



[www.aassjournal.com](http://www.aassjournal.com)

ISSN (Online): 2322 – 4479

**Original Article**

Received: 16/07/2013

Accepted: 03/10/2013

# Optimal Timing of Mental Practice on Learning the Volleyball Service Skill

<sup>1</sup>Mohsen Afrouzeh\*, <sup>2</sup>Mehdi Sohrabi, <sup>2</sup>Hamid Reza Taheri, <sup>3</sup>Ali Afrouzeh

1- Faculty of Physical Education and Sport Sciences, Ferdowsi University of Mashhad- International Campus, Mashhad, Iran.

2- Faculty of Physical Education and Sport Sciences, Ferdowsi University of Mashhad, Mashhad, Iran.

3- Faculty of Physical Education and Sport Science, Shahid Beheshti University, Tehran, Iran.

## ABSTRACT

The goal of this study is searching effective time (before, during and after physical practice) for mental practice in learning the Volleyball Service Skill. Forty-five beginner students, aged 12–14 years, with no history of Volleyball Service Skill participated in the study (45 Male ones). Most of them were Secondary school students. All were unable to serve Volleyball correctly. The subjects were divided into the three groups (MP before PP, MP during PP and MP after PP). All subjects performed mental and physical practice in 21 sessions and for 30 minutes per session. The subjects were tested at the end of the 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>th</sup>, and 28<sup>th</sup> sessions. The Volleyball Serving Test was used for test comparing the rate of learning. The result of this research showed there was significant difference between means of the MP-during-PP group, and the MP-before-PP and the MP-after-PP groups in improving their Volleyball Service skill. Moreover, the MP-before-PP and MP-after-PP groups did not differ from each other concerning the scores. The retention test showed that subjects in the MP-before-PP and the MP-after-PP groups, in contrast to the MP-during-PP group, did not significantly improve their Volleyball Service skill. This study suggested that coaches and P.E teachers apply mental practice (10 minutes) as an essential part in programs and teach the beginners that use mental practice in every time of physical practice (spatially during physical practice).

**Key Words:** mental practice, optimal timing, AAHPERD test, retention test.

---

Corresponding Author:

**Mohsen Afrouzeh**

E-mail: [m\\_afrouzeh@yahoo.com](mailto:m_afrouzeh@yahoo.com)

## INTRODUCTION

The mental imagery refers to a topic in skill learning with throughout the length of history. Richardson (1969) has explained MI as all quasi-sensory or quasi-perceptual experiences that exist in the absence of those stimuli situations that are known to produce real sensory or perceptual experiences (1). Munroe *et al.* (2000) reported athletes in their study used visual, kinesthetic, auditory, and olfactory sense imagery. Sport psychologists generally recommended that athletes use as many sense modalities as possible in their imagery to increase effectiveness (2-5). A remarkable subcategory of mental imagery is created by motor imagery that refers to the internal reproduction of a particular motor action without any obvious motor output. Mental imagery is a training technique by which motor imagery is used with the intention of improving performance, in other words, it is the imagined practice of a motor act with the particular intention of learning or improving that act (6). An oversized body of investigation provided proof that mental imagery and physical practice of identical movements share similar cerebral substrate, though neural networks aren't entirely overlapping (7-10), and showed the influence of central activations on autonomic effectors throughout imagination (e.g., (11, 12). The fact that imagery and actual practice are mediated by the identical neural mechanisms which is known as the principle of functional equivalence (9, 13, 14), that tends to propose that unless imagery is congruent with physical practice, it'll not be as effective in achieving its desired effects. Over the last twenty years, MI investigation has more specifically been designed to find out why, when, where and how to use imagery, as well as what is imagined (8, 15). Generally, there's compelling proof that MI substantially contributes to enhance motor learning and motor performance (16, 17).

Many studies have shown that imagery can be effective in optimizing the performance of movements in athletes. Moreover, it may facilitate novice learners within the acquisition of new skills (6). Several of those studies have been reviewed by Feltz and Landers (1983) and Driskell *et al.* (1994). They show that subjects who mentally practiced for a selected task typically displayed less improvement than subjects who trained physically (16, 18). However, compared with control subjects who didn't practice at all, it could be shown that mental training, indeed, facilitated performance. Supported the results of mental practice, some researchers have suggested the use of mental practice in neurological rehabilitation, as it may be a new and cost efficient treatment tool (19-22).

