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Original Article

Physiology Section

Assessment of Psychomotor Skill using Mentally Guided Imagery and Physical Practice in Medical Interns- An Interventional Study

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ABSTRACT

Introduction: Mentally Guided Imagery (MGI) has successfully been applied in sports for skill acquisition and performance enhancement. Despite the fact that athletes often use mental imagery as a part of their preparation, it has not been extensively explored as a learning technique in medical education. Few studies had highlighted mental imagery as a way to review and practice surgical skills efficiently. The present study aimed to assess the efficiency of intubation skills acquired through mental imagery in medical interns.

Aim: To assess and compare the effect of Guided mental imagery and physical practice using mannequins on intubation technique among 40 medical Interns after seven days of training.

Materials and Methods: The study was conducted in the Department of Emergency Medicine, Velammal Medical College and Hospital, Madurai over a period of seven days. Forty house surgeons were randomly divided into two groups. Group A (n=20) practiced MGI on intubation technique and Group B (n=20) practiced on mannequins one hour everyday for seven days. The performance of the students was assessed using a graded Objective Structured Clinical Examination (OSCE).

Results: Results of Group A and Group B were analysed and compared statistically using paired and unpaired t-test. Though there was significant difference between the pre and post values in the MGI group ($p<0.001$), there was no statistically significant difference ($p=0.216$) in the post-intervention scores between the Mentally Guided Imagery (MGI) and physical practice group.

Conclusion: Guided mental imagery was as effective as additional physical practice for medical students learning to perform intubation.

Keywords: Intubation, Mental imagery, Neuroplasticity

INTRODUCTION

The MGI is an intervention by which a person evokes and generates mental images that recreate various perceptions without the actual stimuli. It is a simple yet potent technique that points imagination in proactive and pragmatic way. It is the process of "seeing with the mind's eye" without a direct external stimulus.

MGI has successfully been applied in sports for skill acquisition and performance enhancement [1]. Despite the fact that athletes often use mental imagery as a part of their preparation it has not been extensively explored as a learning technique in medical education.

There is a perspective that mental imagery involves activation of visual areas in prestriate occipital cortex, parietal and temporal cortex, and that these areas react in the same way as they do in perception [2]. High level visual areas i.e., anterior parts of ventral temporal lobe is associated with changes in semantic content of visual scenery and low level visual area i.e., occipital cortex is associated with visual detail. There are to and fro projections between these two areas. Damage to anterior areas of temporal cortex predominantly because defects in visual imagery, related to objects and colour. The generation, visualisation and rotation of mental images from memory depend on left and right posterior hemisphere [3].

In perceptual learning, performance improves when a task was practiced repeatedly. Neural synaptic changes happen in specific areas of the brain, depending on the task performed, including activation of supplementary motor area, premotor area, and somatosensory areas. Equal changes could also occur in these areas by mental imagery technique, in the absence of physical stimulation as both share common neural mechanisms [4,5]. Mental imagery could function like afferent sensory perception and would enhance the performance of a perceptual task.

Mental imagery was categorised according to the purpose and can be used to practice motivational-general aspect of memory (emotions), motivational-specific aspect of memory (goal oriented), behavioural skills and motor skills [6]. The role of mental imagery in reducing stress, respiration, heart rate, blood pressure, cortisol levels, blood lipids, immune responsiveness, metabolic rates in cells, gastrointestinal motility and secretion, sexual function and stroke rehabilitation had well been documented in many previous studies [7,8].

There are only few studies that highlight mental imagery as a way to review and practice surgical skills efficiently. It has been shown that mental imagery augments the development of certain surgical skills like suturing, venepuncture and lumbar puncture [9-11]. Few studies had also shown that mental imagery enhances performance of surgeons in virtual reality based laparoscopic surgeries [12]. Hence, this study was aimed at assessing the efficiency of intubation skills acquired through mental imagery in medical interns.

1. To assess the effect of Guided mental imagery practice on intubation technique using OSCE after seven days among 20 medical interns.
2. To assess the effect of physical practice on mannequins on intubation technique using OSCE after seven days among 20 medical interns.
3. To compare the skills of both guided mental imagery group and mannequin group on intubation technique after seven days.

