

COMPARISON OF AUGMENTED AUDITORY FEEDBACK WITH AND WITHOUT MENTAL IMAGERY ON PSYCHOMOTOR SKILL LEARNING IN PRECISION SHOOTING AMONG RIFLE SHOOTERS

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ABSTRACT

Background: Mental training is a tool for improving learning and performance. Sports imagery defined as using all senses to create or re-create any (sports) experience in the mind (auditory, visual, tactile, olfactory, gustatory, kinaesthetic, organic) with the goal of enhancing sports performance during training and competition. Feedback refers to performance related information. For learning a motor skill the role of task related feedback information is considered an important factor for enhancing the learning. Motor learning appears to be strongly facilitated by the availability of feedback. Practice under a given feedback condition creates an integrated sensorimotor representation that is highly specific to the learning conditions.

Aims and Objectives: Aim of the study is to investigate whether the mental training is useful or not in precision shooting to improve their concentration-attention control and relaxation.

Methods: Pre and post quasi experimental design was used. The group consisted of 30 subjects out of which 6 were female and 24 were male. Each one being assessed for their fitness. Prior pre assessment all either participants or subjects were explained about study protocol. Randomization was done by chit system and subjects were divided in two groups and assigned to their respective groups. A pre assessment of MI was done using MIQ-R scale and shooting score was recorded. Intervention of Mental imagery technique along with auditory feedback was given to the experimental group twice a week for 4 weeks. Data was recorded before and after the 4 week intervention. Post assessment of Mental imagery by MIQ-R scale and weekly shooting scores were recorded.

Results: Statistical comparison among MIQ-R Score and Shooting Score (SS) was accomplished using an Independent sample t- test between the groups. And Mixed design-analysis of variance (Repeated Measure ANOVA Report) was used to examine data with groups and Tukey-Kramer Multiple-comparison test is used to check the pair wise difference between the means.

Conclusion: Results from this investigation found that experimental group demonstrates progressive increase in both shooting practice and MIQ-R score's though-out intervention from the employment of psychological skills i.e mental training.

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INTRODUCTION

As per records in existence since 1860, "Target shooting" with firearms is a very old established sports. The popularity of Air rifle shooting as a sporting activity is on the rise, and can be

followed on an equal footing by either sex and high performance is possible over a wide range of ages. Varieties of target shooting now exists which now allows for some provision to be made for participation by those suffering from

physical disabilities (G.C, 1972 and A.S, 1980). Mental training is a tool for improving learning and performance in sports, and has largely been used by coaches, psychologist and athletes as an important component of a strategically organized learning experience (Khaled Hegazy, 2015; Jennifer Cumming and Craig Hall, 2002 and Kathleen, 1999). Imagery has been operationalized as: “an experience that mimics real experience” (White, 1998). The use of imagery in sport is a highly effective performance enhancement technique for athletes in a variety of other ways, such as enhancing motivation and self-confidence, coping with injury and pain, regulating arousal, and managing stress and anxiety (Sandra, 2005 and Ruth Dickstein, 2007). The concept of Sports imagery is defined as using all senses to re-create or create any (sports) experience in the mind (auditory, visual, tactile, olfactory, gustatory, kinaesthetic, organic) with the goal of enhancing sports performance during training and competition (Khaled Hegazy, 2015; Jennifer Cumming and Craig Hall, 2002 and Ruth Dickstein, 2007). Motor imagery is the mental representative of movement without any body movement (Ruth Dickstein, 2007). The use of mental training when combined with relaxation is comparatively more effective than imagery alone because it involves senses (Eva, 2009). Players use mental training in a number of ways by recalling good experiences and best performances, few do so by recreating the feeling or by remembering the experiences and learning from them (Khaled Hegazy, 2015). This helps in building and increasing confidence in players (Jennifer Cumming and Craig Hall, 2002; Ruth Dickstein, 2007 and Gros Lambert, 2003). Confidence plays an important role influencing the performance of a sportsperson, and is referred to as a “self-efficacy” one’s belief in one’s ability to successfully execute specific behaviour or a set of behaviours (Sandra, 2005). Confidence is the cognitive process which helps athlete in accomplishing sports specific tasks by making judgments about their capabilities or by understanding the “Mental Blueprint” (Sandra, 2007 and Kathleen, 1998).

