized as substantially convincing. Similarly, a recent attempt on Jordanian disabled population[21] reported to observe changes in self-reported anxiety and self-concept only, and the research intention was not to observe the outcomes of VMBR on actual issue of modification in performance.

With such a background, this study was carried out

1. To study the psychological processes involved in ideomotor phenomenon related to the erroneous performance.
2. To identify the psychobiological make-up of the participants in association with the erroneous performance observed.
3. To observe outcome of VMBR training on soccer shooting and agility performance components.

2. METHODOLOGY

2.1. Participants

This study was concerned with predictive relationships, and hence on the basis of the sample size calculation in this study, 85 high-skilled soccer players of Kelantan province of Malaysia, age ranged between 20 – 23 years were recruited as participants. The sample size was calculated using G power 3.1.7 in which the power of the study is set at 95% with 95% confident interval and the effect size F at 0.25[22]. According to the project only 66 players were required, but considering the possibilities of dropout rates, altogether 85 participants (mostly state selection–level soccer players) were invited (identified by the help of coaches of Majlish Sukan Negera attached with SMK Putera Kelantan) by sending sequentially numbered, opaque, sealed envelopes (SNOSE) (Schultz & Grime, 2002) to the coaches. The inclusion criteria for the players was set in a way so that, those who though having high level of soccer skills, were going through considerable extent of performance disaster for a period of at least 3 to 4 months were communicated for participation in this study. After obtaining their signed consent, they were recruited as participants. It was categorically checked that, the players had no previous exposure to Visuomotor Behaviour Rehearsal (VMBR) training program.

2.2. Materials Used

For this experiment, assessment of psychomotor abilities and motor skill evaluations were done by using - i. Dexterity Equipment (Refer to Figure-1); ii. Mirror Drawing Apparatus (Refer to Figure-2); iii. Two-arm Coordination Test Apparatus (Refer to Figure-3); iv. Electrical Muscle Potentiality (EMG Apparatus) (ME6000, Finland, 2008) (Refer to Figure-4), and v. Skin Conductance Biofeedback Apparatus (ProComp5 Infinity, USA 2014) (figure-5). vi. Ball, cons, stop-watch, marker, PVC box etc. for soccer shooting and agility performance test.

Figure - 1

2.3. Procedure

All of the participants were subjected to an assessment of bilateral symmetry in motor coordination; hand–eye coordination and neuromuscular steadiness by employing the Mirror Drawing Apparatus; Two-arm Coordination Test Apparatus and Dexterity Equipment. Apart from that, assessment of electro dermal activity (Phasic components of Skin Conductance or Sc recovery time was measured). Evaluation of electrical muscle potentiality with particular reference to Vastus Medialis Maximal voluntary Contraction (MVC) was done. Apart from that, two sports specific skill tests, such as- with the ball agility and bilateral shooting ability was also evaluated. First of all, total experimental procedure was elaborated to the participants, and as they agreed to participate, after obtaining written ethical consent from the players to participate in this study they were subjected to evaluation of neuromuscular steadiness (also known as dexterity) by employing the Dexterity equipment (Udyog, 2014 – refer to Fig., 1), following the standardised protocol (Saha et al., 2005; 2012; 2014a & b). In this activity participants were required to hold a stylus steadily within a small hole ensuring that it won't get in contact with the walls of the whole to elicit signals to denote that, errors were committed. Thereafter they were supposed to move a stylus along with a star-like path, observing the image of the path by looking at a mirror attached with the gazette, without touching the metallic edges of the path at all (both in clockwise and anticlockwise directions). Once the edges were touched, those elicited signals to denote that errors were committed (refer to fig., 2). Next to this assessment, they were supposed to face the evaluation of two-arm coordination, in which they were supposed to steer the pointed metallic contact substance of the equipment, by guiding as well as maneuvering the stylus pointer within the star-like pathway without touching the metallic edges (both in clockwise and counter-clockwise directions – refer to Fig., 3). Thereafter the participants were subjected to evaluation of psychobiological make-up, electromyography (EMG – Figure 4) and skin conductance (Sc – as in Figure 5) assessments were carried out, in which some surface electrodes were attached to their palm (Sc), and Vastus Medialis (VM) muscle (EMG). For EMG, players were instructed to contract their rectus femoris muscle and MVC or maximal Voluntary Contraction of the VM was recorded. For Sc analyses, habituation or phasic paradigm data were taken while participants were supposed to remain calm, lying in reclining position, while after a brief period of basal Sc (no-stimulus condition) evaluation standardised visual stimulation (similar to camera-flash) was provided, and recovery time from the autonomic stress, if any, was recorded. Thereafter, apart from all these laboratory evaluations, two sports specific skill tests, such as- with the ball agility and bilateral shooting ability was evaluated (Figure 6)[23].

