EFFECT OF MENTAL IMAGERY IN ENHANCING SOCCER PASSING AND CONTROL SKILLS IN COLLEGIATE LEVEL PLAYERS: A RANDOMIZED CONTROLLED TRIAL

by

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In

SPORTS

Under the guidance of

Prof. Joseph Oliver Raj,
Dean, ABSMARI

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE
BHUBANESWAR
2021-2023

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LIST OF ABBREVIATIONS USED

(In alphabetical order)

CONSORT: Consolidated Standards of Reporting Trials

CTRI: Clinical Trials Registry-India

LSPT: Loughborough Soccer Passing Test

MI: Mental Imagery

MIQ: Movement Imagery Questionnaire

PETTLEP: Physical Environment Task Timing Learning Emotion Perspective

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ABSTRACT

Background: Mental imagery in sports, is mental rehearsal of a task to re-create a sporting scenario without any muscular movement, which is used to enhance sporting performance. In open sports like soccer, wherein the environment keeps changing, a skill like passing and control, needs precision, accuracy and speed. Imagery previously, has been used in athletes to maintain strength and power component, during forced detraining, in rehabilitation and also to perfect a particular skill. However, it has not been extensively used in the Indian setup. Also a combination of external and internal imagery is also less researched. This study aims to see the effect of mental imagery in enhancing soccer passing and control skill in male collegiate-level soccer players.

Methodology: The study evaluated 56 male collegiate soccer athletes, allocated into imagery and control group. Both the groups were tested for their passing and control skills using Loughborough soccer passing test (LSPT) and McDonald Soccer test, as primary and secondary outcome measures respectively. This was followed by both external and internal mental imagery. Post-intervention LSPT and McDonald soccer test scores were taken again. Data was analysed using Wilcoxon signed rank test for within group statistical analysis of the two means pre and post-intervention and Mann-Whitney U test was used for between group statistical analysis.

Results: The result of the study showed that there was a significant improvement in the LSPT and McDonald soccer test score in the imagery group.

Conclusion: Mental imagery can be a beneficial tool in improving skill-specific training in collegiate-level athletes. Imagery hence can be used as an important tool for maintaining focus on skillsets, strength and power post-injury and surgery, during detraining and return to sport.

Keywords: male; soccer; return to sport; athletes; sports; mental imagery

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EFFECT OF MENTAL IMAGERY IN ENHANCING SOCCER PASSING AND CONTROL SKILLS IN COLLEGIATE LEVEL PLAYERS: A RANDOMIZED CONTROLLED TRIAL

Introduction:

Mental Imagery:

Mental Imagery (MI) is a psychological tool used to create mental representation of a task or a situation, without actually doing the task and without any sensory stimuli[1,2].

Role of Mental Imagery in Sports:

- Mental imagery engages multisensorial pathways to recreate a sporting scenario in our minds to improve sport performance.
- MI is used at the time of training, competition, injury, detraining, etc.[3-8]

Theories of Mental Imagery[9]:

As per the '**Psychoneuromuscular theory**', the Mental Imagery-

- Improves athlete's performance- Access to motor cortex of the brain with the help of motor imagery.
- Helps in gaining motor expertise leading to neural reorganizations of networks in the brain which are activity-dependent
- Helps in controlling both real and imaginary performances[10].

As per the '**theory of functional equivalence**'-

- When a person performs a particular task, or when he/she images himself/herself performing the same task, similar areas of the brain get activated.
- It strengthens neural activity leading to improved execution of the desired skill.
- Physiological responses like heart rate, muscle activity, ventilation frequency also increase during mental imagery[11].

Types of Mental Imagery- Internal and External imagery[12]:

Internal Imagery:

- It is also called kinaesthetic imagery- most commonly delivered in the form of an audio script.
- Athlete imagines himself from a first-person's perspective with focus on the simulated scenario.
- Includes not just visual but also spatial and kinaesthetic component of the action[12,13].

External Imagery:

- Here, athlete takes the view of a spectator (a third-person's perspective), watching the movement being performed by someone else or even by himself/herself in a video in front of them[14,15].

Categories of Sports- Closed and Open:

Closed:

- External factors don't influence the athlete's performance.
- Every move can be pre-planned. (Example Javelin throw, Shooting, Springboard Diving).
- In sports like basketball, the 'free-throw' component of it can be treated as a closed element of the game.

Open:

- In sports like football, hockey, etc., the environment keeps changing and nothing can be predicted.

  - Most of the team sports fall under the 'Open Sports' category while most of the individual games under 'Closed Sports' category[16].
  - Although previous studies have suggested the benefits that the athletes can get by using mental imagery, it has mostly been used in closed sports.
  - With the constantly changing environment and other factors in Open Sports like soccer, it has become more crucial for athletes to resort to or utilize various other strategies including cognitive and psychological techniques, multiple senses in a precise manner and the right time to achieve success in their sport.

- **Mental imagery** may prove to be a beneficial tool in improving the athletes' skills in all kinds of scenarios[17].

Need of the study:

Mental imagery studies have previously been used in athletes to maintain strength and power performances during forced detraining. Imagery is also used during rehabilitation and return to sport after an injury. Most of the imagery studies mainly focus on elite level players but no study has been used for collegiate level players in the Indian setup till date. Very few studies have researched on an open sport wherein the environment keeps changing. A combination of external and internal imagery is also less researched.