Mental imagery may be an acquainted aspect of most people's everyday experience (23-26). There are many individuals (perhaps found in disproportionate numbers amongst scientists and other intellectuals (23, 24) who say that they seldom, or perhaps never, experience imagery, but, for the immense majority of us, it is a recognized and commonplace feature of our conscious mental lives.

Imagery as a preparatory approach used before to performance has improved on strength task (27, 28), muscular endurance exercise (29, 30), and golf putting (31, 32).

The studies has shown that the elite athletes cited psychological a lot of skills typically as reasons for their successful performances in tournaments. Consistent with that study, imagery was one of the most common mental methods utilized by the taking-part athletes. Athletes report using MI in their daily practicing, however, they use it most in conjunction with competition (33). Coaches typically encourage their athletes to use MI to assist them to learn new skills and to enhance skills as well as improving the skills they already possess (34). Moreover,

imagery is often a key element in the mental training program developed and enforced by sport psychologists (35-37).

The use of MI by athletes has received considerable attention (38). In association with in-depth examination of the character of imagery use in sport, Munro *et al.* (2000) considered four questions: Where do athletes use MI? When do athletes use imagery? Why do athletes use imagery? What do athletes imagine? Investigation examining the “where” of athletes’ imagery reveals its use in primarily two contexts, tournament and practicing, with imagery being used a lot typically in conjunction with competition than with training (e.g. (39). Athletes, in addition, report using MI outside of those two contexts, including at work, school and home (39), and through sport-injury rehabilitation (40, 41). With respect to the “when” of imagery use, it has been found that mental imagery is utilized most often immediately prior to a competitive event, rather than throughout or after competition (42). When athletes use MI in training, they have an inclination to use it during practice, not prior to or after training (39). Outside of training and game, athletes have reported using MI intermittently during the day, however, most frequently at night just before falling asleep (e.g. (43). The question of “what” athletes imagine has been addressed in many studies (e.g. (15, 44), and refers to the content of an athlete’s image. Munroe *et al.* (2000) classified the content of athletes’ images in sport underneath various headings. These headings enclosed sessions (e.g. length of time athletes use imagery), effectiveness, surroundings, nature of MI (i.e. positive or negative mental imagery, and also the accuracy of the imagined event or behavior) and sort of imagery (e.g. visual, auditory).

The first aim of the present study is to survey the effect of mental imagery on the learning Volleyball Service Skill, and the second aim is to focus on the optimal timing

of mental practice (before, during and after physical practice) in the learning Volleyball Service Skill, and finally, the third aim is to investigate the effect of mental practice timing (before, during and after physical practice) on the retention of Volleyball Service Skill.

## MATERIALS AND METHODS

**Subject.** Forty five male beginner students, aged 12–14 years, with no history of Volleyball Service Skill participated in the study. Most of them were secondary school students. All were unable to serve Volleyball correctly. All subjects gave written informed consent.

**Procedure.** The experiment started with a pre-training measurement, 1 week before the training sessions started. The ability to Serve Volleyball voluntarily, as well as the imagery ability were determined. The ability of mental imagery was assessed by the Vividness of Movement Imagery Questionnaire (45). The VMIQ consists of 24 items reflecting the internal standpoint and 24 items reflecting the external standpoint. The internal standpoint refers to the ability of a subject to imagine that he performs the movement, in contrast with the external standpoint, which refers to the ability of a subject to imagine that somebody else is performing the movement. In the present study only the internal imagery items were employed. A score of 72 or less on the internal imagery items was required to be included. The used cut-off point was based on the following rationale: all 24 items for the internal standpoint had to be scored with a 3 (a moderate capacity to imagine the performance of a movement), a 2 (a good capacity to imagine movement performance), or a 1 (an excellent imagination of the movement performance as lively as actual performance). Scores of 4 (a vague and unclear image) or 5 (no image at all) were not accepted.

