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If You're Reading This, Release the Tension in Your Shoulders: A Study of Progressive Muscle Relaxation and Anxiety Relief For Injury Prevention in Athletes

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IF YOU'RE READING THIS, RELEASE THE TENSION IN YOUR SHOULDERS: A STUDY OF PROGRESSIVE MUSCLE RELAXATION AND ANXIETY RELIEF FOR INJURY PREVENTION IN ATHLETES

by

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A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
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Approved by:

Dr. Julie Partridge, Chair

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TITLE: IF YOU'RE READING THIS, RELEASE THE TENSION IN YOUR SHOULDERS: A STUDY OF PROGRESSIVE MUSCLE RELAXATION AND ANXIETY RELIEF FOR INJURY PREVENTION IN ATHLETES

MAJOR PROFESSOR: Dr. Julie Partridge

The goal of this paper was to examine the impact of progressive muscle relaxation (PMR) training in practice and athletic training sessions. PMR training as a way of decreasing anxiety and increasing readiness to play was examined in a sample of female collegiate soccer players. The specific hypothesis examined was that athletes who participated in long-term PMR training would report lower levels of cognitive and somatic anxiety and increased readiness to play compared to the control group. Participants were assessed on readiness to play and both cognitive/somatic anxiety using surveys previously found to determine these states of being. The surveys used were the Competitive State Anxiety Inventory-2 (CSAI-2) (Lundqvist & Hassmén, 2006) and the Return to Sport After Serious Injury (RSASI) (Podlog & Eklund, 2005). A repeated measures MANOVA analysis was used to compare pre- and post-test scores for experimental and control groups.

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CHAPTER 1

INTRODUCTION

Within the past few years, mental health has become an important topic to athletes and sports medicine staff alike. The focus we now have on both the recovery and overall wellbeing of athletes is something that will continue to change the way we treat athletes as people rather than physical injuries. With these changes in mind, the identification of new ways that we are able to treat athletes from a mental standpoint introduces a multitude of options from the world of sport psychology. Progressive muscle relaxation or PMR is one of those options. PMR is a technique in which you reduce muscle tension by tensing up a particular muscle group and then relax them; continued practice with PMR is key for long-term benefits. This technique falls under the branch of mindfulness, which involves techniques that aid in awareness of the present moment.

The goal of this paper is to demonstrate the need for inclusion of mental training into practice and athletic training sessions. It will examine the use of PMR training as a way of decreasing anxiety and ultimately preventing injury. This topic is particularly important because of the benefits that mental health awareness and mindfulness have on the physical body and recovery. It will help create a more tangible example for the reasoning behind the importance of improving mental health in athletes and offers an alternative to medication for symptoms of anxiety. This helps create a safer environment for athletes and allows for alternative methods of preventative medicine.

This study will show that long-term PMR training will decrease anxiety. This type of PMR will ultimately increase injury prevention in athletes. The population includes college-age athletes from the SIU women's soccer team, a Division I team in the NCAA. Information about

anxiety will be measured via survey before and after the intervention of PMR two times per week over the course of two weeks. The surveys used are the Competitive State Anxiety Inventory-2 (CSAI-2; Lundqvist & Hassmén, 2006) and the Return to Sport After Serious Injury (RSASI; Podlog & Eklund, 2005). The CSAI-2 is a 27-question survey that assess cognitive anxiety, somatic anxiety and self-confidence on a 4-point Likert scale and the RSASI assess readiness of return to play after injury based on ten questions with a 7-point Likert scale. Based on prior readings, I believe that this research will find the benefits of PMR to be based in injury prevention such as increasing awareness, decreasing gameday anxiety, and decreasing kinesiophobia. Overall, these benefits lead to a decrease in injury over time, and hopefully, finding the answers to these questions will lead to a conclusion of an overall increase in injury prevention from PMR training.

CHAPTER 2

LITERATURE REVIEW

Progressive Muscle Relaxation

Progressive muscle relaxation (PMR) is the mindfulness technique that will be used throughout the study and is one of the most notable relaxation techniques used by athletes. PMR is a technique in which you reduce muscle tension by tensing up a particular muscle group and then relax them. For this particular technique, continued practice is key in order for us to see meaningful and lasting results.

Combating Anxiety

When it comes to anxiety, there are a multitude of ways to seek treatment from medication to therapy, and even with different relaxation techniques. Anxiety is a response to internal and external fear and can cause somatic responses such as increase in heartrate, blood pressure, and hormone levels (McCallie, Bloom, & Hood, 2006). Since this study is looking at physical ways to bypass anxiety without taking medication or spending money, we will be focusing on how to combat anxiety effectively using holistic mindfulness techniques in order to create physical and mental relaxation for anxiety relief. Mindfulness has to do with the awareness of the present moment, includes many techniques that help focus on the task at hand. This helps to combat anxiety by decreasing the somatic response within the body that tells us to tense up and prepare for fight or flight (McCallie, Bloom, & Hood, 2006). By decreasing this response through mindfulness, we may ultimately be able to decrease the chance of injury by creating a safer internal environment for the athlete.

