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Incorporating motor imagery into massage education in physiotherapy students.

Incorporación de la imaginería motora en la educación del masaje en estudiantes de fisioterapia.

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Abstract

Objective: This study aimed to investigate the effects of integrating motor imagery (MI) practice into traditional teaching methods on the motor imagery skills and motor learning performance of physiotherapy students. **Methods**: Twenty-four students were randomly assigned to two groups: the Motor Imagery Group (MIG; 21.15 ± 1.46 years) and the Control Group (CG; 21.91 ± 1.58 years). Both groups initially received traditional instruction on infantile colic massage. Following a familiarization session, the MIG additionally engaged in MI practice twice a week for two weeks. Outcome measures included the Motor Imagery Questionnaire-3 (MIQ-3) and mental chronometry tests. At the end of the intervention, qualitative feedback regarding the learning experience was also obtained from the MIG participants. **Results**: Baseline values did not differ significantly between groups ($p > 0.05$) except for the MIQ-3 Kinesthetic score ($p = 0.003$). Within-group analysis revealed a significant improvement in the MIG's MIQ-3 Kinesthetic score from pre- to post-assessment ($p = 0.003$), while other parameters remained unchanged. Mental chronometry results showed a significant reduction in real-time performance duration in the MIG ($p = 0.025$). Qualitative findings indicated that most participants perceived MI as a useful and motivating strategy for enhancing self-learning and memory retention. **Conclusion**: Incorporating MI practice into traditional teaching improved students' kinesthetic imagery ability and performance efficiency in learning infantile colic massage. MI may serve as an effective, low-cost, and student-centered pedagogical tool to support psychomotor skill acquisition in physiotherapy and rehabilitation education.

Keywords: motor imagery, mental imagery, physiotherapy education, manual skills, experiential learning

Resumen

Objetivo: Este estudio tuvo como objetivo investigar los efectos de integrar la práctica de la imaginería motora (IM) en los métodos tradicionales de enseñanza sobre las habilidades de imaginería motora y el rendimiento del aprendizaje motor de los estudiantes de fisioterapia. **Métodos:** Veinticuatro estudiantes fueron asignados aleatoriamente a dos grupos: el Grupo de Imaginería Motora (GIM; 21,15 ± 1,46 años) y el Grupo Control (GC; 21,91 ± 1,58 años). Ambos grupos recibieron inicialmente instrucción tradicional sobre el masaje para el cólico del lactante. Tras una sesión de familiarización, el GIM participó además en prácticas de IM dos veces por semana durante dos semanas. Las medidas de resultado incluyeron el Cuestionario de Imaginería Motora-3 (MIQ-3) y pruebas de cronometraje mental. Al final de la intervención, también se obtuvo retroalimentación cualitativa del GIM sobre la experiencia de aprendizaje. **Resultados:** Los valores basales no difirieron significativamente entre los grupos ($p > 0,05$), excepto para la puntuación

cinestésica del MIQ-3 (p = 0,003). El análisis intragrupo reveló una mejora significativa en la puntuación cinestésica del MIQ-3 del GIM entre la evaluación inicial y la final (p = 0,003), mientras que los demás parámetros permanecieron sin cambios. Los resultados del cronometraje mental mostraron una reducción significativa en la duración del desempeño en tiempo real en el GIM (p = 0,025). Los hallazgos cualitativos indicaron que la mayoría de los participantes percibieron la IM como una estrategia útil y motivadora para mejorar el autoaprendizaje y la retención de la memoria. **Conclusión:** La incorporación de la práctica de IM en la enseñanza tradicional mejoró la capacidad de imaginería cinestésica de los estudiantes y la eficiencia en el aprendizaje del masaje para el cólico del lactante. La IM puede servir como una herramienta pedagógica eficaz, económica y centrada en el estudiante para apoyar la adquisición de habilidades psicomotoras en la educación en fisioterapia y rehabilitación.