The included subjects were randomly assigned to one of three groups:

1) A group (n=15) receiving mental imagery before physical practice (MI-before-PP);

2) A group (n=15) receiving mental practice during physical practice (MI-during-PP); and

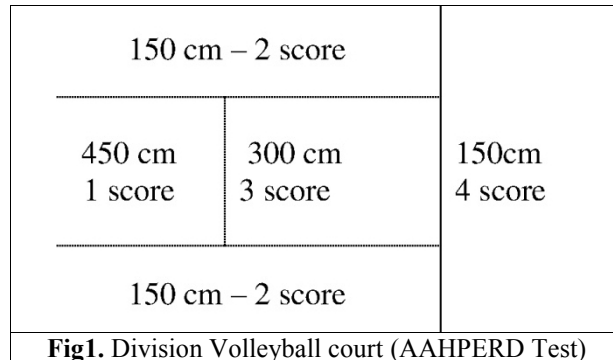
3) A group (n=15) receiving mental practice after physical practice (MI-after-PP).

All the group's training sessions were 21. The time of training for every session was 30 minutes: preparing and warm-up 10 minutes, mental practice 10 minutes and physical practice 10 minutes. The main factor which is different among these three groups is the arrangement and the physical and mental practice.

The group one received mental practice before PP, the subjects warmed up for 10 minutes, and then performed mental practice for 10 minutes and finally they executed Volleyball Service for 10 minutes. The second group received mental practice during PP, the participants warmed up for 10 minutes, then they executed Volleyball Service for 5 minutes, at once they performed mental practice for 10 minutes and finally they executed Volleyball Service for 5 minutes. The third group received mental practice after PP, the subjects warmed up for 10 minutes, then they executed Volleyball Service for 10 minutes and finally the subjects performed mental practice for 10 minutes. All of the factors such as the time, intensity, the period of training for all of the three groups were the same.

**Measures.** To collect information in the research, AAHPERD Volleyball Serving Test was used. In this experiment we divided the Volleyball court into 4 marked parts in which the grades varied from 1 to 4. The experiment was done in a form that every subject was allowed 10 services among which all of the obtained grades were

collected which were considered as that subjects grade. The ball which went out of the court or was hit the net, not only did cause the subject to lose grade but also caused him lose one turnout of 10. (Fig.1)



To evaluate the subject's learning progress in the end of the 7th, 14th, 21st session, we tested them and by comparing the T1, T2, T3 of the triple groups we obtained the level of their progress and by comparing T3 of the groups, we could determine the best time of application as well as doing the mental imagery. To evaluate rate of retention of the subject's learning, after one week without training (28<sup>th</sup> session), we tested them and by comparing T4 of the triple groups, we could determine the best time of application as well as doing the mental imagery for retention of skills.

**Statistical Analysis.** A one-way ANOVA was used to determine whether groups differed from each other in improvement of Volleyball Service Skill. Finally, post hoc multiple comparisons assessed which groups differed significantly from each other (Tukey test). All tests were performed with a 95% reliability interval.

## RESULTS

The result of this research showed a significant difference in improvement between groups. Post hoc multiple comparisons showed that subjects in the

MP-during-PP group scored higher on the measurements after the training 21 sessions than subjects in other groups. They improved significantly more than the subjects in the other groups ( $P < 0.05$ ). Table

1 shows the mean scores of the groups (Table. 1).

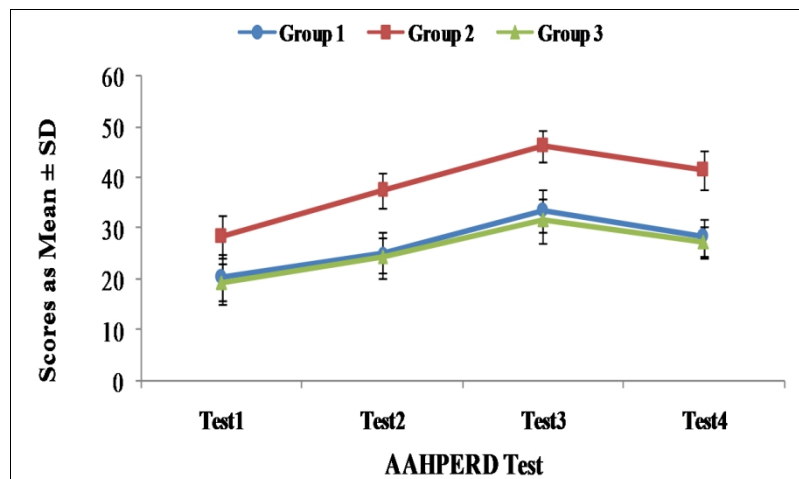
Table 1. Scores of AAHPERD Test as Mean  $\pm$  SD