Mindfulness Techniques in Athletics

Mindfulness techniques can be easily adapted for athletes due to the consistent impact

that anxiety has on athletic events. Anxiety plays an important role in sport because a certain level of anxiety is needed in order to prepare for competition; however, too much can lead to a bad game and even injury. This negative type of anxiety is often referred to as gameday anxiety, which includes feelings of generalized anxiety and excitement towards the play again during a match, game, or other important athletic event.

When looking into the use of mindfulness by athletes, it helps if you look into a specific injury and how mindfulness can aid the healing process. Research by Cupal and Brewer (2001) is useful in this sense because it examined the effect of PMR on knee strength, pain, and anxiety after ACL surgery. The participants included ACL patients ranging from ages 18 to 50. These participants were measured on a Likert scale for reinjury anxiety and for strength using a Cybex 6000 dynamometer before and after the interventions. The experimental groups were put through ten sessions of imagery training over the course of their 6-month surgical recovery. Overall, it was found that these participants had significant increases in knee strength and a decrease in both pain and anxiety post-op compared to the placebo group (Cupal & Brewer, 2001). This is useful in understanding the positive effects that mindfulness techniques like imagery can have on athletes.

Anxiety and Relaxation Techniques

When looking at mindfulness, examining specific techniques allows us to create a better picture of what all is going on. Hashim and Hanafi (2011) specifically looked into the comparison of two relaxation techniques and how it affected the moods of adolescent male soccer athletes. This study used PMR techniques and autogenic relaxation techniques for each of their experimental groups. Each participant was then surveyed with the Profile of Mood States – Adolescents before and after their intervention. This training went three times per week for four

weeks total. At the conclusion, the study found that each of these interventions were the same in relation to creating changes in mood; however, both did find significant decreases in depression scores after the relaxation techniques were administered (Hashim & Hanafi, 2011).

PMR Application

When using PMR, it is important to have a therapist or someone other than the individuals receiving treatment to read the instructions for tensing each muscle group. As described by McCallie, Bloom, & Hood in their article, the key to PMR is tension and release. McCallie, Bloom, & Hood (2006) explain the technique clearly:

> At the direction of the therapist, the muscle group is tensed. Tension is maintained for a period of 5-7 seconds but only 5 seconds for the feet to avoid cramping. At the direction of the therapist, the muscle group is released. The client's attention is held on the muscle group as it relaxes. It is recommended that the individual take three to five abdominal breaths before beginning the relaxation process. They suggest that each muscle group hold tension for five seconds and relax for ten seconds. (p. 53)

By completing this in a session, and with multiple sessions over time, the individual may inherently learn how to relax when the feel tense since their body is now aware of the sensations on either side of a tense muscle group.

Technique: Muscle Groups and Length of Treatment

PMR can be used in many different ways; however, the form is typically the same. The idea is to tense a muscle group and then release to create relaxation. This can be done with different muscle groups, as shown in an article by Maimunah and Hashim (2016), that examined the effect that the length of a PMR training session has on football player's HR, perceived exertion, and reaction time during play.

The article looked at adolescent male soccer players and divided them into two experimental groups and one control. The heart rate was measured via pulse oximeter and the perceived exertion was measured using a 15-point rating scale of perceived exertion after VO2max testing. These groups were tested before and after four weeks of three sessions per week. One experimental group was given a seven-muscle session, and the other a 16-muscle session. Overall, it was found that both groups showed decreased heartrates and faster reaction times than those in the control group, but the group with 16 muscles during PMR training had greater decreases in both than the group with seven muscles. This tension technique leads to the reasoning behind the benefits of PMR as a treatment (Maimunah & Hashim, 2016).

Progressive Muscle Relaxation as a Treatment

Anxiety and Increasing Sleep

When looking at anxiety, you must also look at how anxiety affects sleep, and how we might increase sleep quality through PMR training. McCloughan et al. (2014) looked at how PMR impacted recovery through measurements of both sleep and anxiety. The researches took dancers from Queensland University and measured their trait anxiety with the Endler Multidimensional Anxiety Scale-Trait scale before and after the PMR intervention. They also tracked sleep through wristwatch actigraphy. After the two-week intervention, it was found that those with high initial anxiety and trouble falling asleep significantly improved at two weeks after the PMR intervention, showing us that holistic efforts given to athletes to aid with sleep onset may improve sleep as an alternate to traditional medication.

Decreasing Heartrates

After looking at PMR and its impact on sleep, we can then move on to the effect it has on

heartrate. *Comparison of Long-Term Effects of Two Types of Relaxation Techniques on Choice Reaction Time and Selected Psychophysiological Variables following Repeated Sub-Maximal Intensity Exercises in School Level Athletes* looked at two different relaxation techniques and their effects on heartrate, VO2max testing, and reaction time. The testing was done on school-aged athletes between ages 13 and 18 and involved pre-testing and post-testing before and after the relaxation interventions. It was found that there wasn't much of a difference between the two relaxation techniques, and that even though other studies found that the relaxation techniques both help initially after treatment, the long-term effects were found to be inadequate. This concluded that either the relaxation techniques only help in the short-term after completing them, or that further research needs to be done over longer time periods (Hanafi, Hashim, & Ghosh, 2011).

