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Mindfulness meditation training for tennis players

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MINDFULNESS MEDITATION TRAINING FOR TENNIS PLAYERS

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MINDFULNESS MEDITATION TRAINING FOR TENNIS PLAYERS

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ABSTRACT

The first purpose of this experimental study was to investigate if there is an improvement in tennis players' performance when they use mindfulness meditation training (MMT), an intervention designed for this study. The second purpose of the study was to evaluate whether participation in MMT would increase tennis players' mindfulness and help them reduce anxiety, and whether these factors would mediate performance. The third purpose of the study was to examine whether participation in MMT training decreased the frequency of negative thoughts and improved athletes’ ability to ‘let-go’ of negative thoughts.

In terms of the structure of the research, 100 tennis players were randomly divided into either the intervention group or the control group. The intervention group was asked to listen to a mindfulness meditation training (MMT) CD, while the control group listened to a tennis skills and strategy CD. Both CD’s were ten minutes in duration and the tennis players were asked to listen to their given CD daily over an eight week period. The intervention group finished with 42 participants and the control group finished with 38 participants, therefore, ending up with the total of 80 participants total.
The intervention group, which practiced MMT, significantly outperformed
the control group as measured by tennis results. Compared to the control group,
the intervention group won significantly more games (449 compared to 242) and
matches (211 compared to 99) and lost significantly fewer games (188 compared
to 428) and matches (120 compared to 205). The intervention group also
increased in the level of mindfulness as measured by The Mindful Attention and
Awareness Scale (MAAS) whereas the control group showed no significant
increase. The increase in mindfulness by the intervention group not only helped
participants accept performance related anxiety, but also had a positive effect on
performance; higher scores on the MAAS scale were positively related to the
number of games and matches won. Likewise, the significantly lower scores on
the Social Fear subscale shown by the intervention group could help explain why
those participants lost fewer games and matches. Even though neither the
intervention group nor the control group was able to “let-go” of negative thoughts
if they did occur, the findings indicated that the intervention group experienced
fewer negative thoughts than the control group. MMT helped tennis players’
performance, and although further research is warranted to assess the impact of
MMT with respect to age, gender, sport and practice duration, it should be
considered a potentially valuable intervention for coaches and athletes who are
trying to improve tennis performance.
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CHAPTER 1

INTRODUCTION

*He had to hold on, this was it…*

With just two more points he would put his opponent away. He had been here before, on probably the biggest stage of tennis—Wimbledon—at almost the biggest moment. He had advanced to the quarterfinals in 1996 and 1997; he had bowed out in the Semifinals in 1998, then again in 1999. But this year would be different, he could taste it. But it was happening again. He could not put those negative thoughts out of his mind. He tried to ignore them, he tried to convince himself with positive self-talk, but he couldn’t seem to put them out of his mind.

Tim Henman is like all of us. He just happened to be competing at the highest level of tennis in the world. And in 2001 he was so close, so close it hurt, to making the Wimbledon Finals.

Tim Henman, reached the quarterfinals or semifinals at Wimbledon an incredible eight years in a row but never advanced to the finals. In fact, Henman never reached the finals of any of the four Grand Slam tournaments despite having played in six semifinals matches over the course of his career. There is no shame in his record, he was one of the most successful British tennis players in the modern era, winning over eleven million dollars in prize money along with countless other endorsements. But the problem that Henman faced when the stakes were highest was that he could not overcome himself. He came tantalizingly close, so many times. Some might say he just was not good enough
to play at the very highest level, but Henman won many non-Grand Slam tournaments, such as a Paris Masters during which he took out some of the game’s best: Roger Federer in the quarterfinals and Andy Roddick in the semifinals. In doubles he won the Monte-Carlo Masters twice. Others might suggest he was a “choke-artist,” but he won too many big matches throughout his storied career for it to be as simple as that.

Tim Henman was emotional; one time he lost it, hitting a ball in rage that accidentally hit a ball girl in the head and led to his disqualification from the match. (He later made a public apology.) But emotions are part of sport. John McEnroe and Andy Roddick, two of the sport’s most famous players, were notorious for having bad tempers. Henman kept coming back to Wimbledon with a particular vengeance: how sweet it would be to play in the Grand Slam finals, on his home turf for all his countrymen and women to see. But time after time he turned on himself, unable to overcome the demand he placed on himself. No, this was not a streak of bad luck. It was his Achilles heel. He could not shut out the internal noise and get to that next level.