	Group 1	Group 2	Group 3
Test1	20.33 $\pm$ 4.54	28.46 $\pm$ 4.08	19.2 $\pm$ 3.96
Test2	25.26 $\pm$ 3.9	37.46 $\pm$ 3.56	24.35 $\pm$ 4.06
Test3	33.53 $\pm$ 4.11	46.33 $\pm$ 3.19	31.53 $\pm$ 4.37
Test4	33.53 $\pm$ 3.71	41.51 $\pm$ 3.91	27.21 $\pm$ 3.12

**Group 1:** Mental Practice before Physical Practice. **Group 2:** Mental Practice during Physical Practice. **Group 3:** Mental Practice after Physical Practice. **Test 1:** AAHPERD Test in the end of the 7<sup>th</sup> session. **Test 2:** AAHPERD Test in the end of the 14<sup>th</sup> session. **Test 3:** AAHPERD Test in the end of the 21<sup>st</sup> session. **Test 4:** AAHPERD Test in the end of the 28<sup>st</sup> session (Retention Test: one week without training)

In fact, there was a significant difference between means of the MP-during-PP group, and the MP-before-PP and the MP-after-PP group in improving their Volleyball Service skill. Moreover, the MP-before-PP and MP-A-PP groups did not differ from each other

concerning the scores. The retention test showed that subjects in the MP-before-PP and the MP-after-PP group, in contrast with the MP-during-PP group, did not significantly improve their Volleyball Service skill (Fig.2).



**Fig 2. Scores of AAHPERD Test 1-4.** **Group 1:** Mental Practice before Physical Practice. **Group 2:** Mental Practice during Physical Practice. **Group 3:** Mental Practice after Physical Practice. **Test 1:** AAHPERD Test in the end of the 7<sup>th</sup> session. **Test 2:** AAHPERD Test in the end of the 14<sup>th</sup> session. **Test 3:** AAHPERD Test in the end of the 21<sup>st</sup> session. **Test 4:** AAHPERD Test in the end of the 28<sup>st</sup> session (Retention Test: one week without training)

**DISCUSSION**

This study was devised to investigate the optimal timing of mental practice in learning volleyball service skill. We hypothesized that combining of mental training and physical practice would also contribute to enhancing motor performance especially when we use mental practice during physical practice. First, all groups enhanced their motor performance following training, in comparison to the pre-test. The participants engaged in physical and mental training performed Volleyball Service better following practice. There is now ample evidence that motor performance and MI share common neural substrate, even though the activated networks are not totally overlapping (8, 46-49). Accordingly, and as MI involves the cerebral structures mediating the preparation, the execution and the control of the actual movement, the present results support the principle of functional equivalence stating that MI may improve motor performance in the same way as PP (for reviews, see (8, 14, 18).

The results of this research showed that Subjects in the MP-during-PP group (receiving mental imagery during physical practice), in contrast to the MP-before-PP (receiving mental imagery before physical practice) and MP-after-PP (receiving mental imagery after physical practice) group as well, were able to improve their capacity of serving Volleyball Skill after the 21 training sessions. Post hoc (Tukey test) multiple comparisons showed that, compared with the MP-before-PP and MP-after-PP group, improvement was significantly higher in the MP-during-PP group. However, In spite of seemingly less improvement in the MP-after-PP group, the difference between the MP-before-PP and MP-after-PP groups was not significant. The retention test showed that subjects in the MP-before-PP and the MP-after-PP groups, in contrast to the MP-

during-PP group, did not significantly differ from the rate of retention of their Volleyball Service skill. Moreover, the MP-before-PP and MP-after-PP group did not differ from each other concerning the scores.

