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The effect of warmth imagery on physiological, physical, and psychological states among injured youth sepak takraw athletes: A case study design

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Abstract

The aim of this current study was to examine whether warmth imagery could affect the body temperature, heart rate, quality of life, anxiety, pain rating, and the perception of hand warmth among two female injured Thai Sepak Takraw athletes. Both participants, P1 and P2 female (aged 18 years old) suffered with torn anterior cruciate knee ligament (Grade II), from the Bang Mod Campus, Bangkok Sports School. They participated in 12 sessions of imagery interventions focusing on motivational, relaxation, breathing, concentration and warmth imagery. The results showed that imagery interventions showed decreased in heart rate, increased in body temperature, increased in the perception of warmth, and improvement in the psychological state, which includes the quality of life, anxiety, and pain. The study suggests that the use of warmth imagery intervention showed positive effects on the physiological, physical and psychological on both injured athletes. Thus, similar intervention could be recommended to the injured athletes, to use such intervention during their rehabilitation process.

Keywords: Warmth imagery, Physiology, Physical and Psychological States, Injury.

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INTRODUCTION

Sports performance often influenced by the four major factors, which includes the technical, tactical, physical, and psychological [1]. From the physical aspects, studies had revealed that stronger physical characteristics such as muscular strength, power and endurance, have the advantages in reducing the risks of sports injuries [2-4]. Similarly, stronger psychological skills such as having higher self-confidence level, courage or even mental toughness in sports could have similar advantages, leading to better sporting performance outcomes [5]. Recently, some researchers [6-8] have looked into some aspects of injuries prevention, and its risk. Yang and colleagues [8] found that it is important for athletes to have stronger physical and psychological strength for the prevention and treatment of sports injuries. Other studies also showed that sports injuries have a strong relationship between injury history, the rating of current pain, and health-related quality of life [9,10]. In the context of sport medicine, a causative factor in hamstring injuries was neural tension as a byproduct of inadequate warm-up, poor flexibility, strength imbalance, muscle weakness, fatigue, and muscle stretch [11,12]. These showed that the main factors directly associated with injury are closely related to the athletes' daily life and injury symptoms, which is the physical and psychological aspects.

Takraw is an impressive offensive movement by jumping with back to the net and kicking the ball over the shoulder while flipping [13]. In 2013, Na Chiangmai, as a Thai professional coach, gave an interview that the all of the Thai's Takraw players have been in risks of getting injuries. It is due to the players have to jump up from a hard flooring court and then roll forward or backward to kick the ball in the air, thus they are susceptible of getting various forms of sports injuries [14]. On the other hand, a study on the anthropometric and physiological profiling conducted by Jawis, Singh, Singh, and Yassin [15] showed that three playing positions (tekong/serve, feeder, and killer/spiker) produced different levels of heart rate, oxygen consumption, and VO_2max during a match in which the killer group exhibited higher levels physiological changes compared to the tekong and feeder. Thus, more studies should be investigated looking into the psychological and also the physiological aspects of Takraw's risk of injuries among to prevent the players from getting sports injuries.

For the sport psychological setting, there is also evidence that stress occurs before and during the competition, which could influence the athletes' physical and psychological status and during injuries [16, 17]. Smith and Smoll [18] suggested that injuries also negatively affected an athlete's health status and sports performance. Next, Kemeny [19] and Solomons [20] also showed that the negative psychological state in response to a threat, including anxiety, sadness, frustration, and helplessness could also affect the players' performance. Bhasavanija and Morris [21] said that psychological variable has been most widely studied was anxiety as it is a psychological state disrupting an athlete's sport performance. For instance, Whdan [22] reported that the reduction of anxiety states could lead to better pain tolerance, relaxed muscle tension, and calmer sporting experience. According to Smith [23], negative emotions trigger the sympathetic nervous system, which is originated from the hypothalamus, leading to the physiological changes such as increased in cardiac output, blood pressure or heart rate. For example, an increase in blood pressure will occurs when a person was getting tense, frustration or fatigue. Similarly, other physiological parameters such as body temperature, heart rate, and oxygen saturation are closely related to the psychological and physiological states. Thus, these several factors should be investigated on how to prevent injuries for athletes.

