The Profit of Pettlep Imagery Training Pre-Sleep On Motor Performance

Mohsen Afrouzeh(MSc)[1]- Mehdi Sohrabi(Ph.D)[2]- Hamid Reza Taheri(Ph.D)[3]- Ali Reza Saberi(Ph.D)[4]- Ali Afroozeh(B.A)[5]

1-Ph.D Student of Motor Behavior, Ferdowsi University of Mashhad International Campus, Mashhad, Iran, M_afrozeh@yahoo.com
Ferdowsi University of Mashhad International Campus, Mashhad, Iran
2-Ferdowsi University of Mashhad, Mashhad, Iran
3-Ferdowsi University of Mashhad, Mashhad, Iran
4-Ferdowsi University of Mashhad, Mashhad, Iran
5-Shahid Beheshti University of Tehran, Tehran, Iran

Abstract

The purpose of this investigation is to determine the effects Pettlep imagery pre-sleep on the motor performance. Thirty boys (16 -18 years) after completing the MIQ-R Questionnaire and Following the pretest, were randomly placed into one in all three groups: (A) Consolidated Pettlep MI group (N=10), (B) Preparatory MI group (N=10), and (C) PP only group (N=10). Posttesting was conducted between 8 a.m. – 11 a.m. for all subjects. The result of this study indicated a significant difference in enhancement between pre-test and post-test of consolidated Pettlep MI group. The Consolidated Pettlep MI group was more found to boost motor performance after sleep, therefore suggesting that sleep-related effects are effective following MI. Such findings highlight the reliability of MI in learning process, that is assumed consolidated when related to sleep.

Keywords: Consolidation, Sleep, PETTLEP Imagery

Introduction

According to Vealey and Greenleaf (2006) imagery is “the use of all the sensation to create or recreate an experience in the mind” . Mental imagery has been discovered to produce improvements in motor skills (2-4) and is one of the extremely used performance improvement techniques applied by athletes and sport psychologists (5, 6). During the 1984 Olympic Games, ninety nine percent of the 235 Canadian athletes reported using MI in some fashion (5). MI isn't only popular with athletes, however it is also one of the extremely studied mental training skills (7).

Recent neuroscience imaging investigation has started to answer questions related to enhancing the performance profits of MI. A several of neuroscience studies have employed fMRI and PET neuroimaging techniques to provide proof of an overlap of active brain regions when participants execute a motor task or use MI to re-create the same motor task (8-11). As a result of this finding, Holmes and Collins (2001) advanced the PETTLEP model (12). The model goals to provide guidelines for MI interventions that result in a higher level of "functional equivalence" existing between MI and real performance. PETTLEP is an acronym, with every letter standing for a practical consideration to be made when designing an imagery intervention. These are Physical, Environment, Task, Timing, Learning, Emotion and Perspective.

The physical element of the model refers to the physical responses within the sport context. Therefore, this model dictates that a golfer should be holding a golf club while completing the imagery session. The environment element states that the imager should be in the same environment during the imagery use as they would be during the actual completion of the task. Using imagery in a lab with a golfer would not maximize the imagery use under this proposed model. The task element is individual to each person as it focuses on the imaged task and the actual task being as closely matched as possible. In order for this to be possible, each person using imagery will focus on the specific elements of their own golf swing. The timing component consists of the imagery used with the precise timing of the movements. In this case, the golf swing should be imaged in full speed as it would look during a normal golf swing. Another important aspect to the model is adapting the imagery use to the rate of learning that takes place during the intervention. As the participants progress through the study they will learn more about imagery and their golf swing, and it is important that the imagery use is adapted to accommodate for this effect. Emotion has been referred to as “the missing link” in sports performance (13). All of the emotions that the imager feels during competition should be included in the imaging process. The final element of the model is perspective. This refers to the perspective that the imager sees the imaged scenario, whether it be a first person view (internal) or a third person view (external).

Primary research employing the PETTLEP model has found it to be more effective in producing performance gains. For instance, Smith and colleagues (2007) found that performance developed in a dose-response fashion as more features of the PETTLEP model were incorporated into the six weeks imagery intervention for a field hockey shot task. Other research has found PETTLEP imagery to be as effective as physical practice (PP) (14-16) and to be better than traditional imagery (16) in producing execution gains over the course of a 6 weeks intervention.