With relation to the “when” of mental practice use, it has been found that imagery is utilized frequently in real time before a competitive event, instead of throughout or after competition (42). When athletes use mental practice in training, they have a tendency to use it during practice, not prior to or after practice (39), that the results of the current study are in line with the findings of Salmon et al.,( 1994). In fact, mental practice is a training technique by which motor imagery is employed with the intention of enhancing performance, in other words, it's the imagined practice of a motor act with the particular intention of acquisition or improving that act. Many studies have indicated that mental imagery can be effective in optimizing the performance of movements in athletes. Besides, it may facilitate novice learners within the acquisition of new skills. Several of those studies are reviewed by Feltz and Landers (1983) and Driskell *et al.* (1994). They illustrated that subjects who mentally trained for a particular task sometimes displayed less improvement than people who trained physically. However, compared with control group who did not practice at all, it could be shown that mental imagery, indeed, expedited performance. Supported the results of mental imagery, some researchers have suggested the utilization of mental imagery in neurological rehabilitation, as it may be a novel and cost-efficient treatment tool (19-22). Despite an established research tradition, the theoretical basis for the results of mental imagery remains theoretic. Many theories have been suggested to explain the mechanisms by which mental imagery may enhance motor learning.

## CONCLUSION

Finally, with regard to the nowadays research it is proposed that coaches and P.E teachers apply mental practice( 10 minutes) as an essential part in programs and teach

the beginners to use mental practice in every time of physical practice (spatially during physical practice). It is important to do the practice that leads to progress.

## REFERENCES

1. Richardson A. Mental imagery. Springer, New York Schmidt RA, Lee TD (1999) Motor control and learning: a behavioural emphasis Human Kinetics, Champaign, IL. 1969.
2. Moran A. Sport and exercise psychology: a critical introduction. Sport and exercise psychology: a critical introduction. 2004.
3. Morris T, Spittler M, Watt AP. Imagery in sport: Human Kinetics; 2005.
4. Murphy S, Nordin SM, Cumming J. Imagery in sport, exercise and dance. 2008.
5. Vealey R, Greenleaf C. Seeing is believing: Understanding and using imagery in sport. Applied sport psychology: Personal growth to peak performance. 2001;4:247-72.
6. Mulder T, Zijlstra S, Zijlstra W, Hochstenbach J. The role of motor imagery in learning a totally novel movement. Experimental Brain Research. 2004;154(2):211-7.
7. Gerardin E, Sirigu A, Lehericy S, Poline J-B, Gaymard B, Marsault C, *et al.* Partially overlapping neural networks for real and imagined hand movements. Cerebral Cortex. 2000;10(11):1093-104.
8. Guillot A, Collet C. Construction of the motor imagery integrative model in sport: a review and theoretical investigation of motor imagery use. International Review of Sport and Exercise Psychology. 2008;1(1):31-44.
9. Munzert J, Zentgraf K. Motor imagery and its implications for understanding the motor system. Progress in Brain Research. 2009;174:219-29.
10. Solodkin A, Hlustik P, Chen EE, Small SL. Fine modulation in network activation during motor execution and motor imagery. Cerebral Cortex. 2004;14(11):1246-55.
11. Decety J, Jeannerod M, Durozard D, Bavelier G. Central activation of autonomic effectors during mental simulation of motor actions in man. The Journal of Physiology. 1993;461(1):549-63.
12. Guillot A, Collet C. Contribution from neurophysiological and psychological methods to the study of motor imagery. Brain Research Reviews. 2005;50(2):387-97.
13. Guillot A, Debarnot U, Louis M, Hoyek N, Collet C. Motor imagery and motor performance: evidence from the sport science literature. n A Guillot, & C Collet (Eds), The neurophysiological foundations of mental and motor imagery. 2010:215-26, New York: Oxford University Press.
14. Holmes PS, Collins DJ. The PETTLEP approach to motor imagery: A functional equivalence model for sport psychologists. Journal of Applied Sport Psychology. 2001;13(1):60-83.
15. Munroe KJ, Giacobbi Jr PR, Hall C, Weinberg R. The four Ws of imagery use: Where, when, why, and what. The Sport Psychologist. 2000.
16. Driskell JE, Copper C, Moran A. Does mental practice enhance performance? Journal of Applied Psychology. 1994;79(4):481-91.
17. Weinberg R. Does imagery work? Effects on performance and mental skills. Journal of Imagery Research in Sport and Physical Activity. 2008;3(1).
18. Feltz DL, Landers DM. The effects of mental practice on motor skill learning and performance: A meta-analysis. Journal of Sport Psychology. 1983.
19. Fansler CL, Poff CL, Shepard KF. Effects of mental practice on balance in elderly women. Physical Therapy. 1985;65(9):1332-8.
20. Warner L, McNeill ME. Mental imagery and its potential for physical therapy. Physical Therapy. 1988;68(4):516-21.
21. Page SJ. Imagery improves upper extremity motor function in chronic stroke patients: A pilot study. Occupational Therapy Journal of Research. 2000.
22. Page SJ, Levine P, Sisto SA, Johnston MV. Mental practice combined with physical practice for upper-limb motor deficit in subacute stroke. Physical Therapy. 2001;81(8):1455-62.
23. Galton F. I.—STATISTICS OF MENTAL IMAGERY. Mind. 1880(19):301-18.
24. Betts GH. The distribution and functions of mental imagery: Teachers College, Columbia University; 1909.
25. Marks DF. Visual imagery differences in the recall of pictures. British journal of Psychology. 1973;64(1):17-24.
26. Marks DF. Consciousness, mental imagery and action. British journal of Psychology. 1999;90(4):567-85.