The problem Tim Henman faced in the spotlight of Grand Slam professional tennis represents, in some ways, a problem that nearly all of us face at some point in our lives. It is all too common to experience a negative or unhelpful thought that we simply cannot get out of our minds. And if we do not learn to make peace with that thought it might just devour us. How else do we cope with anxiety, distractions, and negative thoughts? Since none of us are
immune to the possibility of facing down such adverse thoughts and feelings, wouldn’t it be wonderful if there were a way for us to get such thoughts and feelings in check? For Tim Henman it may be too late to go back and rewrite the record books, but for anyone working as, or with, high-level performers, any way that we can help them deal with their stress would be a welcome relief and oasis in the desert.

**Purpose**

This research study evaluates whether Mindfulness Meditation Training (MMT) helps enhance tennis players’ performance. In particular, it attempts to answer the question: does MMT help tennis players cope with competition anxiety and negative thoughts?

In sports, anxiety and negative thoughts have been linked to decreases in performance, and for many years sports psychologists have stated that a reduction in these feelings and thoughts will help players achieve optimal performance (Hardy et al., 1996). This notion that anxiety and negative thoughts need to be replaced or changed has been supported and accepted in sports psychology research, the reason being that more successful performers are better at dealing with anxious states (Gould, Weiss, & Weinberg, 1981; Orlick & Partington, 1988). Nevertheless, despite the widespread use of cognitive behavioral strategies trying to solve this problem of changing and replacing anxiety and negative thoughts, it has been shown that such approaches do not
always help increase performance (Thompson et al., 2011; Beilock, Afremow, Rabe, & Carr, 2001; Gardner & Moore, 2006; Janelle, 1999; Wegner, 1994). What’s more, research concerning the efficacy of cognitive behavioral strategies in sports has been inconsistent and contradictory. Given the shortcomings associated with research using cognitive behavior strategies, mindfulness interventions have been gaining support as an alternative strategy to achieve enhanced performance. In contrast to cognitive behavioral strategies, MMT posits that the willingness to accept one’s thoughts, experiences, and emotions in the present moment, without judgment, can help improve athletic performance. (see Gardner & Moore, 2004, 2006, 2007; Moore 2009; Thompson et al. 2011).

**Background to the Problem**

Advancing to the final round of the Wimbledon tennis tournament is a top career goal for any professional tennis player. Sitting in the locker room before the finals, however, the player may experience emotions that she has never felt before. A sense of anxiety or excitement may be felt, in addition to numerous negative and positive thoughts. The mind is racing and the body subsequently becomes restless, as body and mind work together. As mentioned by Jon Kabat-Zinn (1990), a pioneer and leading figure in the field of mindfulness meditation, “if you are in a period of high stress, the mind will tend to obsess about your predicament...at such times your thoughts may be highly charged with anxiety and worry” (p.67-68). Kabat-Zinn (1990) also discusses the mind and body
relationship during less anxious states. He writes: “at less stressful times the thoughts that go through your mind may be less anxious in nature, but they can be just as powerful in taking your attention away” (p.68). Whether the player is anxious or not, her preparation and ability to focus before a match is crucial for optimal performance and success.

Both elite and amateur athletes experience moments of anxiety and heightened excitement, which is sometimes associated with the inability to focus. Knowing that athletes experience these emotions, their support staff (coaches, trainers, and sports psychologists) look for ways to alleviate the negative effects of anxiety and excitement and hope to thereby enhance performance. There are numerous examples in sports history of athletes underachieving due to problems such as anxiety, heightened excitement, negative thoughts, and inability to focus. In addition, numerous studies indicate that anxiety, focus, and negative thoughts have a significant impact on performance. Hatzigeorgiadis et al. (2009) investigated the effect of self-talk, anxiety, self-confidence, and performance on seventy-two different tennis players. Positive self-talk was found to reduce cognitive anxiety and improve performance, a finding that adds support to the idea that anxiety and negative thoughts play an important role in performance.