Preparatory MI refers to the performance of MI quickly before task performance. Many studies have found, one session preparatory MI to be efficient in making performance gains with little practice of the real task. Perkins, Wilson, and Kerr (2001) employed a preparatory MI intervention and found a meaningful gain in a laboratory grip strength task (17). Similar results have been found for muscular endurance (18) and golf putting (19). Malouffe (2008) utilized a tennis serve skill and found that preparatory MI profited subsequent performance when assessed regarding accuracy (20). Conversely, some studies show that preparatory MI interventions have no efficient on subsequent performance (21, 22). Because of the opposing results concerning preparatory MI, future investigation is essential concerning additional variables that might influence the effects of MI on performance. One intriguing variable to think about is the timing of the MI relative to performance.

The advantages of sleep on the learning of a motor task are well documented over the past many decades. Researchers believe a method referred to as consolidation protects lately learned information from the interference of other competing sensory information. Benson and Feinberg (1977) found that participants who slept for eight hours shortly following learning of a paired-associate word list exhibited a considerably higher level of recall and fewer temporal fluctuation over a twenty four hour period, compared with a participants that was awake for sixteen hours and so slept for eight hours following learning (23). Fischer and colleagues (2002) used a finger tapping motor task to assess the effect of sleep and sleep deprivation following learning. Participants who slept for eight hours following learning augmented accuracy and speed of execution at retest, compared to the sleep deprived group (24). Korman and colleagues (2007) found similar performance advantages on a finger tapping task for a brief sleep (a nap) lasting solely 90 minutes in comparison to a non-sleeping group (25). Walker and colleagues (2004) printed a timeline of the method of consolidation that is during to occur following the learning of a finger tapping task (26). Consistent with this timeline, the foremost essential stage for augmented performance occurs throughout the primary session of overnight sleep following learning. This period is understood because the improvement stage of consolidation and has been found to produce boosted speed and accuracy during a finger tapping task. Karni and colleagues (1994) discovered that consolidation is dependent upon attaining REM sleep stages following learning, as REM deprived subjects didn't enhance on a visual discrimination task based on pretest to posttest scores (27). Gais and colleagues (2000) discovered that late stage sleep alone is not inadequate to influence the consolidation of learned data and experiencing all stages of sleep is important to attain performance enhancements during a texture task (28). Given these findings for tasks that need learning of a new skill, researchers became interested in understanding the potential role of sleep within the consolidation of the advantages of a mental imagery session. Debarnot and colleagues (2009) compared traditional imagery, physical practice, and control groups to assess the role of sleep in producing execution gains in a pointing skill. Following a pretest to determine a baseline performance score, traditional imagery and physical practice groups received their assigned practicing condition followed by an primary posttest (posttest one). Results showed that each MI and PP groups performed at the next level following practicing, as compared to pretest scores. Following posttest one, subjects in each groups slept for eight hours and returned for a second posttest (post-test two). Results showed that the PP group did not enhance their performance following sleep, however the traditional imagery group showed an additional increase in speed and accuracy on the pointing task. Results therefore suggest that sleep served to more consolidate the learning that occurred for the traditional imagery group, however did not confer any further advantages for the PP or control groups (29).

The purpose of this investigation is to determine the effects Pettlep imagery pre-sleep on the motor performance. It is hypothesized that PETTLEP MI administered before to sleep will yield the most profits than Preparatory MI and physical practice only for execution. The principle for this belief lies within the consolidation effects resulting from a period of sleep. The results of a PETTLEP MI intervention before sleep and therefore the consolidation of images and memory that occur throughout sleep are expected to outweigh the positive effects of PETTLEP MI delivered right away before to the task throughout the preparatory MI condition.

Method

Participants

Thirty male healthy right-hand participants aged between 16 and 18 years gave their informed consent to take part in this experiment. None of the participants had previously received imagery training and all participants provided informed consent prior to participation. A questionnaire was used to evaluate participant’s level of experience in dart-throwing. Each participant signed an informed consent which included a document stating there was no penalty for dropping out of the study.

Apparatus and Task

Movement Imagery Questionnaire-Revised (MIQ-R; Hall & Martin, 1997).