Augmented Auditory Feedback

In the context to motor skill learning, the term feedback refers to performance related information that the learner receives during and after performing the task. To learn and enhance a motor skill the role of task related feedback information is considered an important factor. It appears that the Motor learning appears is strongly facilitated by the availability of feedback (alternatively, knowledge of results) during learning. Practicing under a given feedback condition creates an integrated sensorimotor representation (combining central processes and sensory feedback) that is highly specific to the learning conditions (Steven, 2003). There are two general types of feedback in motor skill learning situations; “Intrinsic” and “Extrinsic”. Intrinsic feedback refers to the feedback a learner receives through monitoring his or her task performance; whereas extrinsic seeks feedback from external sources such as instructional videotapes or kinematic display (Niilo Kontinen, 2004). Augmented Information feedback is defined as “Artificial feedback that supplies naturally available intrinsic information”. Knowledge of result and Knowledge of performance is post- response information concerning the consequence of performance (Niilo Kontinen, 2004). “Information provided by the sense organs-usually termed feedback- which is a critical consideration for learning new motor actions” (Steven, 2003). Knowledge of results (KR) refers to the post-response information concerning the

consequences of a performance. A distinction can be made between the two effects of KR: it can be seen as a means to specify the performance goal (prescriptive information), or as a reference to the correctness of the completed response (descriptive information) (Niilo Kontinen, 2004). Knowledge of performance (KP) refers to extrinsically generated information feedback about the actual action pattern of a particular movement. The types of KP common to motor skill instructions are verbal cueing, modeling, graphical representation, and visual feedback (Steven, 2003). Mental imagery enhances one’s visual, auditory, tactile, emotional, and kinesthetic senses, which ultimately leads to increased awareness and performance enhancement (Eugenio, 2005).

MATERIALS AND METHODS

Participant: The participants for the study were 30 national rifle shooters across both sexes (Female-6 and Male-24). They ranged from 18-25 years of age (mean age 20.5±1.9 yrs). All were right handed and ipsilateral- eye dominant and they had normal or corrected- normal vision with lenses and no hearing limitation. The participants were able to read and understand English. Firstly, participants were screened for inclusions and exclusions criteria; randomization was performed by chit system and subjects were divided in two groups, and assigned to their respective group. Mental practice combine with Augmented Auditory feedback (MI) and Auditory feedback alone (C). Informed consent module was obtained from each participant for this study and Ethical approval was obtained from the ISIC Institute of Rehabilitation Sciences Research Ethics Committee.

Measures

Imagery ability: The “Movement Imagery Questionnaire-Revised” (MIQ-R: Hall and Martin, 1997) was used to assess the participants’ imagery ability. MIQ-R is an 8 item questionnaire asking participants to imagine and rate their ability to imagine individual movement on a 7-point Likert scale ranging from 1 (very hard to image) to 7 (very easy to image). The MIQ-R has been shown to have a good internal consistency for the visual subscale ($r=0.84$) and for kinesthetic subscale ($r=0.88$), with a test-retest coefficient over 1 week period of $r=0.80$ for visual and $r=0.81$ for kinesthetic imagery ability. No subjects were divided on the basis of their MIQ-R score (Eva, 2009).

Task and Apparatus

Subjects were asked to perform their normal shooting practice, which was in a standing position in an indoor 10-m shooting range. The target rifle was a LG 400 Walther Anatomic (weight 4.5- 5 kg) and target was a conventional 10-m air rifle target. Shooting result ranges from 0 to 10 which indicate the distance between the hit point and center of the target, higher result means more accurate shot. During practice the participants were instructed to practice into 4 blocks of 10 shoot trials. According to their score both group were given auditory feedback on their 1st and 3th trial blocks, which was recorded and displayed on the screen.

Materials

The motor imagery instructions script was encoded as Mp3 audio file and then stored on a compact disc: the audio track

lasted 11.30 minutes. The script traces the lay-up of shooting with relaxation technique. The athlete was instructed to recollect the real sensations of the movement. Each athlete was asked to imagine from an internal perspective through the use of the second-person singular. This was aimed at enhancing the athlete's involvement in the task. Furthermore, words have been chosen to let the participant feel the movement as if he/she is performing it actually.