Progressive Muscle Relaxation in Athletics

Perceived Exertion

Exertion levels have a huge impact over how an athlete feels and preforms during gameplay. Jaworska et al. (2015) studied the impact of PMR training on athletes' pain threshold and endurance. The study took 32 adolescent male football athletes and tested for pain threshold, endurance, and VO2max. VO2 max testing is an examination of fitness and intense exercise that helps indicate cardiovascular fitness and endurance. These were measured using a Cooper's test before and after eight sessions of PMR training. Overall, it was found that there was no effect on pain threshold, but the boys who went through PMR training were found to have increased endurance by the amount of distance covered in a Cooper's Test (Jaworska et al., 2015).

Readiness to Play

When preparing for competition and practice, athletes need a high level of readiness to play. Readiness to play is based on the physical and psychological state that an athlete may be in prior to activity (Podlog & Eklund, 2005). Due to the psychological nature of readiness to play, it can positively or negatively impact anxiety levels. For this study, readiness to play was measured based on a survey created in 2005. This survey is the Return to Sport After Serious Injury (RSASI; Podlog & Eklund, 2005). The RSASI was initially created to assess readiness to play for those returning to competition after suffering a serious injury; however, it can also be used to see how ready to play an athlete is on a daily basis. The RSASI assesses readiness of return to play based on ten questions using a 7-point Likert scale where 1 = the least or lowest feeling and 7 = the most or greatest feeling. For example: "on a scale of one to seven, when I think about participating in a game or practice after sustaining an injury my confidence in performing challenging skills and techniques has been low". This survey has been adapted to be used for athletes even without injury throughout the course of this study. The adaptation of the RSASI for this study merely removed the comment about injury, so the new questions began with "when I think about participating in a game or practice" and the rest remained the same. Thus, the stems of the questions remained the same as the original RSASI; however, they do not include any references to suffering a prior serious injury.

Goals of Injury Prevention

Along with exertion, reaction time and overall anxiety levels all play a huge role in figuring out how create a better space for injury prevention in athletes. Reaction time is the speed at which you are able to respond to an outside force against your body, and it may ultimately be the deciding factor between injury and safety, especially in sports involving outside objects in the gameplay. With this in mind, the intervention of PMR has been found to alter the anxiety

state of male volleyball players (Navaneethan & Rajan, 2010). High anxiety can lead to dangerous plays and injury, so decreasing anxiety with PMR is a promising alternative. The study examined a group of male volleyball athletes ages 18 to 25 and tested their anxiety levels using the Competitive State Anxiety Inventory-2 (CSAI-2). Anxiety levels were tested before and after the six-week intervention of PMR training. They were able to conclude that after PMR training, these athletes showed improvement in all three categories of cognitive anxiety, somatic anxiety and self-confidence when compared to the control group (Navaneethan & Rajan, 2010). This improvement allows us to use PMR as an option for decreasing anxiety levels which may lead to overall injury prevention.

Sport-Specific Results of Progressive Muscle Relaxation

Though soccer tends to big a big player in the world of PMR training, using different sports to show the effects of PMR are beneficial to how it may be used across the board. *The Effects of Autogenic and Imagery Training on the Shooting Performance in Biathlon* looked specifically at professional French biathlon athletes, who cross country ski and shoot rifles, and how they can benefit from mental training (Groslamber, Candau, Grappe, Dugue, & Rouillon, 2003). The goal of the study was to see if autogenic training and imagery work would aid in increasing shooting performance and stability in the tremometer test. The athletes in the control group received classic shooting training, while the experimental group received that training along with a muscle relaxation training and imagery training. The experimental group saw a significant increase in tremometer test scores, showing that their stability was better overall. They also saw increased performance in time for shooting, but no significant changes in heartrate. Overall, this training proved to improve performance and stability in biathlon athletes (Groslambert et al., 2003).

Measuring Anxiety Levels in Athletes

In order to measure anxiety levels, we must look at the inventory best suited for athletes, the Competitive State Anxiety Inventory 2 (CSAI-2R). The CSAI-2R is a 17-question test that allows the interview to examine anxiety levels on a Likert scale taken by the athlete (Lundqvist & Hassmén, 2006). The study by Rizal et. al. (2019) looked at the use of PMR on new archer's by testing their state anxiety, heart rate, and performance scores. Their state anxiety levels are measured using the Competitive State Anxiety Inventory 2 (CSAI-2R), heart rate using a pulse oximeter, and performance based on a 10-meter shoot distance. 28 participants were measured before and after their archery performance tests with three weeks of 9 PMR intervention sessions. Overall, it was found that the PMR training made no difference in each of the measures taken, likely due to their novice nature. More research must be done for trained athletes in order to determine effectiveness of PMR in higher-level athletes (Rizal et al., 2019).

CSAI-2

When it comes to measuring state anxiety, the use of an inventory is vital to collecting information. The Competitive State Anxiety Inventory-2 (CSAI-2) measures how anxiety affects athletes on the field during gameplay. Lundqvist and Hassmén were able to analyze how successful this measurement of anxiety was in their article involving Swedish athletes. It was found that the 17-item model of the inventory was best at examining an accurate depiction of athletes' anxiety states during play (Lundqvist & Hassmén, 2006). This allows us to measure anxiety levels in order to account for how an athlete is feeling before and after an intervention of PMR throughout the study.