MATERIALS AND METHODS

The present interventional study was conducted on 40 medical interns in the Department of Emergency Medicine of a private medical college in Velammal Medical College and Hospital, Madurai after obtaining the Institutional Ethical Committee clearance (IEC No: VMCIEC/46/2018). The participants chosen were allocated in two

groups: Group A (n=20) who practiced MGI and Group B (n=20) who practiced on mannequins randomly by using a randomisation sequence generated in Microsoft Excel. Informed, written, voluntary consent was obtained from each participant. Duration of the study is seven days.

Inclusion criteria and Exclusion criteria: Interns of both the genders aged 21-24 years were included in the study. The students must have a basic knowledge on how an intubation is done. Those students who were found to be well trained in intubation technique, assessed using a questionnaire, were excluded from the study.

Description of Intervention

On the 1st day, the participants listened to a common basic lecture and underwent a demonstration on intubation in a mannequin. Then both the groups physically practiced the technique for 10 minutes each. A pre-test was conducted on day 2 using OSCE. From the next day, Group A participants were made to practise mental imagery technique for 30 minutes a day for next five days. They were taken to a separate room where they will be allowed to relax in comfortable chairs. As the first step, they were asked to close their eyes and take refreshing deep breaths. Then, they were asked to visualise themselves performing an intubation on a patient following an audio recorded script that would read all the intricate steps of performing an intubation. Group B students were allowed to practice on mannequins for 30 minutes a day for next five days.

Data Collection Method and Tools

Performance of the students was assessed using a graded OSCE. Content of the audio recorded mental imagery script as well as the OSCE steps were developed by experts in emergency medicine. On day eighth, assessment was done during two sessions for all the 40 students on mannequins (General doctor J5 S). Each student was given a time of 10 minutes for intubating the mannequin. Each session which lasted for 4 hours involved the assessment of 20 students from mental imagery group (n=10) and physical practice group (n=10). The assessment was done by the same observer for both the sessions. After the data collection, for the benefit of all interns who participated in the study, cross over was done and the procedure repeated.

Day 1- Lecture and Demonstration

Day 2- Pre-test and then divided into Groups A and B

Days 2-7- Group A underwent MGI practice and Group B physical practice

Day 8- Post-test using OSCE

OSCE: 16 Steps for assessment (each step carries 1 mark)

1. Check for equipments 2. Selection of laryngoscope, ET-Tube 3. Pre-oxygenate with ambu bag 4. Position the patient 5. Open the patient mouth with cross finger techniques 6. Grasp the laryngoscope in left hand 7. Slowly insert the blade into the right side of the patient's mouth and push the tongue to the left 8. Advance the blade and place it in the vallecula 9. Apply external laryngeal manipulation pressure 10. Visualise the vocal cord by lifting the handle 11. Grasp the ET-Tube in right hand 12. Gently insert the ET-Tube along the right side of the mouth under direct visualisation of the vocal cord 13. Withdraw the blade and inflate the ET-Tube cuff with air (5-10 mL) 14. Assess the placement of ET-Tube by bilateral breath sound, symmetric chest movements, absence of breath sound over the epigastrium 15. Fix the tube at appropriate length at the level of incisor 16. Connect to the mechanical ventilator.

STATISTICAL ANALYSIS

The data was analysed using Statistical Package for the Social Sciences (SPSS) version 16.0. Paired and unpaired t test were used to compare the values within the group (before and after) and between the groups respectively. An arbitrary cut off of 0.05 was used to interpret significance of p-value.

RESULTS

According to [Table/Fig-1], the mean scores had increased after the intervention in both groups A (from 9.5 to 12.7) and B (from 8.9 to 12.1) after intervention. A statistically significant increase in mean scores was observed in both the groups after the intervention [Table/Fig-2].

	Total		Group A		Group B	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Pre	9.2	1.6	9.5	1.9	8.9	1.3
Post	12.4	1.6	12.7	1.7	12.1	1.5

[Table/Fig-1]: Comparison of pre and post mean values of Group A and Group B.

Groups A and B	Mean	N	Std. Deviation	p-value
Pre	9.18	40	1.631	<0.001
Post	12.35	40	1.594	

[Table/Fig-2]: Comparison of mean pre and post (after seven days) values of both Groups A and B.
p-value< 0.05 is considered as statistically significant

[Table/Fig-3] shows that no statistically significant difference was observed between the difference in mean of pre and post scores of groups A and B. That means MGI technique was almost as effective as the physical practice in learning skills.