Figure - 2

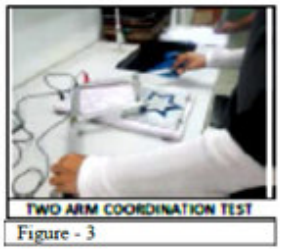

Figure - 3


Figure - 4


Figure - 5

Figure 6
Slalom soccer agility drills test Serdarevic (2011)

Thereafter all of the participants were explained with regard to their own limitations in motion and movement coordination and movement skills representations. Thereafter already monitored audio-visual feedback related to their erroneous performance, and the ideomotor motions characterized by proprioceptive kinesthetic actions in the players were analytically detailed to all of the players separately (one –to –one discussion sessions). Visualization training to realize the process of errors committed and to comprehend the right ways to perform the motor actions was clarified to the players (VMBR training). Finally, all of the afore-mentioned analyses were carried out once again to verify the changes or alteration or modifications, if any, were ensured by virtue of VMBR training. Apart from evaluation of Intraclass correlations, one-way repeated measure of ANOVA was done to identify an impact of VMBR training on soccer shooting and agility performance[23] outcomes.

3. RESULTS AND DISCUSSION

Explanations on the outcomes of this experiment however have been attempted on the basis of Intraclass correlation coefficient indices, which were conceived out of motor learning and coordination ability of the players, and impact of VMBR training on differential motor skill and coordination indices. Tables IA, IB & IC were based on the errors committed by the players while performing bidirectional motor learning tasks employing both right and left hand lateral side of the body.

Table 1A

Intraclass Correlation outcomes between bidirectional Motor Learning ability observed amongst the soccer players as outcomes of VMBR training (when right-hand lateral side was considered)

Intraclass Correlation Coefficient							
		95% Confidence Interval		F Test with True Value 0			
	Intraclass Correlation[b]	Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.508[a]	.331	.650	3.063	84	84	.000
Average Measures	.673[c]	.498	.788	3.063	84	84	.000

Table 1B

Intraclass Correlation outcomes between bidirectional Motor Learning ability observed amongst the soccer players as outcomes of VMBR training (when right-hand lateral side was considered)

Intraclass Correlation Coefficient							
		95% Confidence Interval		F Test with True Value 0			
	Intraclass Correlation[b]	Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.422[a]	.311	.538	3.921	84	252	.000
Average Measures	.745[c]	.643	.823	3.921	84	252	.000

Tables 1A & 1B revealed that in performing bidirectional motor skill activities players committed similar kinds of mistakes in both right-hand (67.3% correlation) and left-hand lateral sides (74.5% of correlation was revealed).

Table – 1C

Intraclass Correlation outcomes between Neuromuscular Steadiness indices was assessed amongst the soccer players as outcomes of VMBR training

Intraclass Correlation Coefficient							
		95% Confidence Interval		F Test with True Value 0			
	Intraclass Correlation[b]	Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.206[a]	-.036	.432	1.570	56	56	.047
Average Measures	.342	-.075	.603	1.570	56	56	.047

Similarly Table 1C revealed that in performing neuromuscular dexterity skill activities, while difficulty levels got increased, players committed similar kinds of mistakes (34.2% of correlation was revealed). Getting assured with the nature of problems persists amongst the players in their psychomotor abilities, the VMBR training was introduced to them. We intended to look into the perceptual-motor and perceptual-cognitive processes involved within motor coordination and skill related activities, and hence a one-way repeated measure ANOVA was done to observe the learning mechanism of VMBR and the resultant changes, if any, was evident in the motor performance outcomes in the players.

Table 2
Means and Mean Differences in the level of Dexterity observed amongst the soccer players across the phases of experimental sessions

Statistics	Dexterity Performance (in % of task accomplished)		
	Pre-introduction of VMBR	In course of VMBR adoption	Final Outcome
Mean	26.01	22.82	17.96
SD	7.17	6.31	4.52
Phase to Phase Mean Difference	From Pre VMBR to Adoption phase *($p < 0.05$)	From VMBR Adoption phase to final outcome *($p < 0.05$)	
	From Pre VMBR to Final phase **($p < 0.01$)		

In the Table 2, outcomes revealed that, in case of Dexterity Performance impact of visualization training based on VMBR was evident as beneficial for improvement both during adoption phase and at the final phase of evaluation as well.