Review of Literature:

- **Antonio Dello Iacono et al.** (2021), conducted a study on effect of mental imagery (MI) training on strength and power performances in athletes during detraining. The study concluded that during periods of forced detraining, MI practice was a viable tool to maintain and increase performance capacity among professional athletes. (3)
- **Donatella Di Corrado et al.** (2020), conducted a study on Mental Imagery skills in competitive young athletes and non-athletes. It was concluded that to improve learning and performance, athletes and coaches should incorporate the regular practice of mental imagery in their training programs. (18)
- **Leonardo de Sousa Fortes at al.** (2019), conducted a study on Effect of motor imagery training on tennis service performance in young tennis athletes. It was concluded that motor imagery training would be considered an effective strategy to enhance the tennis service performance among tennis players. (10)
- **Bianca A. Simonsmeier et al.** (2017), conducted a study on The effect of Motor Imagery training on performance and mental representation of 7-15 year old gymnasts of different levels of expertise. The study concluded that mental imagery improved the performance of young athlete but only for the high-expertise athletes.(19)
- **Mohammed M et al.** (2015), conducted a study in which McDonald soccer skill test was used to find the push pass of ability of the players.

Experimental design was used for this research to find out the difference. The test was constructed on college men and the validity coefficient of the test ranged from (0.63 to 0.94). [20]

- **Andrea Gaggioli et al.** (2013), conducted study to see Benefits of Combined mental and physical training in learning a complex motor skill in basketball. The study concluded that Mental practise condition improved coordination and movement accuracy, suggesting the potential effectiveness of this approach in training complex motor skills. [14]
- **Wan X. Yao et al.** (2013), conducted a study to compare the effect of Kinesthetic imagery training with that of visual imagery training on forceful muscle contractions increase brain signal and muscle strength. They concluded that the kinaesthetic imagery intervention was effective in improving voluntary muscle strength without physical exercise.[13]
- **Phillip G. Post et al.** (2012), conducted a study to see The Effects of imagery training on swimming performance. They concluded that the benefits of imagery observed with discrete/serial tasks may also extend to continuous types of tasks like swimming.[21]
- **CJ Olsson et al.** (2008), conducted a study on Internal imagery training in active high jumpers. It was concluded that Internal imagery training may be used to improve a component of a complex motor skill. [16]
- **Ajmol Ali et al.** (2007), conducted a study to check Reliability and Validity of two tests of soccer skill. It was concluded that LSPT is a valid and reliable measures to assess differences in soccer skill performance. [22]

Aims and Objectives of the study:

Aim:

To see the effect of mental imagery in improving soccer passing and control skills in collegiate-level male soccer players.

Objectives:

1. To see the effect of regular soccer skills training on passing and control skill using LSPT and McDonald soccer skill test.
2. To see the effect of mental imagery along with regular soccer skills training on passing and control skill using LSPT and McDonald soccer skill test.
3. To compare the effect of regular skills and mental imagery along with regular football skills on passing and control skill using LSPT and McDonald soccer skill test.

Hypothesis:

Null hypothesis:

- H_{01}: There is no significant effect of mental imagery in improving passing and control skills in collegiate level soccer players.

Alternate hypothesis:

- H_{11}: There is a significant effect of mental imagery in improving passing and control skills in collegiate level soccer players.

Methodology:

- Study design: Randomized Controlled Trial
- Study population: Collegiate level soccer players
- Sample size: 60
- Sampling technique: Purposive sampling
- Study setting: Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, Odisha.
- Study duration: 1 year

Inclusion criteria:

- Male collegiate level soccer players who are a part of the college team, taking part in competitions (based on Tegner activity level scale- level 9)
- Age: 17-20 years
- Athletes playing/practicing soccer for minimum 7hours/week for minimum 1 year.

Exclusion criteria:

- Goalkeepers
- Athletes having any recent injury, fracture, open wounds over the past 6 months. (using Nordic questionnaire).
- Athletes with pre-existing neurological condition affecting cognition.

Materials used:

- Video tape (skill training videos)
- Audio script of mental imagery
- Stop watch
- Cones, measuring tape
- 4 gymnasium benches
- 3 soccer balls
- Coloured cards
- chalks, paper and pens.

Sample selection and screening:

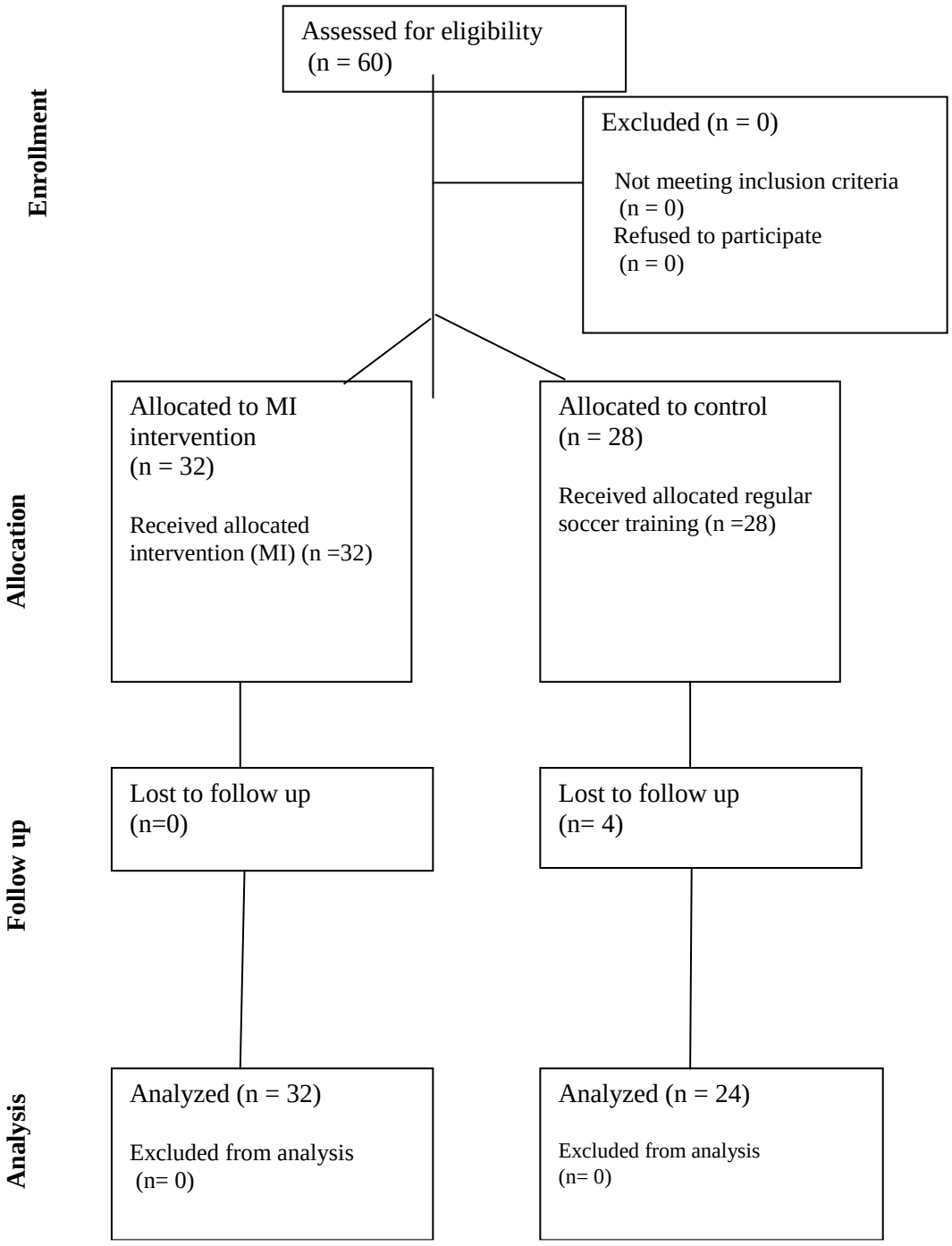
Ethical clearance for the present study was obtained by the Institutional Ethical Committee. A total of 60 collegiate male soccer players were selected according to the selection criteria. All the subjects were explained the procedure of the study and informed consent was taken followed by demographic data of the subjects.

Subjects were randomly allocated into two groups of experimental and control. The experimental group had 32 players (mean age= 18.15$\pm$0.36) while the control group had 28 players (mean age= 18.16$\pm$0.81).

Procedure:

Pre-intervention outcome measures scores were taken for both the groups using LSPT and McDonald soccer skill test. The control group underwent regular football skills training while the experimental group underwent mental imagery training which comprised of external (videotape) as well as internal (audio script) imagery intervention for about 10-15minutes for 3 weeks and 4 sessions/week (total 12 sessions). 4 subjects from the control group dropped-out mid-intervention due to certain reasons. Post-intervention outcome measure scores were taken again for both the groups using the same outcome measures followed by data analysis for the subjects who completed the study (per protocol analysis).

CONSORT Flowchart



Outcome measures:

Pre and Post-intervention:

Primary outcome measure:

- Loughborough Soccer Passing Test (LSPT)

  (Reliability is 0.73)[22]

  Players are required to perform 16 passes comprising 8 long and 8 short passes depending on the coloured card called out by the investigator from within the designated passing zone (between the two rectangles in the middle area) as fast as they can with precision and accuracy.[22]