Groups	N	Mean	Std. deviation	p-value
Group A	20	3.1500	1.03999	
Group B	20	3.2000	0.83351	0.216

[Table/Fig-3]: Comparison of difference in mean of pre and post intervention values between Group A and Group B.

DISCUSSION

The results of the present study is consistent with the results of a study done to teach the venepuncture skill to medical students, where after receiving the lecture demonstration and guided physical practice for 30 minutes, the physical practice group participants received one additional session of 30 minutes physical practice and mental imagery group received one additional session of guided imagery. Both the groups showed improved performance but do not statistically differ from each other [9]. In another study done to learn the technique of lumbar puncture on simulators by medical students, where the performance was assessed with the OSCE scores, the results of the mental imagery and the physical practice group do not differ from each other [10]. Also, in a previous study done to assess the learning of suturing technique on a live pig's foot, the results of the initial physical practice followed by mental imagery rehearsal group was statistically equal to physical practice alone group [11].

In the present study, even for the mental imagery group one session of physical practice training was conducted before the beginning of the intervention, as this technique is not at all a replacement for physical practice. It was a failure when practiced as a sole method of training without a prior exposure to physical practice [13]. However, mental rehearsal definitely would be a better way to review and practice the task efficiently without any risk. This would be an additional method to enhance the performance, an adjunct to physical practice as reported by the results of the previous studies on Virtual Realistic laparoscopic cholecystectomy and laporoscopic suturing training sessions [14,15]. A preliminary exposure to physical practice is required to form a template, which the participant can use as a reference to form a mental image.

Mental imagery practice induce neuroplastic changes in specific areas of the brain by reorganisation due to short and long term action on synapses. This plastic change is detectable at minimal one week and maximal at four weeks. Very few studies contradict the positive effects of MGI, as evidenced by a 2014 study where

neuroplastic changes were not observed in the cortical areas after MGI intervention [16]. But majority of studies confirm the positive role of MGI [17].

Mental imagery is synonymous with mental rehearsal and mental practice. Here participants imagine the experience of performing a skill in elaborate detail in the absence of a stimulus, before its actuation and can produce genuine sensory and perceptual experiences. A review article had reported that successful mental imagery designs were obtained with interventions based on motor and strength-related tasks, with participants aged between 20 to 29 years and of both the genders [18]. Two other important criteria include short retention interval and novice participants. In the present study, participants were new to the technique and were of the age group 21-24 years including both the genders with study duration of seven days and a shorter retention interval. As sleep was also found to enhance MGI performance, similar to physical practice, in this study MGI sessions were conducted every day for seven days [19].

MGI technique enhances the motor performance by enabling the students to prepare for the intubation procedure ahead of time, by building confidence, focusing attention, by identifying complications and solutions and by priming the skeletal muscles to perform physically [20]. By rehearsing again and again, the interns could have understand the steps of the intubation procedure in a step wise, sequential way, overcome weaknesses or intraoperative errors in performance and thought about to how to actually perform the procedure in right way.

An important barrier to concentration and attention during MGI technique is stress, anxiety, and negative thoughts. That was the reason the interns were instructed to relax in the sitting position for few minutes and then take down deep breathing exercises which could reduce stress by balancing the autonomic nervous system and enhance selective attention [21]. Tasks with specific goals and shorter duration were found to be more effective [20]. In this study, the task was specified appropriately and time duration was around only one week. Previous studies had highlighted the effectiveness of MGI on other surgical skills. But its effect in acquisition of intubation skills was for the first time proved to be equally as effective as that of the physical practice.

Limitation(s)

Limitation of the present study was that it should have been done on a larger sample size with a control group. MRI of brain, if done, could have substantiated the neural changes after MGI.

CONCLUSION(S)

MGI was as effective as additional physical practice for medical students learning to perform intubation. Guided mental imagery in acquisition of surgical skills considerably decreases the expense of repeated practice, simulators and staff support. Ultimately, this practice can be incorporated for individualistic 'anytime-anywhere' try out. Incorporating the use of mental rehearsal as an adjunct to physical practice in an effort to facilitate skill acquisition was found to be beneficial.

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