Subjective reliability of the Script: The reliability of motor imagery instructions script was conducted by the 10 panellist who included 4 psychologists, 4 coaches and 2 shooters. All the members of the panel were with a minimum 4 years of experienced in their field. All of them were given a Questionnaire which was designed to describe the procedure of script. After that the feedback was taken for the reliability of the script.

Procedure

All patients were explained about study protocol and assigned into 2 groups: Auditory Feedback with Mental Practice (MI) and Non-training Control group (C). At initial meeting all participants were explained about procedure and the MI group (n= 15) was given acquisition phase that focus on optimizing the psycho-motor performance process. The acquisition phase consists of practice session which lasted 30 minutes. Prior to the practice session MIQ-R scale score was taken, subjects were asked to continue their shooting trials as they were explained earlier. Participants were then informed that for the next four weeks, depending on whether or not a baseline was demonstrated, each was to meet with the observer 4 times in the first week(s) for baseline portion of the study, and 3 times for the following three week intervention portion of the study. Shooting performance was measured before interventions began. Measurements were taken three times a week. Data was collected accordingly.

Table 1. Comparison of Pre and Post- intervention of MIQ-R score and Shooting Score in Experimental groups

Paired Sample Statistics T-test					
	Group: pre-post	Mean	SD	t-value	p-value
E-Pair-1	Pre-MIQ	43.67	6.287	7.442	0.000
	Po-MIQ	50.53	4.190		
E-Pair-2	Pre-S.S	293.47	40.293	12.410	0.000
	Po-S.S	338.60	35.621		

Table 2. Comparison of Pre and Post-intervention Score of Movement imagery questionnaire-Revised (MIQ-R) Score and Shooting Score of Control group

Paired Sample Statistics T-test					
	Group: pre-post	Mean	SD	t-value	p-value
C-Pair-1	Pre-MIQ -R	35.80	10.772	2.577	0.022
	Po-MIQ-R	39.20	8.744		
C-Pair-2	Pre-S.S	302.73	28.803	6.194	0.000
	Po-S.S	305.87	28.251		

Training Intervention

The training programme was therefore introduced to each participant during a single individual session. This type of relaxation training can be accomplished well through different kinds of self-help administration (through laptops, cell phones, players) of instructions. During the whole training phase, each participant was free to take informal individual contacts through email or to discuss any issues related to the study.

Data Analysis

The variables and change in MIQ-R score and Shooting score in rifle shooters in groups examining by the Pre and Post test data. Statistical comparison among MIQ-R Score and Shooting Score (SS) were accomplished using an Independent sample t-test between the groups. Mixed design-analysis of variance was used to examine data with groups as the 'between subjects factor' and 'time' as the within subjects factor and and Tukey-Kramer Multiple-comparison test is used to check the pair wise difference between the means. The statistical significance was accepted at the $p < .05$ level.