27. Shelton TO, Mahoney MJ. The content and effect of “psyching-up” strategies in weight lifters. *Cognitive Therapy and Research*. 1978;2(3):275-84.
28. Tynes LL, McFatter RM. The efficacy of “psyching” strategies on a weight-lifting task. *Cognitive Therapy and Research*. 1987;11(3):327-36.
29. Gould D, Weinberg R, Jackson A. Mental preparation strategies, cognitions, and strength performance. *Journal of sport psychology*. 1980;2.
30. Lee C. Psyching up for a muscular endurance task: Effects of image content on performance and mood state. *Journal of sport & exercise psychology*. 1990.
31. Murphy SM, Woolfolk RL. The effects of cognitive interventions on competitive anxiety and performance on a fine motor skill accuracy task. *International Journal of Sport Psychology*. 1987;18(2):152-66.
32. Woolfolk RL, Parrish MW, Murphy SM. The effects of positive and negative imagery on motor skill performance. *Cognitive Therapy and Research*. 1985;9(3):335-41.
33. Hall C, Rodgers WM, Barr KA. The use of imagery by athletes in selected sports. *The Sport Psychologist*. 1990;4(1).
34. Hall CR, Rodgers WM. Enhancing coaching effectiveness in figure skating through a mental skills training program. *The Sport Psychologist*, 3, 142-1. 1989;54.
35. Daw J, Burton D. Evaluation of comprehensive psychological skills training program for collegiate tennis players. *Sport Psychologist*. 1995;8(1):37-57.
36. Fenker RM, Lambiotte JG. A performance enhancement program for a college football team: One incredible season. *The Sport Psychologist*, 1, 224. 1987;36.
37. Hughes S. Implementing psychological skills training program in high school athletics. *Journal of Sport Behavior*. 1990;13(1):15-22.
38. Driediger M, Hall C, Callow N. Imagery use by injured athletes: a qualitative analysis. *Journal of Sports Sciences*. 2006;24(3):261-72.
39. Salmon J, Hall C, Haslam I. The use of imagery by soccer players. *Journal of Applied Sport Psychology*. 1994;6(1):116-33.
40. Sorodoni C, Hall C, Forwell L. The use of imagery by athletes during injury rehabilitation. *Journal of Sport Rehabilitation*. 2000;9(4):329-38.
41. Sordoni C, Hall C, Forwell L. The use of imagery in athletic injury rehabilitation and its relationship to self-efficacy. *Physiotherapy Canada*. 2002;54(3):177-85.
42. Barr K, Hall C. The use of imagery by rowers. *International Journal of Sport Psychology*. 1992.
43. Rodgers W, Hall C, Buckolz E. The effect of an imagery training program on imagery ability, imagery use, and figure skating performance. *Journal of Applied Sport Psychology*. 1991;3(2):109-25.
44. White A, Hardy L. Use of different imagery perspectives on the learning and performance of different motor skills. *British journal of Psychology*. 1995;86(2):169-80.
45. Isaac A, Marks DF, Russell DG. An instrument for assessing imagery of movement: The Vividness of Movement Imagery Questionnaire (VMIQ). *Journal of Mental Imagery*. 1986.
46. Gerardin E, Sirigu A, Lehericy S, Poline JB, Gaymard B, Marsault C, *et al.* Dissociable neural networks for real and imagined hand movements. *Cerebral Cortex*, 10, 1093–1104. 2000.
47. Guillot A, Collet C, Nguyen VA, Malouin F, Richards C, Doyon J. Functional neuroanatomical networks associated with expertise in motor imagery. *Neuroimage*. 2008;41(4):1471-83.
48. Guillot A, Collet C, Nguyen VA, Malouin F, Richards C, Doyon J. Brain activity during visual versus kinesthetic imagery: an fMRI study. *Human brain mapping*. 2009;30(7):2157-72.
49. Lotze M, Halsband U. Motor imagery. *Journal of Physiology-Paris*. 2006;99(4):386-95.