Imagery, as a psychological skill that has been widely used with injured athlete for maintaining a positive outlook, controlling stress, improving self-confidence, managing pain, and in promoting healing effects during rehabilitation [24-26]. Moreover, Plessinger [27] suggested that imagery can be employed to enhance physical skills (e.g., technique and tactic), and mental skills (e.g., positive thought, anxiety reduction, confidence building, and mental toughness during injury). It has positive effects especially on injured athletes' returning to practice [28]. In the context of the cognitive specific imagery use, warmth-related imagery can increase muscle relaxation and skin temperature, which have an effect on the trigger point sites for pain reduction [29]. Besides, imagery had shown positive correlation between sport performance improvement and autonomic nervous system responses in skin temperature, oxygen saturation, and heart rate, during both actual activity and mental imagery [30-32]. The results from the studies showed that warmth-related imagery could help an athlete to recover from symptoms of injury relates to physiological, physical, and psychological states.

From the literature reviewed, studies had shown that injuries could occur to athletes at any time of the season and it can affect athletes' psychological states (quality of life, anxiety), physical states (pain), and physiological parameters (body temperature, heart rate). But, some studies had shown that the use of warmth imagery could lead to the reduction of pain, reduction of muscle tensions, decreased heart rate, and increased body temperature [32]. Thus, the aim of this study was to examine the effectiveness of using imagery as intervention on body temperature, heart rate, perceived warmth, pain rating, quality of life, and anxiety on two injured youth Takraw athletes.

METHOD

Design

This is a single-case research study design, and it employed a mixed method research approach including descriptive, observational, and experimental research examining the cognitive-specific aspects of imagery on warmth imagery training program [32]. The training includes one full session (twelve weeks) with six times per week. Participants were assigned to practice approximately 10 minutes a day, and their physiological, physical and psychological states were measured to investigate whether the imagery intervention has any effect on them.

Participants

Two injured 18 years old female Thai's Sepak Takraw athletes volunteered to participate in this study. Both athletes had at least five years of competitive experience at the national level. They were injured with torn anterior cruciate knee ligament (Grade II). Both athletes came from Bang Mod Campus, Bangkok Sports School. Participant 1 (P1)'s left knee was injured and swollen. She was in pain and unable to move. She needed to limit her movements and received medical treatments. She was assigned to get rest, ice compression, and medications. Participant 2 (P2)'s right knee was swollen, knee ligament and blood vessels were torn and she was also in pain, and was unable to move for three weeks. She was assigned to stop all sporting activities and received medical treatments. Her treatments include rest, massage with ice-compression, and medications. Both participants received antibiotic with a high dose of painkiller.

Measures

The Physical and Psychological State Measure in Sports with Pain and Medication (PPSMS-PM). The PPSMS-PM [33] is a 29-item questionnaire used to examine participants' quality of life, anxiety, and pain rating. The questionnaire consisted of seven variables, designed in 5 Likert's scale to measure, 1) Quality of Life (lifestyle, behaviour, and environment), 2) Anxiety (physical and mental), 3) Self-confidence (general and efficacy), 4) Multidimensional imagery (vividness, control, ease of generation, speed of generation, and duration), 5) Motivation, 6) Perception of Muscle-tension, and 7) Pain Rating and Medication. This measure is adequate since the Cronbach's alpha coefficient value ranged between .7 to .8 as followed a study of Ertas and colleagues [34].

Infrared ear thermometer. The infrared ear thermometer (Model: IR1DE1 Microlife AG, Switzerland) ranging from 0 - 100 C° [35] was used to measure participants' skin temperature during imagery training. The gap between the thermometer sensor and the index finger was 1 cm.