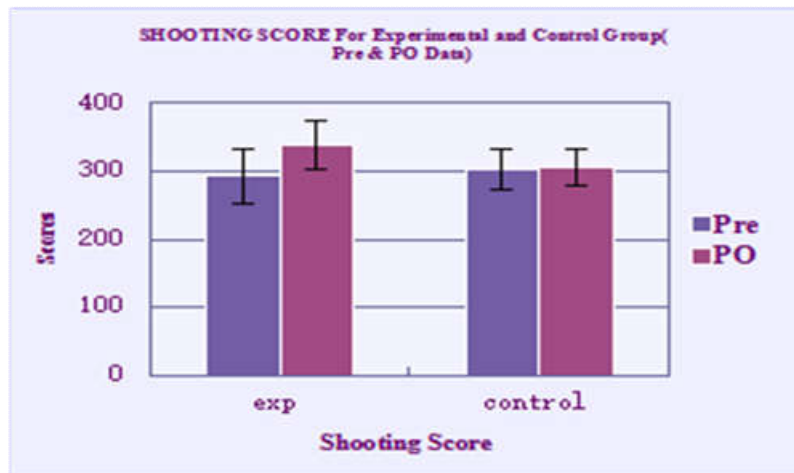
RESULTS AND DISCUSSION

The primary outcomes were Psycho-motor Skill performance-Shooting accuracy which is measured by shooting score and the MIQ-R was used to measure imagery ability among the athletes. There is a significant difference found in the pre and post scoring in experimental group after mental imagery training intervention. Both variables showed a significant difference after four week intervention sessions. The results of this study showed that mental imagery combined with augmented auditory feedback is a useful strategy that young athletes may use to enhance their shooting performance. Difference in mean between pre and post MIQ-R score of the experimental group was 43.67 ± 6.287 in pre and 50.53 ± 4.190 in post 4th week was found to be statistically significant at 0.01 level. Difference in mean between pre and post shooting score of the experimental group was 293.47 ± 40.293 in pre and 338.60 ± 35.621 in post 4th week was found to be statistically significant at 0.01 level. Difference in mean between pre and post MIQ-R score of the control group was 35.80 ± 10.772 in pre and 39.20 ± 8.744 in post 4th week was found to be statistically significant at 0.05 level. Difference in mean between pre and post shooting score of the control group was 302.73 ± 28.803 in pre and 305.87 ± 28.251 in post 4th week was

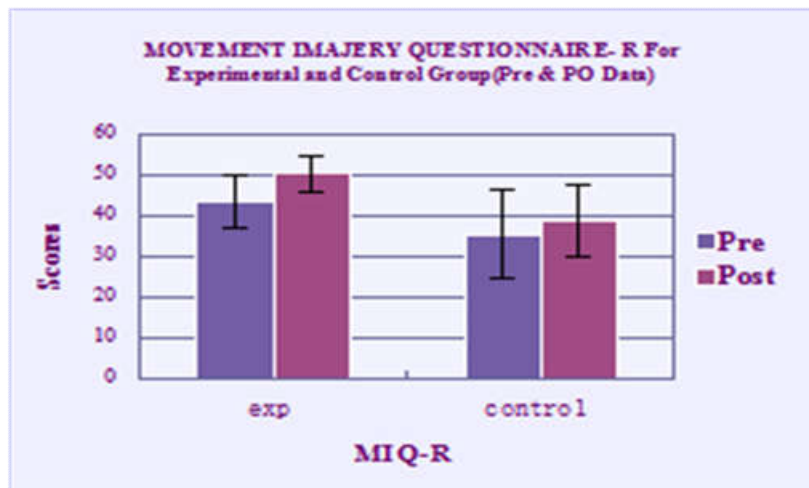
found to be statistically significant at 0.01 level. Difference in mean between post MIQ-R scores of both the groups was 50.53 ± 4.190 in group-1 and 39.20 ± 8.744 in group-2 in 4th week was found to be statistically significant at 0.01 level. Difference in mean between post shooting scores of both the groups was 338.60 ± 35.621 in group-1 and 305.87 ± 35.621 in group-2 in 4th week was found to be statistically significant at 0.01 level. There was a significant difference within the group pre-post intervention. The effect of intervention was significant only on the 4th week in experimental group (Group

1) means difference was 45.153 (338.6-298.4). Data shows their week wise progressive improvement within the weeks of experimental group (Group-1) expect in 2 week which shows there was a slight decline in result from the normal base line.

physical training results in improvement in athletes performances (Khaled Hegazy, 2015; A. Gros Lambert, R. Candau, 2003; Ruth Dickstein, 2007).



Graph 1. Graphical representation of Shooting Score of Pre and Post-intervention of Experimental and Control group



Graph 2. Graphical representation of MIQ-R score of Pre and Post-intervention Scores of Experimental and Control group

There was marked improvement in week 4th in group 1, whereas group 2 displayed no major difference. Participants in group 1 demonstrated an increase in score (Shooting score and MIQ-R score) from their individually established baseline by 4 week session. Researches says that application and extensive practice of mental imagery has a positive effect on psychological skills which develop as a similarly to physical skills. Consistent with the main hypothesis of this study, the findings of the present study indicate that Mental imagery and physical training with auditory feedback is effective for performance enhancement in shooting (Niilo Kontinen, K. Mononen 2004; Andrea Gaglioli 2013), in as briefly as 11.30 minute sessions three times a week, for four weeks. Layout of the mental imagery script was about the shooting sequence along with the relaxation technique. Present study shows that, there was progressive weekly improvement in the shooting scores except in second week of the intervention, which showed slight down fall. While greater shooting performance scores were recorded in the last week of the intervention of the study, this is believed to be a response to the time in which the participants had been engaged in imagery practice. Previous studies demonstrated that mental imagery combined with

Clinical Relevance: It is designed to engender a feeling of calm energized relaxation so that individual can be confident and motivated enough. It is my hope that this project will help coaches to teach their players how to be confident and motivated about their own practice performance and concentration on the task about to be performed as well as create a positive, confident attitude.