Palabras clave: imaginería motora, imaginería mental, educación en fisioterapia, habilidades manuales, aprendizaje experiencial

1. Introduction

Motor imagery (MI) is defined as the mental representation of a movement without any overt motor execution (1). Through imagery, one can experience animated movement, perceive visual objects, or even sense auditory, tactile, gustatory, and kinesthetic qualities as if they were real (2). Motor imagery involves the mental simulation of real-life actions and should not be confused with daydreaming (3). Early investigations into MI-related brain activity date back to Jacobson, who observed small but measurable muscle contractions during the imagination of arm flexion (4). These findings indicated that MI produces physiological effects similar to those of actual movement. Neuroimaging studies have further confirmed that the pattern and magnitude of brain activation during MI closely resemble those observed during real movement (5).

MI has been classified in several ways. One common classification distinguishes between external and internal imagery (6). External imagery refers to visualizing oneself performing an action from an observer's perspective, whereas internal imagery involves visualizing the movement from one's own first-person perspective (7). Another approach divides MI into visual and kinesthetic imagery. Visual imagery pertains to mentally visualizing an object or movement, while kinesthetic imagery involves feeling the movement—its direction, amplitude, speed, muscle tension, and spatial characteristics (8).

In recent years, MI has been increasingly applied across diverse educational fields, including medicine, music, and sports (9). Since health-related professions rely heavily on motor practice, the potential role of MI in enhancing clinical skill acquisition has been explored in medical education. For instance, a study examining the effect of imagery training on peripheral venous catheter insertion in medical students reported that those who received MI training mastered the skill faster than those in the control group (10). MI thus supports motor learning in health professionals, who require such skills throughout their careers to deliver effective and evidence-based interventions (11). Notably, both medical and nursing students have demonstrated significant improvements in motor learning outcomes following MI-based training (12-13).

Physiotherapists, as experts in human movement, frequently teach, prescribe, and perform various motor tasks such as exercise instruction, mobilization, manipulation, and massage (14). Therefore, incorporating MI into physiotherapy education may enhance students' motor learning capacity and facilitate the transfer of these skills into clinical practice and lifelong professional development. Infantile colic massage—defined as a manual therapy technique aimed at relieving paroxysmal crying and restlessness in infants (15)—is one such motor skill routinely taught to physiotherapy and rehabilitation students (16-17).

Accordingly, the present study aims to investigate the effects of incorporating MI training of infantile colic massage into traditional teaching methods on the MI skills and motor learning abilities of physiotherapy and rehabilitation students.

2. Methods

Participants

All students (n=32) who chose the Physiotherapy and Rehabilitation Department Pediatric Rehabilitation course were included in the study. Those over 18 years old and those who firstly and regularly participated in the Pediatric Rehabilitation course in the Eastern Mediterranean University Physiotherapy and Rehabilitation Department in the Fall semester of the academic year were included in the study. Individuals who had advanced vision and hearing problems, and diagnosed attention problems, or other diseases that prevented participation in the study, and individuals who received MI training before were excluded from the study. According to the participation criteria, 24 students were included and divided into two groups as the motor imagery group (MIG) and the control group (CG) (figure 1). Written informed consent was obtained from all participants before data were collected. The study was approved by the Eastern Mediterranean University Scientific Research and Ethics Committee, Health Ethics Subcommittee (ETK00-2022-0275). The study was also registered with the number NCT05706142 for ClinicalTrials.gov.

Study Design

A prospective single blind study with randomized controlled trial

Experimental Design

Within the scope of the pediatric rehabilitation course, all students received colic massage training in the same course with traditional methods, that is, as a practical demonstration on a baby doll by the first author and let students experience the massage movements on their own baby dolls. Then the students in the study were randomly divided into two groups. Randomization was done by lottery method. Detailed information was given to both groups at the beginning of the study and a consent form was signed. Then, demographic information, movement-motor imagery test and multiple evaluations of recording mental chronometer were performed on the individuals, respectively.

Intervention Group

MI training was given to the students in the intervention group two times a week for 2 weeks, 4 sessions in total. Within the scope of MI training, a familiarization session was made to the individuals about the definition and aims of MI with some examples. "PETTLEP" model was used for imagery training. In this model, imagery training was prepared in accordance with our purpose, taking into account the physical, environmental, time, task, learning, emotion and personal subheadings (9). In the training sessions, relaxation exercises were given for 5 minutes first. After the relaxation exercises, motor imagery training of colic massage for infants was given for 10 minutes. The session was conducted by the first author who was lecturer and a certified infant massage instructor by International Association of Infant Massage. An example of sentences used in the first session after asking from the students close their eyes were given below. The imagination of these movements lasted around 40 seconds in every session.