Fingertip Pulse Oximeter. The fingertip pulse oximeter can use for measuring heart rate and oxygen saturation to examine athlete's training recovery [36]. This study was designed to use the fingertip pulse oximeter (Model: MD300C2, ver4.0C2, China) ranging from 70 - 99% (±3%) to measure participants' heart rate during imagery training.

Measurement of Warmth Perception. A 10-cm-visual analogue scale was used to measure participants' perception of hand warmth during imagery training. Participants were asked immediately after completing the imagery program, "How would you rate the warmth in your hand, which occurred during the imagery training you experienced today?" Participants then placed a cross (X) on a 10 cm-visual analogue scale between two anchor statements (the left end of the scale = very cold, to the right end = very warm) [37].

Imagery Intervention. The imagery program was created using the cognitive specific function model, which employed both the internal and external imagery perspectives [38]. The imagery consisted of five sections: 1) Motivational, 2) Relaxation, 3) Breathing, 4) Concentration, and 5) Warmth imagery, with one separate introductory session. All five sections were recorded into the MP3 format, with the duration of approximately five to ten minutes in each section. Participants were assigned to perform the imagery training program five days per week, for twelve weeks.

Procedures

This study was approved by the research committee of the Faculty of Education, Ramkhamhaeng University. It was conducted in accordance with the Declaration of Helsinki. We performed a face validity test on the questionnaire with two sports science experts and a sports psychologist. Then, we prepared the imagery training script and pre-tested the scripts. Participants read the research information sheet and

provided written informed consent before the study commenced. Participants were given an introductory for producing hand-warmth using the imagery training program, and participants were taught to use cue words for producing warmth in their hand while performing the imagery. During the imagery training, participants sat in silence and relaxed for 5-10 minutes before listening to the voice-recorded MP3 to conduct their imagery training. During the imagery training, participants' heart rate, skin temperature was measured. Immediately after finishing the imagery, participants reported their perceived hand warmth using the visual analogue scale. Both participants completed all twelve weeks of interventions. At the end of the study, participants were debriefed and thanked for their participation.

RESULTS

This aim of this study was to examine heart rate, body temperature, quality of life, anxiety, the perception of warmth, and pain rating, measured over the 12 weeks of imagery training using a single-case research design.

Figure 1 showed P1 and P2's heart rate during the imagery intervention from Baseline, Week 1 to Week 12. P1 showed slight decrease in heart rate, however, P3 showed more changes, with slightly increased from Week 1 to Week 2, then decreased from Week 3 to Week 12.

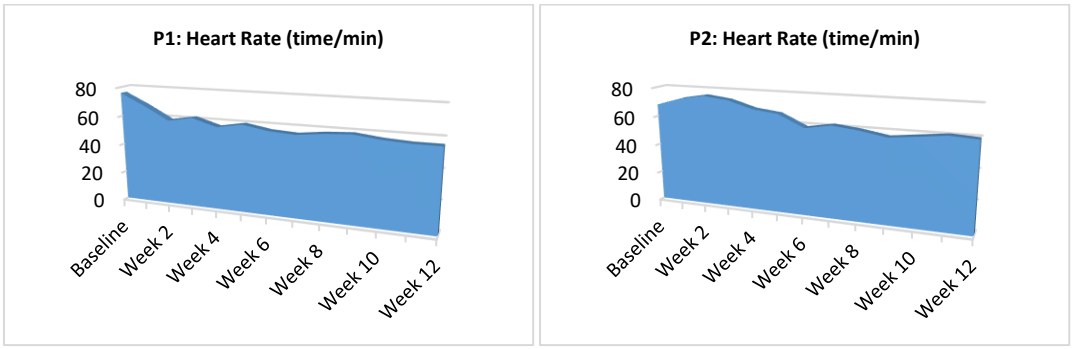

Figure 1: Mean heart rate (in beat per minute) for both participants during the Imagery intervention from Week 1 to Week 12

Figure 2 showed participants' body temperature during performing the imagery intervention from Baseline, Week 1 to Week 12. For P1, her body temperature showed higher than baseline at Week 1 to Week 3, then followed by little changes between Week 4 to Week 12. For P2, her body temperature showed moderately higher than baseline, and it increased from Week 2 to Week 12.