Measuring Readiness to Play in Athletes and State Anxiety

In order to continue to build confidence in PMR, we must also look at how it impacts

readiness to play. This is an important piece of injury prevention and how athletes prepare for competition. Saha and colleagues (2014) examined how the use of PMR training impacted coordination and performance of soccer skills in adolescent male soccer players. The study took 81 participants and assessed their anxiety levels using a State-Trait Anxiety Inventory (SAI) levels and soccer skills using a Soccer Skill Performance Test. They were assessed prior to the training, six weeks in, and at the final of 12 weeks. There was a modified intervention of PMR and a full session intervention. Overall, it was found that both interventions were effective in decreasing anxiety levels on the inventory and increasing soccer skills on the exam as well (Saha et al., 2014).

Research Questions

Problem Statement and Hypotheses

The goal of this paper is to demonstrate the need for inclusion of mental training into practice and athletic training sessions. It will examine the use of PMR training as a way of decreasing anxiety, increasing reaction time, and ultimately preventing injury.

Hypothesis 1: Athletes who participate in long-term progressive muscle relaxation training will have lower levels of reported anxiety compared to the control group.

Hypothesis 2: Athletes who participate in long-term progressive muscle relaxation training will have increased readiness to play compared to the control group, as assessed by the RSASI.

CHAPTER 3

METHODS

Participants

The population involved are athletes proficient in their activity, including collegiate and professional athletes. Anxiety can impact people across sex, gender, and age; however, this study includes collegiate females, with ages ranging from 18-25; therefore, these variables were not considered in the data analysis. This sample comes from the SIU Carbondale Women's Soccer team. This sample did not exclude injured athletes from participation in this study. There were a total of 12 participants in the study (six in each condition).

Measures and Materials

The participants were assessed for readiness to play and anxiety at baseline and following a PMR intervention. Information about anxiety was measured via survey before and after the intervention of PMR two times per week over the course of two weeks. The surveys used are the Competitive State Anxiety Inventory-2 (CSAI-2) and the Return to Sport After Serious Injury (RSASI). The CSAI-2 is a 27-question survey that assess cognitive anxiety, somatic anxiety and self-confidence on a 4-point Likert scale (1 = Not At All; 4 = Very Much So. An example of an item from the CSAI-2 is, "I'm usually concerned about competing". The RSASI assesses readiness of return to play after injury based on 10 questions with a 7-point Likert scale (1 = the least or lowest feeling; 7 = the most or greatest feeling). An example of a question from the RSASI is, " when I think about participating in a game or practice, my confidence in performing challenging skills and techniques has been low". The intervention was a YouTube reading of PMR that occurred two times per week over the course of two weeks. The PMR reading for muscle relaxation lasted for ten minutes and incorporated a seven-muscle group PMR session led

by the researcher. The control group was told by the researcher to take time to relax for 10 minutes and will be monitored by that researcher for their time in the classroom.

Procedure

The goal of this study is to demonstrate the need for inclusion of mental training into practice and athletic training sessions. It examined the use of PMR training as a way of decreasing anxiety and increasing readiness to play. Hypothesis 1 was that athletes who participate in long-term PMR training will decrease anxiety levels in athletes during activity. Hypothesis 2 was that athletes who participate in long-term PMR training will increase readiness to play during athletic activity. The population involved includes Division I collegiate soccer athletes proficient in their activity.

In order to solicit participants, an email was sent out to the SIU Women's Soccer team by a third-party recruiter. The recruitment email included information about the study, including the goals of the study and an introduction into what PMR involves. There was also an explanation of the pre- and post- surveys and an introduction to the control and treatment groups used. Once the recruitment email was sent by the third-party recruiter and the participation response emails were received, the recruiter then paired off the participants by similar field positions and randomly place those pairs into either the treatment group or the control group. This was done via SIRI coin flip. The third-party recruiter then assigned each participant a numeric code to help track the surveys while still promoting confidentiality within the surveys. The final step of recruitment was a second email sent by the third-party recruiter that included the assigned code and group, as well as the online link to the survey given via SurveyMonkey. After gathering participants, the intervention process began.

When the participants followed the link to the survey, the first page of the survey was an

agreement and consent to participate in the study. This included the consent documents. The participant then entered their code to help track the surveys. The surveys and intervention groups were all linked via these assigned codes, from the third party recruiter, so that the survey responses remained confidential. The next two pages of the survey were the two questionnaires; one measured readiness to play (via the Return to Sport After Serious Injury; RSASI) and the second measured competitive state anxiety (via the Competitive State Anxiety Inventory-2; CSAI-2).