> *"Now you are in a green garden. You are sitting on a soft mat with your baby in front. You are smelling fresh air and you are hearing birds. Your baby's giggling to you with a beautiful smile. You are taking massage oil. Today you are using the olive oil. Pour it into palm and smell it (the author*

made a smelling voice). Spread the oil into your palm in front of your baby's eyes. You are giving message that you are starting massage. And now you are ready for the massage. Touch your baby's abdomen. Feel the pure skin of your baby and before starting take a deep breath. Start the massage with using 5th finger of your right hand and stroke up to down and then with your left hand simultaneously do the movement. While doing your massage, talk to your baby or sing a song. After 3 repetitions, now take the knees of baby. Start to bend them towards the abdomen and correct them with 3 repetitions. Now you are placing your both hands to the midline of the subcostal area. Start to stroke with the shape of reverse moon with your right hand. When you complete the moon, start to stroke with your left hand with a round shape. Do these movements simultaneously with 3 repetitions. Lastly you are taking the knees of your baby again. Bend them towards the abdomen and correct them with 3 repetitions. Now you completed today's massage."

Control Group

CG took the traditional training only during study duration.

Data Collection

The outcome measures were conducted by the second author. All assessments were conducted in a quiet room. This is the information obtained:

1. *Demographic Information Form*. Written informed consent was first obtained from the individuals included in the study, and then age, gender, and difficulty of the course were questioned.
2. *Movement Imagery Questionnaire-3* (MIQ-3). Movement Image Questionnaire-3 (MIQ-3) is a version of the Movement Imagery Questionnaire with a high evidence for validity and reliability (18,19). Through this questionnaire, internal visual imagery, external visual imagery and kinesthetic imagery are evaluated. It consists of 3 subscales and a total of 12 questions. Before the evaluation, the participants were informed about the survey. The 12 questions in the questionnaire were first performed physically by the participants, then the participants returned to the starting position specified in the question and imaged according to the desired imagery type. Scoring was made between 1 and 7, with 1 point: very difficult to see/feel, 7 points: very easy to see/feel. In the calculation of the questionnaire, external visual imagery, internal visual imagery and kinesthetic imagery were evaluated separately (19).
3. *Mental Chronometry*. The individuals participating in the study were asked to do infantile colic massage actively, and real time duration (without any fault in the movements) was recorded by stopwatch in seconds. The aimed duration of massage which was taught in the demonstration of the author was 40 seconds. Afterwards, they were asked to perform the infantile colic massage using the internal imagery and then the external imagery method. Imagery time durations were recorded in seconds.
4. *Qualitative Questions*. The individuals included in the MI group were asked qualitative questions after the intervention. These questions were whether the found MI useful or not and the reason of their answer. They were also asked which imagery could be conducted more easily between internal or external and lastly whether they could use this training for their patients in future.

At the end of the imagery training, a final evaluation was conducted for both MIG and CG. In addition, voice recordings were taken from the individuals participating in the MIG and their experiences in this training were evaluated with semi-structured questions. After the final evaluations of the study were completed, the same imagery training was presented to the individuals in the CG in order to provide equality among all students before exams.

Statistical Analysis

The data were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) 22.0. The qualitative findings are presented as frequencies and percentages (%). The quantitative (continuous data) findings were shown as means and standard deviations. The Shapiro–Wilk test was used to analyze the distribution of the variables. Since there was non-normal distribution, Wilcoxon test was used in the intragroup comparisons of the first and last measurements, and Mann-Whitney U test was used for the intergroup comparisons.

3. Results

The study was completed with 24 students (women=10, men=14) who were eligible according to the inclusion and exclusion criteria. The mean age of the MIG was 21.15 ± 1.46 years old, while it was 21.91 ± 1.58 years old in the CG (p1=0.250).

Comparisons between groups

The comparisons were conducted as before and after the study. There was no significant difference between the control and MI groups before and after the study (p1>0.05, p2>0.05), except the MIQ-3 Kinesthetic Score (p1=0.003) (Table 1).