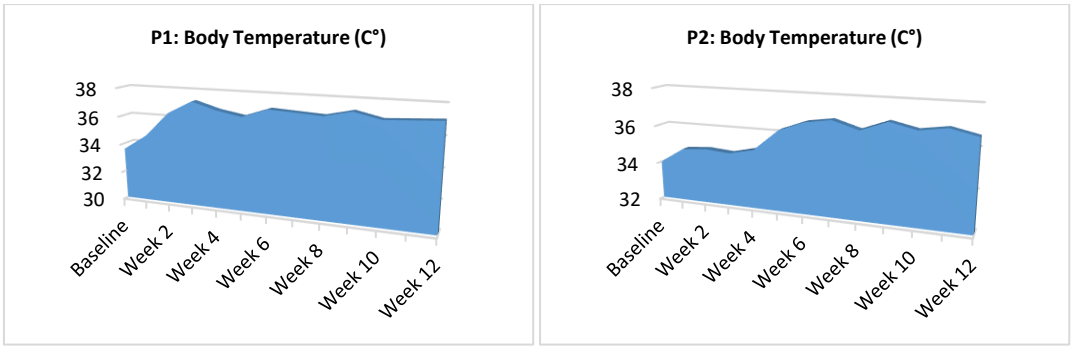

Figure 2: Mean body temperature (Degree Celsius) of both participants during the imagery intervention from Week 1 to Week 12

Figure 3 showed participants' quality of life during performing the imagery intervention from Baseline, Week 1 to Week 12. Overall, both participants increased in their quality of life compared to the baseline. Although P2 showed a slower increase from Week 1 to Week 8, she demonstrated the highest quality of life, meaning that both participants did felt that the imagery intervention enhanced their quality of life.

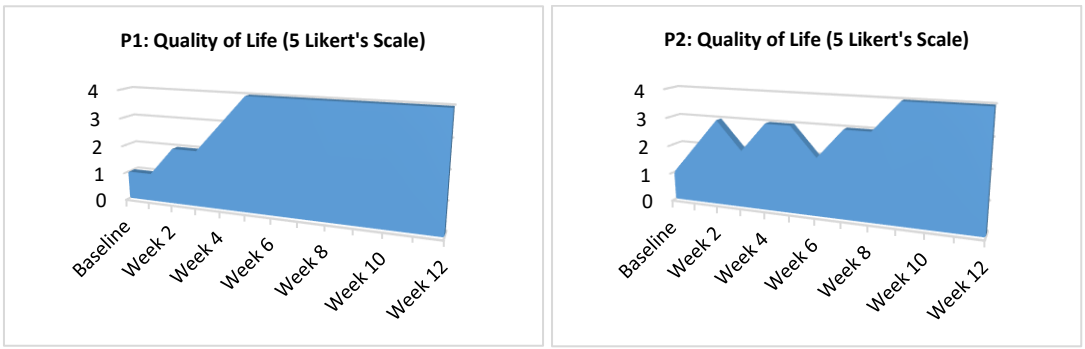

Figure 3: Mean Quality of Life (5 Likert's scale) of both participants during the imagery intervention from Week 1 to Week 12

Figure 4 showed participants' anxiety level at baseline, Week 1 to Week 12 during the imagery intervention. Initially (baseline), P1 and P2 showed highest anxiety level. However, both participants showed a steady decrease in their anxiety level from Week 1 to Week 12. This

showed that the imagery training was effective in lowering the anxiety levels among the two injured athletes.