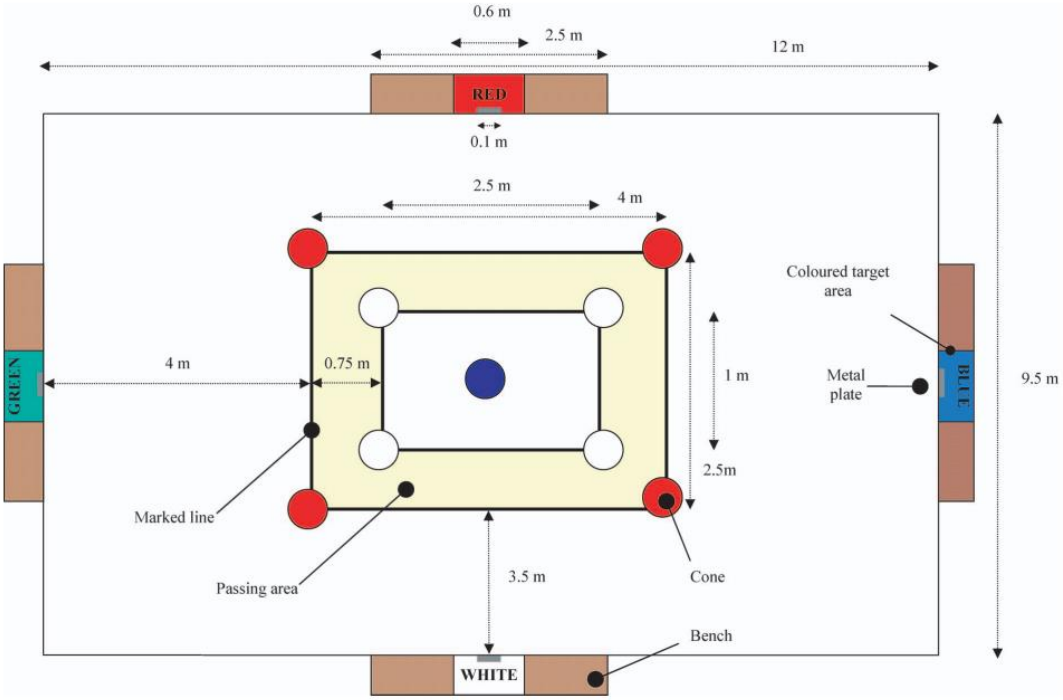


Figure 1. Schematic representation of the Loughborough Soccer Passing Test (LSPT).

Figure 1: LSPT[22]

Secondary outcome measure:

- McDonald Soccer skill test

(Validity coefficient of the test ranges from 0.63 to 0.94)[20]

The players are instructed to make maximum number of kicks in 30 seconds by keeping the ball in control while using any type of kick and ball control method. In case the ball fails to rebound sufficiently, the player has the option to either retrieve the same ball or take one of the extra balls with the help of either hands or feet which is kept 9 feet behind the restraining line.

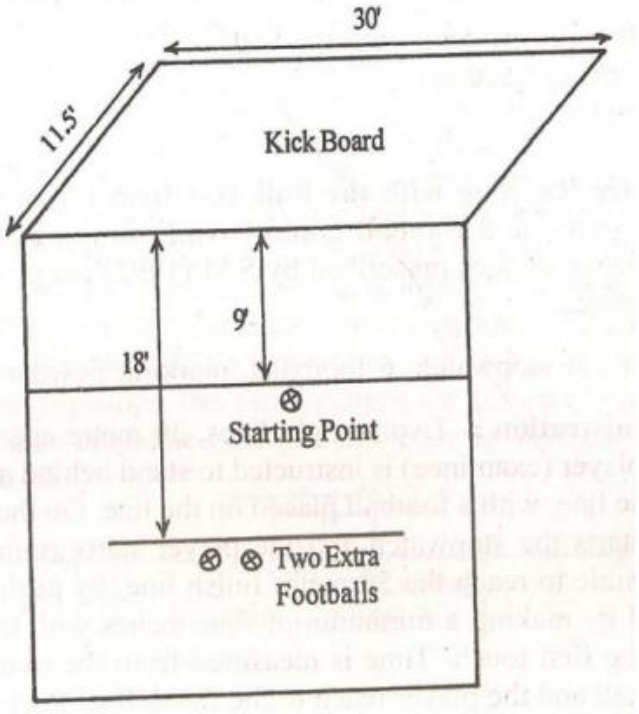


Figure 2
Measurement of test short pass and receiving kickboard

Figure 2: McDonald soccer skill test[20]

Sample size of Estimation:

$N = 2k\ SD^2/d^2$

Zα=0.5

Zβ(1-β)=80%

Confidence interval= 95%

K=10.5

SD (Standard Deviation)= 6.2

d= (Standard error measurement (SEM))= 2.2

n= 26.4~27 + 15% drop-outs = 30/group.

Statistical Analysis:

Data was analyzed using the statistical package **SPSS 22.0** (SPSS Inc., Chicago, IL) and level of significance was set at **$p<0.05$**.

Normality was taken out using kolomogorov-smirnov test.

Data was not normally distributed.

Inferential statistics to find out the statistical difference within groups (pre and post-intervention) was done using **Wilcoxon signed rank test** and analysis for between groups (experimental and control) inferential statistics was done using **Mann-Whitney U test.**

Table 1: Demographic data of the subjects:

	Experimental	Control
Mean age	18.15	18.16
SD	0.36	0.81

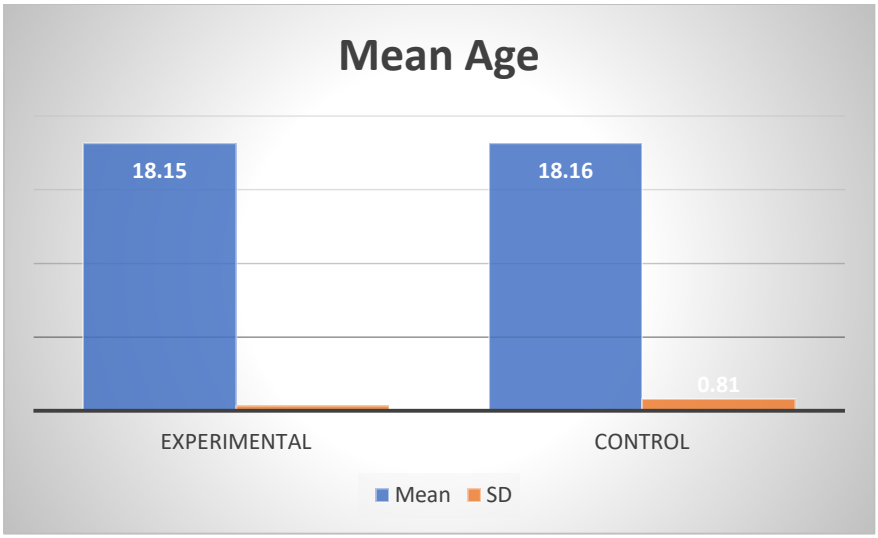


Chart 1: Mean age for both Experimental and Control group

Table 2: Within group analysis of Loughborough soccer passing test (LSPT) for both Experimental and Control group:

	Experimental	Control
Pre	1.29	1.2
Post	1.05	1.21
p value	0.000	0.132

p<0.05 is statistically significant

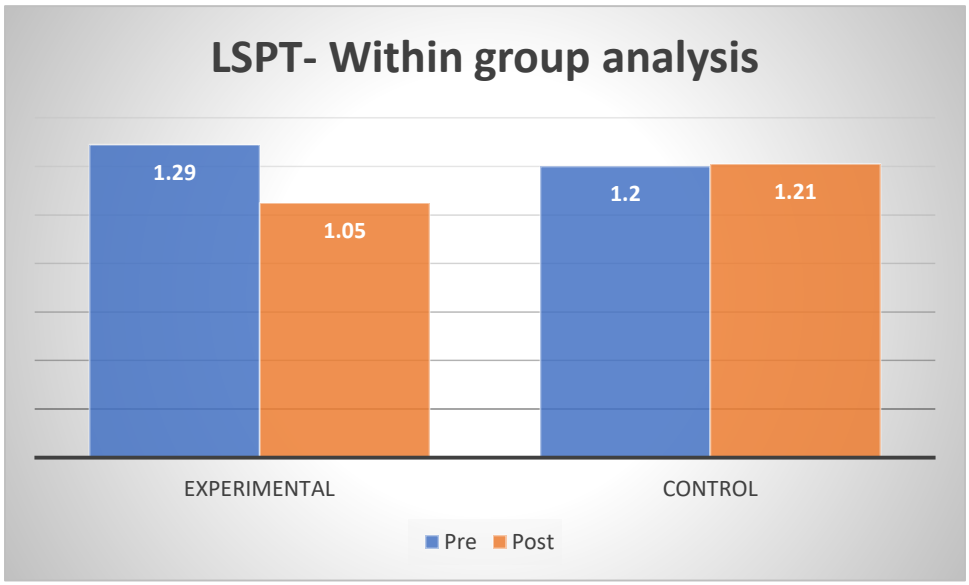


Chart 2: LSPT within group analysis (pre and post-intervention)

Table 3: Within group analysis of McDonald soccer test for both Experimental and Control group:

	Experimental	Control
Pre	22.56	21.7
Post	24.4	21.08
p value	0.000	0.054

p<0.05 is statistically significant

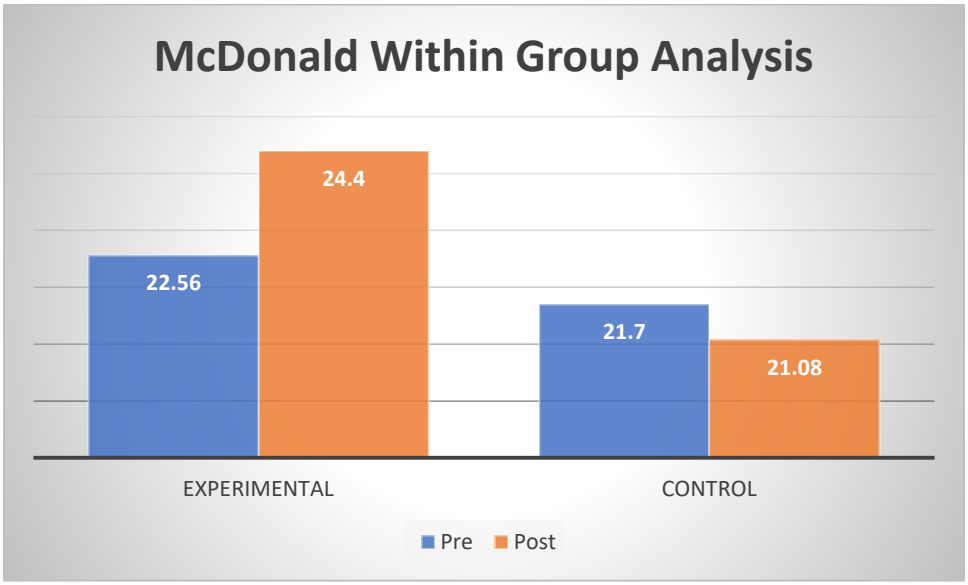


Chart 3: McDonald soccer test within group analysis (pre and post-intervention)

Table 4: Between group analysis of Experimental and Control groups for both LSPT and McDonald soccer test outcome measures:

	LSPT difference (pre-post)	McDonald difference (pre-post)
Experimental	0.24	1.84
Control	0.01	0.67
p value	0.000	0.000

p<0.05 is statistically significant

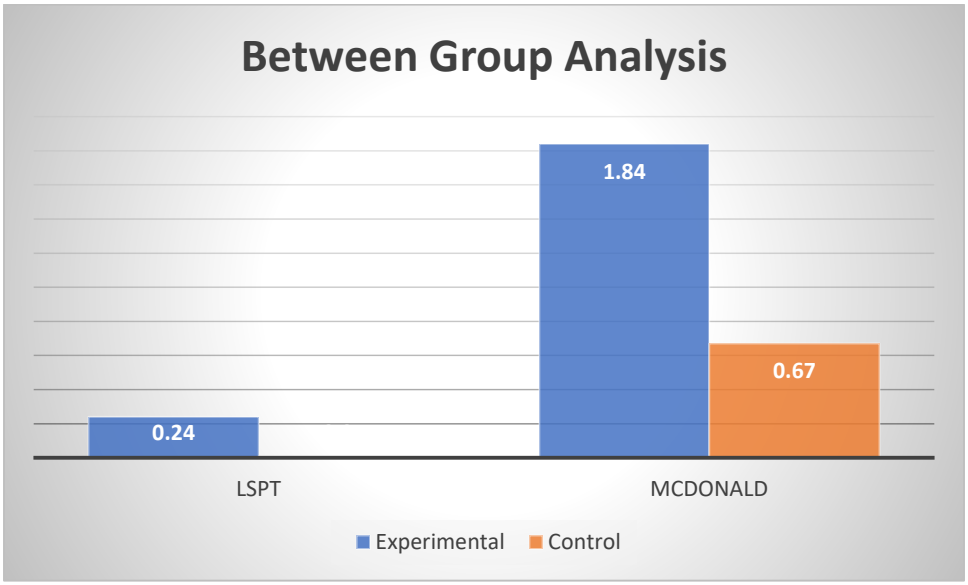


Chart 4: Between group analysis of Experimental and Control groups (LSPT and McDonald soccer test).

Table 5:

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
LSPT Diff	Cohen's d	.25110	.974	.410	1.530
	Hedges' correction	.25465	.960	.404	1.509
	Glass's delta	.28240	.866	.274	1.443
McDiff	Cohen's d	1.91107	-1.390	-1.975	-.794
	Hedges' correction	1.93814	-1.371	-1.947	-.783
	Glass's delta	2.43614	-1.090	-1.697	-.467

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control (i.e., the second) group.

Effect size value for the outcome measure of LSPT (difference between pre and post-intervention) between the experimental and control group is 0.25110 which is small indicating that the difference between the two groups with respect to LSPT is small.

Effect size value for the outcome measure of McDonald (difference between pre and post-intervention) between the experimental and control group is 1.91107 which is high indicating large difference between the two groups with respect to McDonald.

Results:

Statistical difference ($p<0.05$) was found within the experimental group (pre and post-intervention) for both the outcome measures i.e., Loughborough soccer passing test (LSPT) and McDonald soccer test as is expressed in Table 2 and 3 and in chart 2 and 3.

There was no statistical difference found within the control group for both the outcome measures.

Statistical difference was also found between the experimental and control group for the difference calculated between both the outcome measures (LSPT (pre-post) and McDonald soccer test (pre-post)) as is expressed in Table 4 and chart 4.

For the LSPT outcome measure, the effect size was 0.25110 indicating small difference between the control and experimental group.

For the McDonald outcome measure, the effect size was 1.91107 indicating large difference between the control and experimental group.

Hence the null hypothesis is rejected and alternate hypothesis is accepted which states that there is a significant effect of mental imagery in improving passing and control skills in collegiate level soccer players.

Discussion:

This study comprised a total of 56 collegiate male athletes out of which 32 were allocated in the experimental group undergoing mental imagery (MI) along with regular football training and the rest 24 were allocated in the control group undergoing only regular football training. The purpose of the study was to see the effect of mental imagery (MI) intervention in enhancing soccer passing and control skills. Consistent with the main hypothesis of this study, findings indicate that mental imagery does help in improving passing and control skills in collegiate level soccer players. These findings corroborate with various previous research studies which showed improvement in motor performance using mental imagery training [10,14,16,17]. The first reason for achieving a significant improvement in the experimental group could be that a supervised session of imagery before the regular training in the form of a warm-up, helped the athletes to easily incorporate the technique in their regular training schedule without making any major changes [17]. Secondly, the utilization of both, video tape and audio script, i.e., a combined effect of external and internal form of imagery, might have reinforced the imagery of passing and control skill, making stronger neural networks in the brain leading to more clarity in the execution of the skill. According to previous studies, giving external imagery (video tape) alone, proves to be more of a motivational factor and hence combining internal imagery (audio script) with external helps in gaining the cognitive benefits of MI [18,23]. The imagery script that was used for this study was in accordance with the PETTLEP model of imagery which is proven to be a beneficial format for athletes undergoing internal imagery training [11,24]. Sports