Scores on the Movement Imagery Questionnaire-Revised MIQ-R (30) were used to evaluate a participant’s imagery ability. The MIQ-R is an eight-item inventory that evaluates an individual’s ability to perform visual and kinesthetic imagery. The MIQ-R had acceptable synchronal validity once related to with its earlier version, the MIQ, with values of -.77, -.77 and -.87 for the visual subscale, kinesthetic subscale, and overall score severally (Hall & Martin, 1997). In this study, the MIQ-R was used as a screening tool. As per previous investigation (e.g., (31) participants evaluation under sixteen (the mid-point, showing moderate imagery ability) on either MIQ-R subscales were excluded from the study because of obvious lack of ability to image.

Sleep Quality and Quantity

The Pittsburgh Sleep Quality Index (PSQI) (32) was used to evaluate sleep quality at the pretest and following the post intervention test. This test was used to acquire sleep information relating to disturbances throughout sleep/wakefulness cycles and to determine the participants' predisposition to profit from a normal night of sleep. The PSQI may be a self-rated questionnaire that measures sleep quality and sleep disturbances. The measure includes 7 scores together with subjective sleep quality, sleep latency, sleep period, regular sleep efficiency, sleep disorder, use of sleeping medication, and daytime disfunction. The add of those 7 scores produces one global score. The reliability coefficient for the 7 element scores of the PSQI was found to be 0.83, indicating a high degree of internal consistency (32). Participants additionally completed a short questionnaire that evaluated sleep quantity for the previous night.

Task

Performance was assessed using a dart throwing task. The target consisted of a regulation bristle dartboard with a standard 0.75 cm bull's eye in the center and a 2 foot by 2 foot foam insulation segment surrounding the dartboard. The throwing line was identified with a plastic oche secured to the floor at a regulation distance of 2.33 meters for all participants in the study. The dartboard was placed at standard competition height, 1.70 meters from the floor. Performance on the dart throwing task was scored based on the distance from the center of the bull's eye in millimeters (mm) based on x and y coordinates (33). (Fig. 1)

Procedure

All subjects after completing the MIQ-R Questionnaire (30) and Following the pretest, were randomly placed into one in all three groups: (A) Consolidated PETTLEP MI group (N=10), (B) Preparatory MI group (N=10) twelve hours before to the post-test with approximately 8 of those hours being sleep time, and (C) Physical practice only group (N=10). Posttesting was conducted between eight a.m. – 11 a.m. for all subjects.

Session one began approximately twenty four hours before to posttesting. Participants were instructed to come back to the research laboratory to complete consent, sleep and mental imagery questionnaires, and therefore the pretest measure of dart throwing task. After informed consent was signed by every participant, the MIQ-R was administered to find out imaging ability. Any participant with a score below 25% of the total point value on the MIQ-R was known as not meeting the inclusion criteria and was excluded from the data analysis. However, all participants were allowed to participate till completion of the MI intervention. The PSQI was also be filled out at this time to evaluate sleep quality. Sleep quantity was accessed using a simple questionnaire that asked participants to provide details on the amount of sleep they got during the previous night. Researchers briefed each participant as to the purpose of the study (investigating the effects of listening to audio recordings on dart throwing performance). Participants were asked to complete a short questionnaire to assess dart throwing experience and ability. Participants were randomly assigned to one of the three experimental conditions: consolidated PETTLEP MI, Preparatory MI and Physical practice only. Participants listened to an audio recording giving brief instructions on correct dart throwing technique to use when completing the task. Following instructions, they were allowed to practice the dart throwing task by executing 30 (6 block and each block 5) throws prior to the start of the pre-test. They were informed as to the scoring system and were instructed to aim at the center of the board at all times. Both the pre- and post-test included throwing 10 darts, one at a time. The researchers measured the distance of the dart from the x axis and y axis for each of the 10 throws and recorded this information during each trial. The Pythagorean Theorem was used to measure accuracy by calculating the distance to the bull's eye in millimeters (mm). Consistency of performance was also calculated using bivariate variable error (BVE) to evaluate the clustering of dart throws.