After these baseline measures of readiness to play and competitive state anxiety were measured, the two participant groups attended two sessions a week each, over the course of two weeks. One group was a treatment group session, and one group was a control group session. Prior to the initial intervention sessions, the treatment and control groups signed a written consent form for either the treatment session or the control session, depending on their assigned group. The treatment group was a PMR intervention which was provided by a 10-minute, seven-muscle group, YouTube PMR reading. This is the link to YouTube PMR reading used: https://www.youtube.com/watch?v=eoSvD7YQnNQ. The control group did not have an actual treatment and simply laid down and relaxed quietly for ten minutes in the same room. After the two weeks of intervention for each group was complete, the groups were sent another email by the third-party recruiter instructing them to follow the attached link and once again filled out the RSASI and the CSAI-2 forms via Survey Monkey for a post-intervention measurement.

In total, the surveys were completed by participants twice, once prior to any intervention and once after completing the intervention. This is the link to survey used: https://www.surveymonkey.com/r/5G5HK2C. These measures helped gather information about how participants' current anxiety levels and readiness to play changed after the two weeks of

intervention. These surveys were confidential, linked only by the randomly assigned number for each participant given to them by the third party used in initial recruiting. After the intervention process and questionnaires were complete for everyone involved, the information was assessed by comparing pre and post questionnaires to see if the intervention of PMR training actually impacted anxiety levels and readiness to play in order to demonstrate if PMR training can potentially decrease injury occurrence in athletes by reducing anxiety levels and increasing readiness to play.

PROPOSED ANALYSIS

Table 1: Proposed Analysis

Research Question & Hypotheses	**Population & Sample**	**Variables & How they will be measured**	**Research Approach**	**Planned Analysis**
The goal of this paper is to demonstrate the need for inclusion of mental training into practice and athletic training sessions. It will examine the use of PMR training as a way of decreasing anxiety and decreasing reaction time. **Hypothesis 1:** Athletes who participate in long-term progressive muscle relaxation training will have lower levels of reported anxiety compared to the control group. **Hypothesis 2:** Athletes who participate in long-term progressive muscle relaxation training will have increased readiness to play compared to the control group.	The population involved are athletes proficient in their activity, specifically collegiate athletes. Sex, gender, and age do not play a big factor; however, the age rage will likely be those typically involved at this level, ages 18-50. This sample comes from the SIU Carbondale Women's Soccer team. This population does not exclude injured athletes at this level.	Cognitive anxiety and somatic anxiety levels (Measured via the Competitive State Anxiety Inventory-2 or CSAI-2, a 27-question survey that assess cognitive anxiety, somatic anxiety and self-confidence on a four-point Likert scale.) Readiness to play and self-confidence levels in return to play (Measured via the Return to Sport After Serious Injury or RSASI, a survey based on ten questions with a seven-point Likert scale. Progressive Muscle Relaxation technique (A YouTube reading of PMR	Will athletes have lower levels of reported anxiety after long-term PMR training? -Answered by pre- and post-measurements of anxiety levels on a Likert scale Will athletes have increased levels of readiness to play after long-term PMR training? -Answered by pre- and post-measurements of anxiety levels on a Likert scale	Paired sample t-test (comparison of pre and post testing for each survey, and subsequent comparison of treatment and control groups)

		that will occur two times per week over the course of two weeks. The PMR reading will be ten min, seven-muscle group PMR session lead by a researcher.) Time		

CHAPTER 4

RESULTS

The results from the comparisons of pre-test to post-test and between treatment groups will reveal how the interventions of PMR and relaxation change the participants' levels of anxiety and readiness to play. The goal of this paper is to demonstrate the need for inclusion of mental training into practice and athletic training sessions. Descriptive statistics were not calculated for the sample, as all of the means and standards deviations for the RSASI and the CSAI-2 were calculated for the sample and are presented in Table 1. Means and standard deviations by group are presented in Table 2.

Table 2: Descriptive Statistics Totals

	Mean	Std. Deviation	N
Pre Intervention: CSAI-2	50.42	12.05	12
Post Intervention: CSAI-2	50.50	11.78	12
Pre Intervention: RSASI	25.25	11.44	12
Post Intervention: RSASI	20.50	10.96	12

Table 3: Descriptive Statistics By Group

	Control Group		Intervention Group	
	Mean	Std. Dev.	Mean	Std. Dev.
Pre-Test CSAI-2	53.67	9.73	47.17	14.12
Post-Test CSAI-2	54.67	10.31	46.33	12.55
Pre-Test RSASI	23.67	13.41	26.83	10.11
Post-Test RSASI	18.67	12.86	22.34	9.52

A paired-sample t-test was used to compare the pre- and post-test scores of the control and intervention groups on the RSASI and CSAI-2 measures. The result was not significant for both readiness to play and anxiety ($p > .05$). However, the pre- to post-test difference on the RSASI in the control groups was indicating a trend toward significance at $p = .253$. Participants who participated in the PMR group did report slight decreases in anxiety scores but also decreases in readiness to play. The control group reported slightly higher levels of anxiety following the two-week intervention, and also indicated lower levels of readiness to play. For the entire sample, the average pre-intervention score for the CSAI-2 treatment group was 47.17±14.12, and the average post-intervention score for treatment was 46.33±12.55. These were lower than the control group pre- and post-intervention averages of 53.67±9.73 and 54.67±10.31, respectively. The average pre-intervention score for the RSASI treatment group was 26.83±10.11 and the average post-intervention score was 22.34±9.52. These were higher than the control group pre- and post-intervention averages of 23.67±13.41 and 18.67±12.86, respectively.