Dagrou, Gauvin, and Halliwell (1992) also looked at the relationship between self-talk and performance, and found that their study’s control group was significantly outperformed by a positive self-talk group, and that the control group outperformed the negative self-talk group. Hatzigeorgiadis et al. (2009)
reached similar conclusions, finding that athletes’ anxiety, negative thoughts, and distractions could be detrimental to their performance. Likewise, the Morris et al. (2005) book, Imagery in Sports, arrives at a similar conclusion. According to Morris et al. removing negative imagery and replacing it with positive imagery allows athletes to enhance focus and reduce anxiety, which leads to improved performance.

Sports psychologists have introduced a number of methods to help athletes deal with anxiety and negative thoughts, methods that can help tennis players mentally prepare for major athletic events such as Wimbledon. To date, sports psychology has predominantly utilized cognitive behavioral methods to help athletes achieve ideal performance states, primarily through self-regulation strategies (Wehlen, Mahoney, & Meyers, 1991). The sports psychology methods most commonly used and studied include self-talk, imagery, goal setting, breathing, and awareness training. Some of these sports psychology methods are designed in such a way as to identify and indicate negative or unproductive thoughts and positively correct them (Bernier et al., 2009). Similarly Terry Orlick (2008) indicates, it is important to realize when a problem arises and be able to identifying negative or unproductive thoughts. Moreover, Orlick (2008) states that once one is aware of these ineffective thoughts, one is more likely to choose a sports psychology method that will assist in positive changes.

Traditional sports psychology methods (such as self-talk, imagery, goal setting, breathing, and awareness training) have been researched in depth.
Research suggests that these methods help tennis players achieve enhanced performance. For example, the Hatzigeorgiadis et al., (2011) meta-analysis study encourages the use of self-talk not only to improve performance but also to facilitate learning. Research that supports the finding that positive self-talk improves performance has also been conducted by Van Raalte, Brewer, Cornelius, and Petitpas (2006). Van Raalte, Brewer, Cornelius, and Petitpas (2006) investigated the idea that athletes shown using positive self-talk would be perceived more favorably than the same athletes shown using negative self-talk. They found that positive self-talk not only positively affects performance, but that it also affects the perceptions of athletes held by observers and opponents.

Another study by Dagrou, Gauvin, and Halliwell (1992) used forty-six male and female dart-throwing athletes to investigate the influence of self-talk on motor performance. They concluded that positive self-talk outperformed the control group, which in turn outperformed the negative group. Finally, Landin and Herbert (1999) investigated the influence of self-talk on volleying skills in tennis. Their research is consistent with the idea that self-talk helps players engage and maintain focus, which results in increased performance.

Similarly to self-talk, imagery also plays an important role in sports psychology when trying to improve performance. Imagery in Sports by Morris et al. (2005) indicates that positive imagery (when used properly) improves performance. Research conducted by Morris et al. (2005) implies that positive imagery will reduce anxiety, enhance focus, and hence, improve performance. In
addition, Nicholls, Polman and Holt (2005) used four high performance golfers to investigate the effect of imagery on performance. The findings showed that all four golfers improved their putting performance. Similarly, a meta-analysis done by Driskell, Copper, and Moran (1994) reviewed the literature on mental practice (imagery) to see if there was an effect on performance. The results of the research state that there is a significant positive effect between mental practice and performance.

In tennis specifically, performance improvements have also been seen in the imagery research. The findings of research done by Guillot, Genevois, Desliens, Saieb, and Rogowski (2012) showed that both the motor imagery group and the ‘placebo-racket effect’ group (this group used visual, feel, and auditory senses) experienced significant increases in serve accuracy, hence, improving tennis performance. Likewise, research by Coelho et al. (2008) assessed an imagery-training program on tennis serve performance. The research used forty-six junior male athletes and indicated that imagery is an effective way to improve serve and tennis performance. All together, there is a significant amount of research that indicates that the use of sports psychology methods like imagery and self-talk helps athletes, and in particular tennis players, to improve performance.