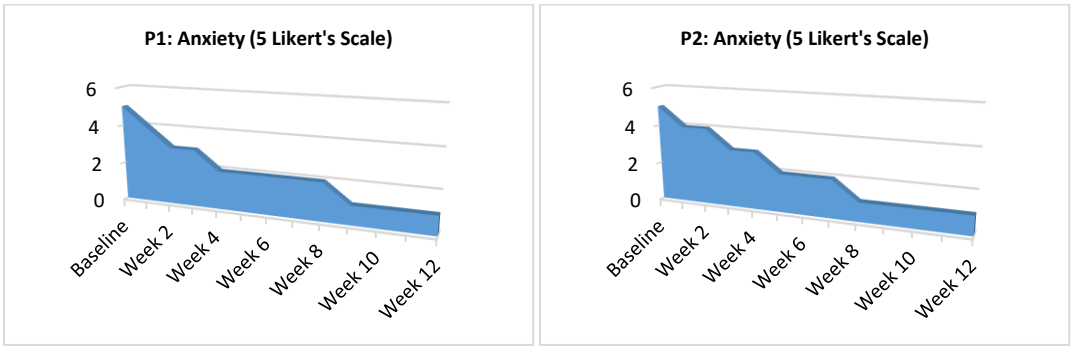

Figure 4: Mean Anxiety (5 Likert's scale) of both participants during the imagery intervention from Week 1 to Week 12

Figure 5 showed participants' pain rating from Baseline, Week 1 to Week 12 during the imagery intervention. As showed in the rating scores in Figure 5, both participants' pain rating were highest at baseline, but then slowly reduced with the imagery training. This showed that the imagery training was effective to lower the pain ratings among both participants.

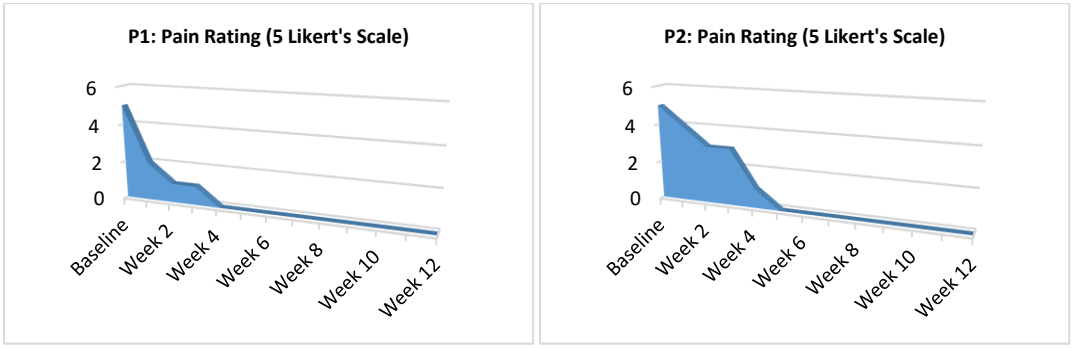

Figure 5: Mean Pain Rating (5 Likert's scale) of both participants during the imagery intervention from Week 1 to Week 12

Figure 6 showed participants' perceived warmth from baseline, Week 1 to Week 12 during the imagery intervention. Compared to P2, P1 showed higher perceived warmth compared to P2.

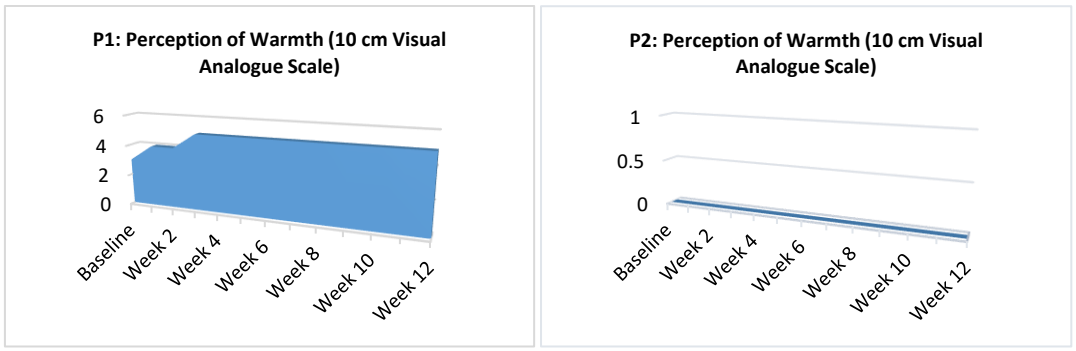

Figure 6: Mean Perception of Warmth (10cm Visual Analogue Scale) of both participants during the imagery intervention from Week 1 to Week 12