Overall, these results suggest that, while there is a numerical difference in anxiety levels and readiness to play between the treatment and control groups, there is not a statistically significant difference in anxiety levels and readiness to play within each of those groups.

CHAPTER 5

DISCUSSION

Results from this study found results provided practical support for the hypotheses. It was hypothesized that athletes who participated in a two-week PMR training program would have lower levels of reported anxiety compared to the control group, and also that athletes who participated in a two-week PMR training would have increased readiness to play when compared to the control group. Based upon the results of the study, neither of the hypotheses were supported.

Based on this information, the results from the current study were different than those with similar testing done by Hanafi, Hashim, & Ghosh (2011). Their school-aged athletes between the ages 13 and 18 were also involved in pre-testing and post-testing before and after the relaxation interventions. This was done with two different relaxation techniques, autogenic relaxation and PMR, as well as a control group. It was found that there was not a significant difference between the two relaxation techniques, and that even though other studies found both the relaxation techniques help initially after treatment, the long-term effects after four weeks were found to be inadequate. The authors concluded that either the relaxation techniques only help in the short-term after completing them, or that further research needs to be done over longer time periods (Hanafi et al., 2011). Hanafi, Hashim, & Ghosh (2011) may have needed more time similarly to the current study; however, my study was still able to find some differences between groups in a basic comparison of interventions, suggesting that PMR has some further benefit when contrasted against a control of telling a patient to sit comfortably and relax. The difference could also have been due to the fact that Hanafi, Hashim, & Ghosh (2011) used younger, scholastic-aged athletes, while my study used collegiate athletes. Hanafi, Hashim,

& Ghosh (2011) helped to show how time can impact a study like mine, while Saha and colleagues (2014) will help to present information on the clinical applications of PMR.

With further examination into the clinical uses of PMR, Saha and colleagues (2014) also examined how the use of PMR impacts coordination and performance of soccer skills in adolescent male soccer players. This study was found to be the most similar to the setup of the design of the current study. Saha et al. (2014) used the State-Trait Anxiety Inventory (SAI) to determine anxiety levels in participants; they also examined soccer skills. Overall, it was found that both interventions of PMR training and active relaxation training were effective in decreasing anxiety levels, when compared to the control group, on the SAI and increasing soccer skills on the soccer agility and juggling exam as well (Saha et al., 2014). The results from the current study partially supported the Saha et al. results in that relaxation training was found to positive impact levels of anxiety. The results tell us that the time frame of the studies were lacking, since none of the results saw similar changes over time, even though there was a difference within the interventions.

Even with non-significant differences found within groups (i.e., no main effect for time), the results in the current study were still helpful for measuring anxiety in the soccer athletes involved and were especially ideal in revealing just how impactful anxiety is on athletes. Specifically, no athlete involved in this study reported a complete absence of anxiety on the CSAI-2, which suggests that it is likely present in all athletes in the sample. Some of this information is beneficial in order to help incorporate PMR and other relaxation techniques into rehabilitation and practice. Similar results were shows in the 2019 study by Rizael and colleagues (2019). The archers in this study were measured for anxiety using the Competitive State Anxiety Inventory 2 (CSAI-2R), heart rate using a pulse oximeter, and performance based

on a ten-meter shooting distance. Participants (n = 28) were measured before and after their archery performance tests with three weeks of nine PMR intervention sessions. Overall, it was found that the PMR training made no difference in each of the measures taken, likely due to their novice nature (Rizal et al., 2019). More research needed be done for trained athletes in order to determine effectiveness of PMR in higher-level athletes; however, this is still something we saw with the college-level athletes in this study, indicating that training level is perhaps has less of an impact on the effect of PMR training than originally thought .

Within another setup for the effects of imagery training on the shooting performance in professional biathlon competitions, Groslambert et al. (2003) also saw anecdotal differences as well as improvements to the performances and physical stability in their participants. However, the study saw no significant changes in heart rate. Since this training proved to improve performance and stability in biathlon athletes, but no physical changes from the mental training interventions (Groslambert et al., 2003), it is possible that some of their participants had a natural tendency towards less anxiety. The phenomenon would make sense in the above study as well, since no difference was seen over time within the groups, but there was a difference between groups when the treatments were compared. Overall, this information tells us that PMR is an applicable option for mental training in athletes since there is a difference in anxiety levels and readiness to play between the treatment and control groups; however, there is still more work to be done to see how the impact truly measures up over time and against injury rates.

Limitations and Future Directions

Limitations

Based on the results of the study, the main limitation was the time period that was

utilized, because time was the biggest difference between the current study and prior studies involving PMR interventions. Four weeks is the typical minimum found across the studies examined throughout the literature review such as the article by Maimunah and Hashim (2016); however, I wanted to be able to see how quickly the impact of PMR would work on anxiety and readiness to play. Unfortunately, the results suggest that a longer period of intervention may be needed to see long-term results on anxiety and readiness to play, which provides valuable information for practitioners. Though PMR tends to provide anecdotal relief immediately after, long-term results seem to be more effective at around four weeks based on the results from this study when compared to the results of prior studies using similar techniques.