Twelve hours prior to post-testing (between 8 p.m. - 11 p.m.), participants arrived at the research lab to complete session 2 of the study. At this time, the consolidated PETTLEP group listened to the 5-minute audio MI script while standing in front of the dartboard with their eyes closed and dart in hand after that they practice dart throwing 5-minute in their mind. Following completion of the MI intervention, participants were asked to get a normal night of sleep and avoid any physical practice of dart throwing. Participants in the preparatory PETTLEP condition and physical practice only were asked to read a magazine for 10 minutes in order to provide equal exposure time for the experimental procedure across all groups.

During session 3 all participants completed the sleep quantity questionnaire to assess sleep characteristics for the previous night. Participants in the consolidated PETTLEP MI condition were asked to read a magazine for 10 minutes prior to the post-test. Participants in the preparatory PETTLEP MI condition listened to the 5-minute audio MI script while standing in front of the dartboard with their eyes closed and dart in hand after that they practice dart throwing 5-minute in their mind and then completed the post-test. Each participant was given 10 warm-up throws to practice the technique prior to performing the post-test which consisted of 10 dart throws. Finally, a post-intervention manipulation check was used to evaluate prior experience using MI, level of commitment to the use of MI in the current study, effort in using MI, and if the participant practiced darts physically or mentally overnight.

Data analysis

First, we checked that there was not any group difference during the pre-test performance. All statistical computations (duration and directional errors) were made using a transformation (log) to fit the usual normal distribution assumptions. Two-by-two comparisons were further carried out using Student's paired t-tests when the interaction reached the 5% threshold. Finally, all behavioral test scores (MIQ-R, Dart throwing Test, and Pittsburg Sleep Quality Questionnaires) were compared using Student's paired t-tests. The results are presented as mean (standard deviation values) and the alpha level was set at $p < .05$.

Results

We hypothesized that PETTLEP MI prior to sleep would have a more positive effect on dart throwing performance compared to the preparatory PETTLEP MI and physical practice only methods. In order to test the above hypothesis, analyses of variance (Paired-sample t-test and one-way ANOVA) were conducted to compare scores on the skill test for groups under different treatment conditions for the two time points (pre-test and posttest). Pretest was used as a baseline for participants' dart throwing skill.

Participants average sleep score, as measured by the PSQI was 4.9 (±2.1). Mean MIQ-R scores (SD) were 48.66 (±4.28) out of 56 possible points for all participants. The MI consolidation PETTLEP group mean was 48.9 (±2.18) and the preparatory PETTLEP MI group mean was 49.1 (±2.56), indicating no significant difference between groups. Individual scores on the MIQ-R were all above the threshold to be excluded from the current study.

The result of this research showed a significant difference in improvement between pretest and posttest of consolidated Pettlep MI group (Table.1), but there was no significant difference in improvement between pretest and posttest of preparatory PETTLEP MI and Physical practice group (Table 2 & 3). However, the mean score's preparatory PETTLEP MI group was better than the mean score's Physical practice group. Three paired-samples t-tests were directed to follow up the significant interaction. There was significant difference between mean ratings scores of pretest-posttest in Pettlep MI consolidated group ($t_{12}= 4.588$, $p < 0.05$) and there were no significant difference between mean ratings scores of pretest-posttest in Preparatory Pettlep MI ($t_{12}= 0.671$, $p < 0.05$) and physical practice groups ($t_{12}= -0.529$, $p < 0.05$).

Table 1. Paired Samples Test of the Dart's throwing for the Pettlep MI Consolidated condition

Table 2. Paired Samples Test of the Dart's throwing for the Preparatory Pettlep MI condition

Table 3. Paired Samples Test of the Dart's throwing for the Physical practice only condition

Results of the one-way analyses of variance indicated that there was significant difference between the post test scores of three groups ($F= 4.711$, $p < 0.05$), (Table. 4). Tukey HSD tests revealed that significant development of consolidated PETTLEP was better than Preparatory Pettlep MI and physical practice condition. (Table. 5).