DISCUSSION

The aim of this study is to investigate the effectiveness of the 12 weeks of imagery intervention on body temperature, heart rate, pain rating, perceived warmth, quality of life, and anxiety. To begin, we recognised that both participants were injured, which was the main factor of inducing high pain rating leading to increased in anxiety and heart rate, as well as decreased in body temperature, and poor quality of life. Subsequently, the study employed imagery intervention, which was designed by Bhasavanija and Morris [39] with the objective of improving the physiological, physical and psychological states of both injured athletes, as well as their perception of warmth over 12-week of imagery training.

Similar to the findings of this study, Bhasavanija and Morris [39] also showed that body temperature for imagery participants increased more than in non-imagery participants, which also leads to better muscle relaxation and decreased in anxiety level. Besides, Ohkuma's studies [40, 41] also reported that warmth or thermal sensation imagery could produce increased in skin temperature. Regarding the participant's perceived warmth at their hand, the imagery intervention also showed increased in the perception of warmth [42-48]. Besides, the results of this study also showed that pain rating could be reduced using the imagery intervention. This is similar to the study conducted by Albright and Fischer [49], reported that warmth-related imagery could increase muscle relaxation and skin temperature at the trigger point sites, which is effective for pain reduction. Besides, Hamson-

Utley [50] also suggested that imagery, as a psychological technique, has been widely used with an injured athlete for maintaining a positive outlook, control stress, improve self-confidence, manage pain, and promote healing during rehabilitation.

As for the physiological effect on heart rate, the present study had reported that participant 1's heart rate during warmth imagery training was lower than baseline. Similarly, Abreo [51] also noted that interventions such as guided imagery, massage therapy, yoga and biofeedback could affect the participants' heart rate reduction, oxygen saturation increased, and the stress-hormone such as cortisol decreased. Some of the reasons why participant's heart rate was higher at baseline, and then was lower during the trials are, firstly, while the participant was injured, she might be exposed to highly physically weak state, such as inflammation of ligament or muscle tear. This aligned to the study conducted by Hoolihan and Streeck [52], who mentioned that while one has a fever urging responses of the immune system, it would generate high heart rate. The second reason is, Smith [53] revealed that negative emotion, is a reaction of the sympathetic nervous system, originates in the hypothalamus and produces cardiac output, such as high blood pressure and increased heart rate. Another reason that caused participant's heart rate decrement during the trial could be due to their injuries started to recovering. Also, Ivarsson, Johnson, and Podlog [54] proposed five psychological predictors of injury occurrence (trait anxiety, negative-life-event stress, hassle, maladaptive coping, and injuries). In this study, participants who performed the imagery intervention had reported that lower anxiety level over the 12 weeks of intervention.

CONCLUSION

To conclude, the use of imagery of warmth in the hand has been conducted to increase hand temperature and to reduce the perceptions of pain. Previous researchers had also shown that employing imagery of warmth intervention could also enhance both body and mind conditions. The results from the present study suggested that the imagery intervention is effectively for a) decreased heart rate, b) increased body temperature, c) increased perception of warmth, and d) induced positive effects on psychological states, such as quality of life, anxiety, and pain. The implications from this study showed that Takraw athletes and possibly other sports athletes, who have injured employ the12-weeks imagery intervention during their rehabilitation.

Conflicts of interest

Both authors have no conflict of interest in conducting this study.

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