This study was also limited by the fact that these participants were in the middle of their competitive season; however, due to COVID-19, they were playing this season in the spring of 2021, rather than their normal competitive season, which is typically in the fall. The uniqueness of this experience, combined with the general feelings of stress and anxiety that were common, not only to student-athletes, but to people in general, could certainly have impacted not only anxiety and readiness to play, but also resistance to a relaxation protocol that was only conducted for two weeks.

Another important limitation to this study was group size and compliance in completing surveys. These are two fairly common limitations; however, I believe that they are easily altered in the future. The main complaint noted by participants after taking the survey was the length. Though it was simple to complete, it was also 38 questions long due to the nature of the CSAI-2. This led to missing data from three of the participants' second survey. Even though each participant was emailed twice in order to ensure the highest level of

participation, there were still some participants who never responded. This can be unavoidable in many research projects involving pre- and post-test surveys; however, a shorter survey may prevent avoidance in the future and recruiting a larger group size would also decrease the effect that missing data has on the results. This would also help with effect size in future research and applications.

Future Directions

With a longer study and larger group size to combat effectiveness and involvement, future PMR studies need to include an injury rate measurement or injury tracking throughout the procedure. This setup was meant to make steps towards injury prevention; however, there was not an effective way to include tracking injury rates in the procedure and setup due to the testing timeline and game schedule changes, both of which were impacted by COVID-19. Future studies can adapt this study to include a longer intervention timeline as well as a timeline that runs parallel with the season in order to fix some of these shortcomings. This may also allow for an easier method of taking into account injury rates throughout the study in order to see how the use of PMR and/or other relaxation techniques truly affects the possibility of injury during the season.

Two other things that may have a positive impact on future studies involving PMR techniques involve the standardization of the YouTube video used for the intervention as well as taking into account phone usage during the intervention. Intervention standardized via a YouTube video created by the researcher would allow for personalization of the PMR while still maintaining a regulated intervention across sessions. There were a few issues with the video used in this project, so creating a new PMR intervention video would allow for the intervention to remain at ten minutes while taking into account the progression that the researcher wants the

participants to follow. Another piece that could be controlled in future sessions would be a rule against phone usage during the session. This wasn't taken into account during the sessions in this study and was only realized when one rang during the first session. Technology should be taken into account since it is so frequently used amongst those participants who may be involved in these types of studies and can be disruptive to relaxation experiences.

Conclusion

Though further research still needs to be done in regard to mental training and injury prevention; overall, this study was still clinically beneficial to creating further conclusions about implementing PMR in athletics. Clinicians should continue to include mental practices like PMR in rehabilitation and practice in order to aid with anxiety relief for their athletes, and hopefully in the future we will find clinically based research and proper application for the use of PMR as another means of injury prevention for our athletes.

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APPENDIX A

CONSENT FORMS

Dear participant,

My name is Lindsey Honkomp, and I am a graduate student at Southern Illinois University. The goal of this project is to demonstrate the need for inclusion of mental training into practice and athletic training sessions. It will examine the use of progressive muscle relaxation training as a way of decreasing anxiety, increasing reaction time, and ultimately preventing injury.

If you agree to participate, will be asked to fill out one survey with two questionnaires (the Competitive State Anxiety Inventory-2; CSAI-2, and the Return to Sport After Serious Injury; RSASI) once before the intervention and once after the intervention is complete at the end of the two weeks.

Your responses will be logged, but your personal information and participation will be kept confidential. You have been given a number by a third party to track these surveys with confidentiality. There are no known risks, and there are no known personal benefits; however, this will help advance the care and use of progressive muscle relaxation in sport. The question asking for your assigned number is required; however, that is the only question you are unable to skip. Your participation is voluntary, and you may refuse to participate at any time. You can withdraw your participation at any time by contacting the researcher via email.

If you have any questions or concerns, please contact me using the information below.

Lindsey Honkomp, ATC, LAT, B.S. of Athletic Training

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This project has been reviewed and approved by the SIUC Institutional Review Board. Questions concerning your rights as a participant in this research may be addressed to the committee chairperson, Office of Research Compliance, SIUC, Carbondale, IL 62901- 4344. Phone (618)453-4534. E-mail: siuhsc@siu.edu

By clicking "next" below I certify that I am at least 18 years of age and consent to participate in this research.

Dear participant,

My name is Lindsey Honkomp, and I am a graduate student at Southern Illinois University. The goal of this project is to demonstrate the need for inclusion of mental training into practice and athletic training sessions. It will examine the use of progressive muscle relaxation training as a way of decreasing anxiety, increasing reaction time, and ultimately preventing injury.

If you continue to agree to participate, your assigned control group will lay down and relax for the next ten minutes, or your assigned treatment group will listen to a YouTube video on progressive muscle relaxation recording for the next ten minutes. You will do this activity twice a week for two weeks. You have also been asked to take one survey with two questionnaires (Return to Sport After Serious Injury; RSASI, and the Competitive State Anxiety Inventory-2; CSAI-2). The same survey will be completed once before the intervention and once at the end of the two-week intervention period.