Table 3
Means and Mean Differences in Average Power Spectrum EMG Evoke Potential observed amongst the soccer players across the phases of experimental sessions

Statistics	Average Maximal Voluntary Contraction (in microvolt)		
	Pre-introduction of VMBR	In course of VMBR adoption	Final Outcome
Mean	99.1200	116.5846	128.7411
SD	8.98	11.24	13.27
Phase to Phase Mean Difference	From Pre VMBR to Adoption phase *($p < 0.05$)	From VMBR Adoption phase to final outcome *($p < 0.05$)	
	From Pre VMBR to Final phase **($p < 0.01$)		

Similarly in the Table 3, outcomes revealed that, in case of EMG Maximal Voluntary Contraction also, impact of visualization training based on VMBR was evident as beneficial for improvement both during adoption phase and at the final phase of evaluation as well.

Table 4
Means and Mean Differences in Skin Conductance Recovery Time observed amongst the soccer players across the phases of experimental sessions

Statistics	Skin Conductance Recovery Time (in seconds)		
	Pre-introduction of VMBR	In course of VMBR adoption	Final Outcome
Mean	15.68	11.69	8.19
SD	5.17	6.94	3.42
Phase to Phase Mean Difference	From Pre VMBR to Adoption phase *($p < 0.05$)	From VMBR Adoption phase to final outcome *($p < 0.05$)	
	From Pre VMBR to Final phase **($p < 0.01$)		

Beneficial changes continued, as in the Table 4 outcomes revealed that, in case of Skin Conductance Recovery time also, impact of visualization training based on VMBR was evident as beneficial for improvement both during adoption phase and at the final phase of evaluation as well.

Table 5
Means and Mean Differences in Shooting Performance observed amongst the soccer players across the phases of experimental sessions

Statistics	Bilateral Shooting Performance (in Numbers)		
	Pre-introduction of VMBR	In course of VMBR adoption	Final Outcome
Mean	9.97	11.24	15.43
SD	4.15	3.19	4.13
Phase to Phase Mean Difference	From Pre VMBR to Adoption phase *($p < 0.05$)	From VMBR Adoption phase to final outcome *($p < 0.05$)	
	From Pre VMBR to Final phase **($p < 0.01$)		

Table 6
Means and Mean Differences in Soccer Agility Skills Task observed amongst the soccer players across the phases of experimental sessions

Statistics	Soccer Agility Skill (in min.s)		
	Pre-introduction of VMBR	In course of VMBR adoption	Final Outcome
Mean	1.24	1.19	0.89
SD	1.03	0.92	0.63
Phase to Phase Mean Difference	No difference from Pre- VMBR to Adoption phase	From VMBR Adoption phase to final outcome *($p < 0.05$)	
	From Pre VMBR to Final phase **($p < 0.01$)		

Finally the Tables 5 & 6 however showed that in cases of soccer performance parameters also outcomes of visualization training were evident. In case of soccer bilateral shooting performance impacts of the interventions were observed both in mid and post-intervention phases. Whereas in case of soccer agility skills, (i.e. in Table 6), beneficial impacts of interventions were observed only at the post-intervention phase of assessment. Outcomes however hint upon that the players perhaps by virtue of relaxation training (Sc biofeedback related), could learn to cope with their autonomic stress (had faster recovery time), which made them more task-focussed to deliver their best[3,7,9,13-16]. Further to that, being aided by audio-visually monitored details of motor-skill errors and with the help of cognitively mediated guided imagery; they could further realize the core areas of problems pertaining to closed skill performed in a situation in which the skill actually becomes open skilled task. Visuomotor behavior rehearsal actually helps in enhancement in information-processing involved in motor control. This process involves faster stimulus recognition followed by appropriate response selection[24]. Based on the outcomes of this experiment, it could be postulated that owing to enhanced perceptual-motor coordination (as it was revealed through improved maximal voluntary contraction) and heightened emotional regulation (enhanced Sc recovery time), perhaps the ideomotor ability of the players got improved, which in turn helped them to enjoy better motor control required for performance excellence in soccer[12,13&16]. This enhanced understanding perhaps could lead to the minimization of errors in performance, leading towards more coordinated display of motor performance, which warrants further studies [6-8, 13-15].

4. CONCLUSION

Based on the outcomes of this study, it could be concluded that, the bidirectional motor learning skill and muscle steadiness were observed as significance factors for reduction in erroneous motor performance. Further to that, faster recovery from autonomic stress was identified as essential for psychobiological adaptation required for modification in erroneous motor performance. Finally, dexterity and optimal muscle contraction along with efficient in motor learning skill are required to adopt an optimal level of VMBR training required for heightened soccer performance.

5. ACKNOWLEDGEMENT

Corresponding author Dr. Soumendra Saha is indebted to the Fundamental Research Grant Scheme (FRGS) Ministry of Education, Govt. of Malaysia research grant (203/PPSK/6171151) authorities for having awarded to carry out the study.

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