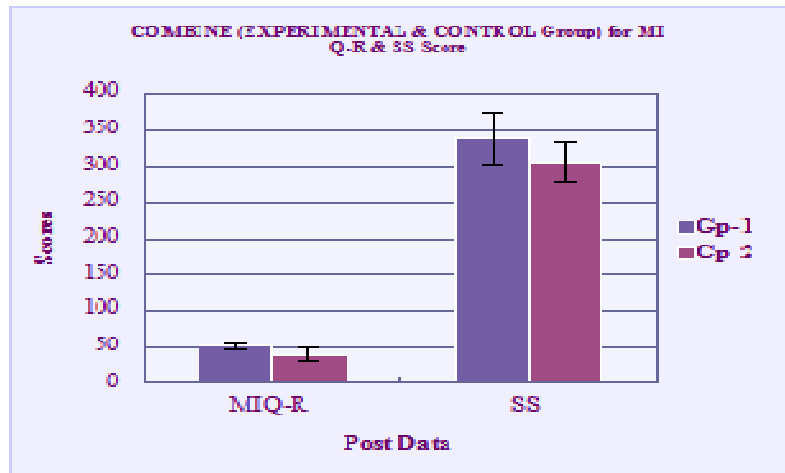
Limitation of the Study: Availability of practice area with less noise was the major distraction in mind. It was difficult to assemble all the participants at the same time for training session, lack of day schedule, individual motivation which leads to variation on the individual environment and psychology factor. Lastly it was very difficult to control overall psychological influences, individuals will react to the intervention differently. Future research can be done with more strict criteria so that more pronounced effects may be identified, research should attempt to examine the different levels of impact at different levels of competition. The present findings imply that effects can be seen from an imagery training which combine with auditory feedback on a shooting performance, in as quickly as 4 weeks.

Combined (EX & CON)

Post-Post

Table 3. Comparison of Post intervention score of MIQ-R and Shooting score in Experimental and Control group

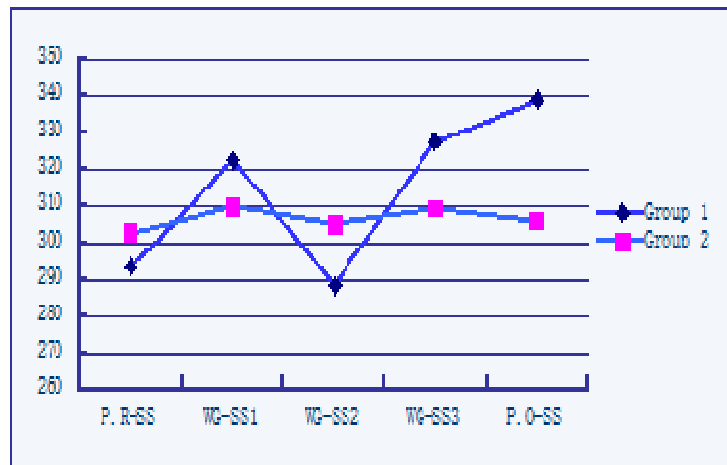
Independent sample Test					
	Groups	Mean	SD	t-value	p-value
PO- MIQ-R	1	50.53	4.190	4.527	0.000
	2	39.20	8.744		
PO- S.S	1	338.60	35.621	2.788	0.009
	2	305.87	28.251		



Graph 3. Graphical representation of MIQ-R score and Shooting Score of post-intervention score of metal imagery technique, in Experimental group and Control group

Table 4. ANOVA shows a statistically significant interaction between the two factors (group and time)

Term	Degree of Freedom	F-value	Level of significance
Group	1	0.31	0.57 ^{NS}
Time	4	4.80	0.001*
AC	4,112	3.42	0.011**



Graph 4. Graphical representation of week-wise improvement in shooting score technique in both the groups after intervention

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