psychology research has demonstrated the benefits of imagery in athletic performance on discrete/serial tasks which is in line with the results of this study [10,14,16-19,21,24]. The primary outcome measure, Loughborough soccer passing test (LSPT), is a test that measures passing accuracy, precision, along with taking time component (time to complete 16 passes) into consideration [22]. After a 3 week protocol of MI, comprising a total of 12 sessions (4 sessions/week), the experimental group athletes, showed an improvement in the LSPT's component of passing and control precision, accuracy and the time taken to complete the test became shorter. While the control group athletes, who also underwent regular football skills training, without MI, took either the same time to complete the test as compared to their baseline values, or longer by a few seconds. The precision and accuracy component of LSPT in the control group remained more or less near the baseline values. One of the reason for the increased time taken to complete the test could be the low adherence towards the practice sessions. Few athletes from the control group could not keep up with the regular football practice sessions as they went home for holidays. The secondary outcome measure was McDonald soccer passing test which tested the speed with which the athletes could kick maximum number of times on the wall from a designated distance [20]. Here as well, the experimental group athletes showed increase in the number of kicks and speed post MI intervention as compared to the control group. Few players in the control group were older in age by a few years while all the players in the experimental group were younger. According to a study done by Tohid Seif-Barghi et. al, younger soccer players, use more of cognitive specific and cognitive general

imagery as compared to their older counterparts[17]. It is worth noting that this study comprised collegiate-level athletes, who have never undergone any kind of MI or sport psychology training before. According to previous studies, MI was found more beneficial in elite-level athletes as it would help them in improving the scope of fine-skilled movements which generally gives them the extra edge at elite-level competitions[17-19]. However there are studies which suggest that younger athletes have capabilities of being great imagers which is why they can engage in imagery more frequently and strongly as compared to older adult players, who are more interested in the motivational component of imagery than the cognitive aspect of it and which is in line with the results of this study[17,21]. A study done by Bianca A. Simonsmeier et al. counters this concept by saying that more the expertise and experience level of an athlete, more is the imagery ability of the athlete and hence more will be the effect of MI intervention in them as compared to novice players[19]. Previous studies have also mentioned the concept of individual differences, which doesn't consider age or expertise level but states that factors like genetic activity, neural activity and behaviour, along with environmental factors like physical, social and cultural differences may affect physical performance parameters post-MI training and hence should also be considered[16]. As far as the frequency of MI training and training duration is considered, different studies have mentioned different time periods for giving MI training subject to the age, level of play and type of MI intervention given to the athletes. However, according to a review study done by Jesmy Jose et al., the duration of the MI intervention should not be less than 1 week as it may not show much improvement[25]. Along with positive effects of MI

on skill development demonstrated in this study, there were a few limitations as well:

- There was a possibility of cross-contamination between imagery group and control group as both the groups belonged to the same study setting.
- Ability of the athletes to use imagery was not assessed pre-intervention which is an important factor considering individual differences.
- Our study involved only male athletes which limits generalizability of findings.

Suggestions for future scope of the study includes:

- Feedback sessions can be included post every session of MI as it might help the athletes to process and reinforce the information even better.
- New video tapes and diverse audio scripts should be made available, covering each and every aspect of the technique to be mastered be it discrete or continuous. The athletes should be encouraged to make customized scripts based on their self-analysis on where they need to improve and in which technique.
- More studies on MI training should be encouraged on open sports or sports containing continuous tasks (eg. swimming) which require continuous focus throughout the competition.
- Studies should also focus on novice players who demonstrate greater difficulty in performing a synchronized movement and also paediatric athletes.

- Studies should include a pre-screening tool to assess imagery ability (eg. Movement Imagery Questionnaire (MIQ)).
- Biomechanical analysis of movement can be added as an objective outcome measure.
- Effect of a higher intensity of movement, with more MI sessions can be assessed.

Conclusion:

The study concludes that using mental imagery along with regular football training helps in enhancing soccer passing and control skills in collegiate-level athletes. Therefore, imagery proves to be an important tool for maintaining focus on skillsets and hence can also be used to maintain strength and power post-injury and surgery, during detraining and return to sport.

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ANNEXURE

Consent Form

I, _____, confirm that I have understood about the mental imagery procedure and its potential benefits on athletes as explained by Miss Tanmaya Kapre and is as mentioned in her study which is taking place under the guidance of Prof. Joseph Oliver Raj, Dean, Abhinav Bindra Sports Medicine and Research Institute (ABSMARI). I understand that my participation is voluntary and I'm free to withdraw at any time, without giving any reason.

I understand that confidentiality will be maintained.

I voluntarily agree to and give my consent to be a part of the above mentioned study.

_____ _____

(signature) (date)

Copy of Ethical Committee Clearance certificate

ABHINAV BINDRA
Sports Medicine & Research Institute
A Unit of the Abhinav Bindra Foundation Trust
Recognised by DMET, Health & FW Dept., Govt. of Odisha, Affiliated to Utkal University
Recognised by Odisha State Council for Occupational Therapy and Physiotherapy

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Reference No. – ABSMARI/IRB/01/2023
Date: 4th Jan 2023

INSTITUTIONAL REVIEW BOARD

To
Mr/Ms. Tanmaya Milind Swati Kapre,
Post Graduate student, Department of Physiotherapy,
Abhinav Bindra Sports Medicine and Research Institute (ABSMARI).

This is to certify that your proposal for the study titled "**Effect of Mental Imagery in enhancing soccer pass and control skills in collegiate level soccer players - A Randomized controlled Trial**" has been taken for discussion in the meeting held on 02nd Jan 2022. Following the meeting, the committee approves the proposal and it has no objection on the study being carried out.