Comparisons within groups

The findings from the MIQ-3 showed that there was a significant difference in the MIG in terms of the MIQ-3 Kinesthetic Score from first to second assessments (p3=0.003), whereas no significant difference was found in other parameters (p3>0.05). The findings from the mental chronometry, the real time duration significantly decreased in the MIG (p3=0.025). The other results of mental chronometry did not change significantly within the MIG and CG (p3>0.05) (Table 1).

Qualitative findings

Table 2 and 3 show the qualitative results. The answers to qualitative questions presented that twelve students found the MI beneficial on motor learning and self-learning of infantile colic massage. Only one student found imagination hard (Table 2). Most of the students used internal imagination easier than external. For the future use, most students thought to get benefit from MI for their patients, whereas some students replied that they would decide according to the cognitive level of patient. Only one student found it hard for patients so he/she will not use it in future.

4. Discussion

Motor imagery (MI) was found to be effective on the MIQ-3 kinesthetic score and the real-time duration of mental chronometry in the motor imagery group (MIG), whereas no significant changes were observed in other parameters. To the best of our knowledge, this is the first study to investigate the effects of MI on learning a manual skill among physiotherapy and rehabilitation students. Qualitative findings also revealed that most students accepted this new learning approach and considered it beneficial. Moreover, many participants expressed willingness to apply MI techniques in clinical practice according to their patients' cognitive levels.

The literature presents varying durations and frequencies of MI interventions, investigating both immediate and long-term effects. Some researchers applied MI only once before surgical skill training for medical students and reported immediate improvements compared to control groups (12). Another study implemented MI three times per week for four weeks among nursing and midwifery students and found significant positive outcomes (20).

Table 1. Comparisons between and within groups.

		The first assessments (before the study)			The second assessments (after the study)		
		X ± SD	p_1		X ± SD	p_2	p_3
MIQ-3 Score Internal	MIG	6.06 ± 0.61	.771	MIG	6.15 ± 0.64	.726	.506
	CG	5.65 ± 1.53		CG	5.89 ± 0.77		.572
MIQ-3 Score External	MIG	6.02 ± 0.97	.837	MIG	6.23 ± 0.93	.230	.325
	CG	6.11 ± 0.44		CG	5.91 ± 0.82		.326
MIQ-3 Kinesthetic Score	MIG	4.37 ± 1.24	**.003**	MIG	5.02 ± 1.03	.103	**.003**
	CG	5.86 ± 0.66		CG	5.8 ± 0.89		.570
Chronometry during real action (sec)	MIG	50.02 ± 16.73	.582	MIG	40.07 ± 17.84	.862	**.025**
	CG	48.79 ± 26.79		CG	45.62 ± 24.68		.959
Mental chronometry during internal imagery (sec)	MIG	50.44 ± 29.91	.486	MIG	44.32 ± 23.83	.562	.552
	CG	53.66 ± 22.88		CG	42.25 ± 27.15		.083
Mental chronometry during external imagery (sec)	MIG	51.24 ± 28.79	434	MIG	44.86 ± 21.69	.271	.529
	CG	55.84 ± 23.35		CG	39.19 ± 20.65		.056

X ± SD, mean and standard deviation; p1: first assessments, between groups, p2: second assessments, between groups, p3: comparisons within the groups from first to second assessments

Table 2. Qualitative findings for the usefulness of motor imagery to learn colic massage.

	Is this a useful method	**Reason**
Case 1	YES	when you want to do real action, it is like a preparation
Case 2	YES	to increase learning
Case 3	YES	to understand movements easier
Case 4	YES	to practice the movements in my head so to support self-learning
Case 5	NO	it is hard to imagine
Case 6	YES	it helps to learn actively from far so helps self-learning
Case 7	YES	it makes learning easier because I imagine the tasks in an order
Case 8	YES	to learn quicker
Case 9	YES	a good way to learn motor and cognitive skills actively
Case 10	YES	my brain understood the general idea with imaging
Case 11	YES	we can feel the movement
Case 12	YES	make remember easier the order of the massage
Case 13	YES	to increase learning

Table 3. Qualitative findings for the easier type of motor imagery and its usefulness in future

		n
Internal/external	Internal	10
	External	3
Use of the method in future	*Yes,* it will probably support me while teaching exercises to patients	9
	No, it might be hard for patients	1
	Maybe, according to cognitive level, need to learn more	3

In the present study, MI was practiced twice a week for two weeks, consistent with the intended learning duration for infantile colic massage. Nevertheless, the duration and frequency of MI practice could be adjusted in future research to determine the optimal training dose for skill acquisition.