## مقاله اصیل

تاریخ دریافت: ۱۳۹۲/۰۴/۲۶

تاریخ پذیرش: ۱۳۹۲/۰۷/۱۱

## تازه‌های علوم کاربردی ورزش

دوره اول، شماره سوم

صص ۲۹-۳۸، پاییز ۱۳۹۲

# زمان بهینه تمرین ذهنی در یادگیری مهارت سرویس والیبال

محسن افروزه\*، مهدی سهرابی<sup>۲</sup>، حمیدرضا طاهری<sup>۳</sup>، علی افروزه<sup>۱</sup>

۱. دانشجوی دکتری رفتار حرکتی، دانشکده تربیت بدنی و علوم ورزشی، پردیس بین‌المللی دانشگاه فردوسی مشهد، مشهد، ایران.

۲. دانشیار گروه رفتار حرکتی، دانشکده تربیت بدنی و علوم ورزشی، دانشگاه فردوسی مشهد، مشهد، ایران.

۳. دانشکده تربیت بدنی و علوم ورزشی، دانشگاه شهید بهشتی، تهران، ایران.

## چکیده

هدف این پژوهش، تعیین اثر زمان تمرین ذهنی قبل، در حین، و بعد از تمرین عملی در یادگیری مهارت سرویس والیبال می‌باشد. تعداد ۴۵ دانش‌آموز مبتدی ۱۲ - ۱۴ ساله مقطع راهنمایی، بدون هیچ سابقه بازی والیبال، به عنوان نمونه آماری انتخاب شدند. هیچ یک از آزمودنی‌ها قادر نبود سرویس والیبال را به طور صحیح اجرا کنند. شرکت‌کنندگان در سه گروه تمرین ذهنی قبل از تمرین عملی، تمرین ذهنی در حین تمرین عملی و تمرین ذهنی بعد از تمرین عملی تقسیم شدند. آزمودنی‌ها تمرین ذهنی و عملی را در ۲۱ جلسه و هر جلسه ۳۰ دقیقه اجرا کردند. شرکت‌کنندگان در جلسات هفتم، چهاردهم، بیست‌ویکم، و بیست‌وهشتم مورد آزمایش قرار گرفتند. آزمون استاندارد سرویس والیبال جهت آزمون میدان یادگیری سرویس والیبال مورد استفاده قرار گرفت. نتایج تحقیق نشان داد تفاوت معنی‌داری بین میانگین نمرات گروه تمرین ذهنی در حین تمرین عملی و گروه تمرین ذهنی قبل و بعد از تمرین عملی در توسعه مهارت سرویس والیبال وجود داشت، اگر چه تفاوت معناداری بین میانگین دو گروه تمرین ذهنی قبل و بعد از تمرین عملی وجود نداشت. آزمون یادداری نشان داد که شرکت‌کنندگان در گروه‌های تمرین ذهنی قبل و بعد از تمرین عملی در مقایسه با گروه تمرین ذهنی حین تمرین عملی پیشرفت معنی‌داری در مهارت سرویس والیبال نداشتند. این مطالعه پیشنهاد می‌کند مربیان و به ویژه معلمان تربیت بدنی تمرین ذهنی را به عنوان بخش اساسی برنامه‌های آموزش خود، به ویژه در خلال تمرین عملی، جهت آموزش به مبتدیان مورد توجه قرار دهند.

**واژگان کلیدی:** تمرین ذهنی، زمان بهینه، تست ایفرد سرویس والیبال، آزمون یادداری.

\* - نویسنده مسئول:

محسن افروزه

پست الکترونیک: [m\\_afrozeh@yahoo.com](mailto:m_afrozeh@yahoo.com)