You are advised to familiarize yourself with the ICMR guidelines on biomedical research in human subjects and also adhere to the principles of Good Clinical Practice. You are hereby directed to submit the final report to the committee, on completion of the study.
Any case of adverse reactions should be informed to this ethics committee and action will be taken thereafter.
Any such adverse reactions during the course of the study are the sole responsibility of the Principal Investigator and there is no onus on the Ethical Committee members resulting thereof.
We wish you all the best for your study.

Member Secretary

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE

Chair Person

Proforma format (used for documentation)

Subject Evaluation Form

Name: Age/Gender: Group:

Pre-intervention:

1) LSPT score:

Time taken to complete the test (in sec):	
Penalty time (in sec):	
Performance time (in sec):	

2) McDonald soccer skill test score:

No. of passes-

Trial 1	Trial 2	Trial 3	Final score(highest)

Post-intervention:

1) LSPT score:

Time taken to complete the test (in sec):	
Penalty time (in sec):	
Performance time (in sec):	

2) McDonald soccer skill test score:

No. of passes-

Trial 1	Trial 2	Trial 3	Final score(highest)

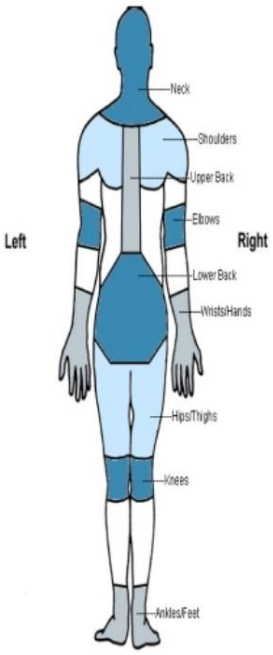
Nordic Musculoskeletal questionnaire (for exclusion)

Musculoskeletal Discomfort Form (Based on the Nordic Questionnaire (Kourinka et al. 1987)) **Employee ID:**_____

Job/Position: _____ Gender: M F Age: _____ Height: ___ ft.___ in. Weight: _____
How long have you been doing this job? __years __ months How many hours do you work each week? ____

How to answer the questionnaire:

***Picture*:** In this picture you can see the approximate position of the parts of the body referred to in the table. Limits are not sharply defined, and certain parts overlap. You should decide for yourself in which part you have or have had your trouble (if any).



Back View

***Table*:** Please answer by putting an "X" in the appropriate box - one "X" for each question. You may be in doubt as to how to answer, but please do your best anyway. Note that column 1 of the questionnaire is to be answered even if you have never had trouble in any part of your body; columns 2 and 3 are to be answered if you answered yes in column 1.

To be answered by everyone	**To be answered by those who have had trouble**	
Have you at any time during **the last 12 months** had trouble (ache, pain, discomfort, numbness) in:	Have you at any time during the **last 12 months been prevented from doing your normal work** (at home or away from home) because of the trouble?	Have you had trouble at any time during **the last 7 days?**
Neck ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
Shoulders ☐ No ☐ Yes, right shoulder ☐ Yes, left shoulder ☐ Yes, both shoulders	☐ No ☐ Yes	☐ No ☐ Yes
Elbows ☐ No ☐ Yes, right elbow ☐ Yes, left elbow ☐ Yes, both elbows	☐ No ☐ Yes	☐ No ☐ Yes
Wrists/Hands ☐ No ☐ Yes, right wrist/hand ☐ Yes, left wrist/hand ☐ Yes, both wrists/hands	☐ No ☐ Yes	☐ No ☐ Yes
Upper Back ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
Lower Back (small of back) ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
One or Both Hips/Thighs ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
One or Both Knees ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
One or Both Ankles/Feet ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

Tegner Activity level score (for inclusion)

TEGNER ACTIVITY LEVEL SCORE

Please indicate in the spaces below the HIGHEST level of activity that you participated in BEFORE YOUR INJURY and the highest level you are CURRENTLY able to participate in. Using the circles below, check space you wish to participate in, in the future.

BEFORE INJURY LEVEL: _____ CURRENT LEVEL: _____

Level 10	Competitive sports- soccer, football, rugby (national elite)	○
Level 9	Competitive sports- soccer, football, rugby (lower divisions), ice hockey, wrestling, gymnastics, basketball	○
Level 8	Competitive sports- racquetball or bandy, squash or badminton, track and field athletics (jumping, etc.), down-hill skiing	○
Level 7	Competitive sports- racquetball or bandy, squash or badminton, track and field athletics (jumping, etc.), down-hill skiing	○
Level 6	Recreational sports- tennis and badminton, handball, racquetball, down-hill skiing, jogging at least 5 times per week	○
Level 5	Work- heavy labor (construction, etc.) Competitive sports- cycling, cross-country skiing, Recreational sports- jogging on uneven ground at least twice weekly	○
Level 4	Work- Work- moderately heavy labor (e.g. truck driving, etc.)	○
Level 3	Work- light labor (nursing, etc.)	○
Level 2	Work- light labor Walking on uneven ground possible, but impossible to back pack or hike	○
Level 1	Work- Work- sedentary (secretarial, etc.)	○
Level 0	Sick leave or disability pension because of knee problems	○

YTegner and J Lysolm. Rating Systems in the Evaluation of Knee Ligament Injuries. Clinical Orthopedics and Related Research. Vol. 198: 43-49, 1985

Surgical History

Have you had any additional surgeries to your knee other than those performed by Dr. Sterett? YES / NO

IF YES:

What procedure(s) were performed?

When was the surgery performed?

When performed surgery?