Your responses will be logged, but your personal information and participation will be kept confidential. You will be given a number by a third party to track these surveys with confidentiality. There are no known risks, and there are no known personal benefits; however, this will help advance the care and use of progressive muscle relaxation in sport. The question asking for your assigned number is required; however, that is the only question you are unable to skip. Your participation is voluntary, and you may refuse to participate at any time. You can withdraw your participation at any time by contacting the researcher via email.

If you have any questions or concerns, please contact me using the information below.

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By signing and dating below I certify that I am at least 18 years of age and consent to participate in this research.

APPENDIX B

COMPETITIVE STATE ANXIETY INVENTORY-2 (CSAI-2) QUESTIONNAIRE

Instructions: Complete the following scale on two separate occasions: during a quiet time before practice when you are fairly relaxed, and during a competitive situation that you feel is highly stressful. If you are not currently active in competition, recall such situations as clearly as possible and record your responses.

The following are several statements that athletes use to describe their feelings before competition. Read each statement and circle the appropriate number to indicate how you feel right now, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement.

	Not at all	**Somewhat**	**Moderately so**	**Very much so**
1. I am concerned about this competition.	1	2	3	4
2. I feel nervous.	1	2	3	4
3. I feel at ease.	1	2	3	4
4. I have self-doubts.	1	2	3	4
5. I feel jittery.	1	2	3	4
6. I feel comfortable.	1	2	3	4
7. I am concerned I may not do as well in this competition as I could.	1	2	3	4
8. My body feels tense.	1	2	3	4
9. I feel self-confident.	1	2	3	4
10. I am concerned about losing.	1	2	3	4
11. I feel tense in my stomach.	1	2	3	4
12. I feel secure.	1	2	3	4
13. I am concerned about losing.	1	2	3	4
14. My body feels relaxed.	1	2	3	4
15. I'm confident I can meet the challenge.	1	2	3	4
16. I'm concerned about performing poorly.	1	2	3	4
17. My heart is racing.	1	2	3	4
18. I'm confident about	1	2	3	4

performing well.

19. I'm worried about reaching my goal.	1	2	3	4
20. I feel my stomach sinking.	1	2	3	4
21. I feel mentally relaxed.	1	2	3	4
22. I'm concerned that others will be disappointed with my performance.	1	2	3	4
23. My hands are clammy.	1	2	3	4
24. I'm confident because I mentally picture myself reaching my goal.	1	2	3	4
25. I'm concerned I won't be able to concentrate.	1	2	3	4
26. My body feels tight.	1	2	3	4
27. I'm confident of coming through under pressure.	1	2	3	4

Scoring: This scale is called the Competitive State Anxiety Inventory-2 (CSAI-2), a sport-specific state anxiety scale developed by Martens, Vealey, and Burton (1990). The scale divides anxiety into three components: cognitive anxiety, somatic anxiety, and a related component-self-confidence. Self-confidence tends to be the opposite of cognitive anxiety and is another important factor in managing stress. To score the CSAI-2, take all the scores for each item at face value with the exception of item 14, where you "reverse" the score. For example, if you circled 3, count that as 2 points (1 = 4; 2 = 3; 3 = 2; 4 = 1). Total your scores in the following manner:

___ Cognitive state anxiety: Sum items 1, 4, 7, 10, 13, 16, 19, 22, and 25.
___ Somatic state anxiety: Sum items 2, 5, 8, 11, 14, 17, 20, 23, 26.
___ Self-confidence: Sum items 3, 6, 9, 12, 15, 18, 21, 24, and 27.

Your scores for each will range from 9 to 36, with 9 indicating low anxiety (confidence) and 36 indicating high anxiety confidence.

APPENDIX C

RETURN TO SPORT AFTER SERIOUS INJURY (RSASI) QUESTIONNARE

Rate each of these on a scale of 1 to 7, with one being not ready at all and seven being most ready.

Within my first season since returning to sport after injury . . .

Return concerns (10 items)

- . . . my confidence in performing challenging skills and techniques has been lower.
- . . . my belief in myself has been lower.
- . . . my confidence has been lower.
- . . . my fear of reinjury has interfered with performances.
- . . . my performances have been unsatisfying.
- . . . my anxiety about competing has been greater.
- . . . my struggles to regain technical skills/abilities have been frustrating.
- . . . my inability to meet others' expectations has been frustrating.
- . . . my ability to focus during competition has been worse.
- . . . my ability to perform has been affected by my injury.

Renewed perspective (5 items)

- . . . my appreciation of sport has been greater.
- . . . my enjoyment of practice and competition has been greater.
- . . . my motivation for sport success has been greater.
- . . . my mental toughness has been better.
- . . . my understanding about how to train/compete has been better.

VITA

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Research Paper Title:
If You're Reading This, Release the Tension in Your Shoulders: A Study of Progressive Muscle Relaxation and Anxiety Relief for Injury Prevention in Athletes

Major Professor: Dr. Julie Partridge