At baseline, both groups showed similar values except for the MIQ-3 kinesthetic scores, which were higher in the control group. This questionnaire reflects participants' ability to perform motor imagery; therefore, this difference suggests a pre-existing variation in kinesthetic imagery ability. By the end of the study, a significant improvement was observed only in the MIG, while no between-group difference remained. This finding is consistent with the nature of the task, as infantile colic massage relies predominantly on kinesthetic imagery. The students did not take any MI education before so developing imagery skills may need more time. Nevertheless, it seems that 2-week imaging colic massage contributed their kinesthetic imagery skill. Previous research has also emphasized the importance of kinesthetic imagery in physiotherapy, particularly in patient populations where movement perception and body awareness are crucial (6, 8). Developing this skill during university education may therefore contribute to physiotherapists' readiness for clinical practice and enhance their ability to use MI therapeutically.

Several studies have identified MI as a cost-effective strategy for supporting motor learning in medical education (12). In the present study, massage quality was not assessed in all dimensions, but timing, hand movements and order of these movements were recorded. Students who received MI training performed the massage task correctly with improved real-time duration, approaching the expected completion time and demonstrating better movement fluency. Moreover, they did massage in the correct order. Although cost-effectiveness was not a direct outcome of this study—since infant massage was practiced without massage oil on baby models—MI training may nonetheless reduce learning time. When applied in clinical contexts, this could translate to more efficient therapy sessions and, consequently, potential economic benefits (10).

MI has also been shown to reduce students' self-reported anxiety before performing invasive procedures (13). Managing emotional responses is particularly important in health education to prevent errors and ensure patient safety. Physiotherapy students often face challenges memorizing complex manual techniques and exercises, which require understanding both the logic and sequence of movements. Participants in the present study emphasized that MI can be practiced mentally anytime and anywhere, facilitating both cognitive and motor learning. Similarly, studies utilizing PETTLEP-based MI in nursing and midwifery education reported improved learning of nasogastric tube insertion skills (20).

MI enhances neuroplasticity by providing opportunities for "repetition without physical repetition," as learners engage in multiple forms of rehearsal—listening to explanations, visualizing the action, and physically practicing it (21). This multidimensional repetition strengthens motor learning pathways. Accordingly, students in the MIG reported that MI made learning easier.

Limitations of the study

The primary limitation of this study was the small sample size, although all eligible students enrolled in the course during the semester were included. Although previous studies have demonstrated significant effects of even a single MI session, extending the intervention duration or increasing session frequency could provide more robust results. Moreover, only real-time performance for the correct massage sequence was objectively recorded. Parameters such as massage pressure, or movement smoothness were not measured objectively. Therefore, the study had limited capacity to comprehensively assess manual skill performance. Future studies should incorporate objective kinematic or pressure-based measurements to better evaluate the influence of MI on manual techniques.

5. Conclusions

- Participation in motor imagery (MI) sessions positively influenced the kinesthetic imagery scores and the real-time performance of infantile colic massage among physiotherapy and rehabilitation students. Moreover, students in the intervention group expressed positive perceptions regarding the applicability and educational value of MI in developing manual skills.
- MI appears to be a promising and innovative adjunct to traditional teaching approaches in health professions education. It provides an active and student-centered learning strategy that enhances psychomotor skill acquisition, supports cognitive engagement, and promotes deeper understanding of movement-based practices.
- The results highlight the potential of MI as an effective pedagogical tool that can be integrated into physiotherapy curricula and similar health education programs to strengthen experiential and reflective learning.
- The results also highlight the limited research on the use of MI in the field of education of health sciences. Further studies with larger sample sizes and different clinical skills are recommended to explore the broader impact of MI-based training on educational outcomes and professional competence in health sciences education.

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