Table 4. The one-way analyses between the post test scores of three groups

Table 5. Tukey test (HSD) of the pretest scores of three groups

Discussion

This research was designed to determine the effects Pettlep imagery pre-sleep on the dart throwing task. We hypothesized that Pettlep imagery training would also contribute in improving dart throwing after a night of sleep. The researchers were particularly involved with the consolidation of MI following a time of overnight sleep and the effect this would have on dart throwing execution. Supported previous findings of the good thing about sleep consolidation following one session of MI on a motor task (29), it had been hypothesized that the consolidation group would outstrip the preparatory mental imagery and physical practice only groups. The results of the peresent study support the hypotheses. The current results offer expected proof that Pettlep MI enhanced the subsequent motor performance in real time following training. Additionally, the main finding of this research is that the participants engaged in Pettlep MI condition significantly enhanced their motor performance following a night of sleep. The results of the current study are in line with the findings of Benson and Feinberg (1977), Fischer and colleagues (2002), Walker and colleagues (2004), Korman and colleagues (2007) and Debarnot and colleagues (2009). In addition, the results indicated that there was no significant increase in dart throwing execution preparatory Pettlep MI and physical practice only groups from pretest to posttest. In regard to this results, Some investigator (21, 22) have showed that preparatory MI interventions have no impact on future performance.

Single session PETTLEP MI intervention used to study the consolidation method of MI could explain the results. Within the peresent protocol, a single session intervention was utilized to insure that the preparatory group did not have the chance to sleep overnight following the MI intervention. However, Wakefield and Smith (2009) found PETTLEP MI to be most thriving when training sessions took place at a frequency of 3 times per week, as compared to once or twice per week (34). Future researchers curious about studying the consolidation of MI ought to think about doing several weeks of education and generic PETTLEP MI training before to applying these skills to a particular task. Previous study has utilized 4 to 6 weeks of PETTLEP MI training before to performance testing (14, 15, 34). This longer training period with the PETTLEP MI is also necessary for performance gains to be observed and, hence, is also requisite to further understand how sleep effects the advantages of a final MI session.

Mental imagery is known to effect the motor memory consolidation, within the same manner that impairment in working memory may compromise the long-term retention of a skilled behavior with mental imagery, thus hindering the ability to engage with success in MI. Despite this, however, very little was known in respect to the combined impact of sleep and MI on memory consolidation. In line with previous research (29), the main finding is that a night of sleep following MI evoked delayed gains in execution on dart throwing task, thus refecting a significant offline consolidation process. In contrast, a comparable interval of time without intervening sleep did not result in any execution gains. Moreover, data showed that, Compared with the preparatory PETTLEP MI and Physical practice groups, subjects in the consolidated Pettlep MI group significantly improved their performance of dart throwing.

As expected, and in keeping with the motor learning literature, all participants enhanced their performance following the same amount of either physical or mental practice (35, 36). When initial viewing the offline motor memory consolidation following physical practice, the results of the current study therefore indicated significant offline gains in performance after sleep. These findings are in line with those of other investigations and supply more proof that sleep contributes to the improvement of motor performance (37-40). For example, our results are consistent with those of Fischer and colleagues who reported that the primary night of sleep following training was crucial for delayed gains (24).

As well, and in keeping with before study (29), similar sleep-related impacts were seen following MI, thus supporting the principle of functional equivalence between mental imagery and motor performance (12). Overall, the results of this research strengthen the concept that performance gains following MI are somewhat sleep dependent, therefore assuming that a night of sleep after MI results in similar motor memory consolidation than following physical practice.

To conclude, our findings confirm and expand on the sleep-related effects on motor memory consolidation following MI that we have got a bent to reported previously in Debarnot and colleagues (2009). These results more reinforce the principle of functional equivalence between mental imagery and physical practice. They need strong theoretic and practical applications in each motor learning and (neuro) rehabilitation processes, during which performing MI is cost effective and simply possible (41, 42). Similar cerebral plasticity to that seen following physical practice of a motor performance has been reported throughout MI (43). Mental imagery could therefore be incorporated throughout the classical course of physical therapy, and most importantly before a period of sleep, to profit from the offline motor consolidation throughout the recovery process. Second, as a result of sleep-spindle activity is believed to play a role in motor memory consolidation by making easy the neural plasticity, we tend to predict that more researches that contain recording polysmonographic data are required to see whether or not options of Stage a pair of sleep are similarly modulated following MI. Likewise, consolidation may additionally be connected to NREM sleep and slow wave sleep. Hence, future study ought to determine the specific stages of sleep that are critical for discrete steps in motor memory consolidation following MI. As for motor skill consolidation (44), there could be more than a single phase of sleep-dependent consolidation.

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