In addition to self-talk and imagery, goal setting has also been researched in depth for its effect on improving performance. Tenenbaum, Weinberg, Pinchas, Elbaz, and Bar-Eli (1991) used 214 students and compared subjects’
sit-up performance when subjects adopted short-term and long-term goals. The results of the research indicated that sit-up performance increased both when subjects set short-term and long-term goals. Moreover, the most improvement was seen when the subjects combined short-term and long-term goals. A similar study by Goudas, Laparidis, and Theodorakis (2007) tested the effects of goal setting on the endurance performance of 75 female cycle athletes. The findings are consistent with those of Tenenbaum et al. (1991) who found the female cycle athletes that were in any of the goal-setting groups experienced improved performance. Mamassis and Doganis (2004) investigated the impact of season-long Mental Training Program (MTP), one aspect of which was goal setting, on nine tennis players. Consistent with previous findings, their research found that all of the tennis players in the MTP group demonstrated increased performance as compared to tennis players in the control group.

It is important to notice that there are problems common to all of these methods, however. Athletes may not benefit from these techniques because some of these sports psychology methods support the notion that suppression or replacement of negative thoughts (Thompson et al., 2011) could in turn increase the regularity and amount with which these same thoughts recur (Beilock, Afremow, Rabe, & Carr, 2001; Gardner & Moore, 2006; Janelle, 1999; Thompson et al., 2011; Wegner, 1994). Similarly mentioned by Thompson et al., (2011, p.111) study, “A large body of evidence suggests that attempts to suppress unwanted thoughts may lead to cognitive interference, as thought suppression
paradoxically increases the frequency of the thoughts the person wishes to avoid” (Wagner 1994). In addition, these sports psychology methods do not encourage only suppression or replacement and some of the research findings associated with these methods have been controversial. There are numerous research studies, for example, that suggest that these methods do not, in fact, help improve performance at all (Goudas et al., 2007; Jordet, 2005; Lane & Streeter, 2003; Van Raalte et al., 1994).

Given the problems associated with sports psychology methods, one alternative that has gained empirical support is called Mindfulness. Mindfulness is the ability to accept one’s thoughts and experiences without being judgmental, which can in turn enhance athletic ability (see, Gardner & Moore, 2004, 2006, 2007; Moore, 2009, Thompson et al. 2011). In addition to enhancing performance, a study by Thompson et al. (2011) found that, “the willingness to experience task-relevant worries, task-irrelevant concerns, and occasional disruptions in concentration may contribute to reductions in the frequency of negative thoughts detrimental to sport” (p.111-112).

As mentioned earlier, one of the main goals of sports psychology is not only to locate negative thoughts, but also to suppress and/or replace these thoughts. Mindfulness practices, in contrast, do not attempt to locate and suppress negative thoughts, but rather attempt to focus an athlete’s attention on the present experience without being judgmental. This is the basis of peak performance psychology (Bernier et al., 2009; see, Jackson & Csikszentmihalyi,
1999; Ravizza, 2002). In addition to being linked to peak performance and the ability to enhance performance, mindfulness practices help to achieve heightened self-awareness, acceptance, and attention. Where the suppression of negative thoughts and replacement has been found to increase the frequency and saliency of such thoughts (Beilock, Afremow, Rabe, & Carr, 2001; Gardner & Moore, 2006; Janelle, 1999; Wegner, 1994), mindfulness practices teach athletes to accept negative thoughts, without being judgmental of them. This approach could be shown to help many athletes achieve enhanced performance. Although there is not yet enough research in the performance realm to demonstrate this conclusively, there is support in general psychology that mindfulness practices have a positive impact on numerous mental health problems by improving psychological functions and reducing stress.

**Mindfulness Practice in sports**

Because mindfulness-based stress reduction intervention has been successful in studies conducted with the general public, there is reason to believe that mindfulness practice may also help athletic performance. Mindfulness meditation can teach athletes to accept their thoughts and emotions without being judgmental. This manner of thought acceptance may help athletes to better prepare for a match and thereby improve their performance. Mindfulness Meditation techniques may lead to heightened self-awareness (Roemer & Orsillo, 2002), a reduction in the frequency of negative thoughts, and
improved ability to let-go of negative thoughts (Frewen, 2007). In addition to heightened self-awareness and reduction of negative thoughts, mindfulness practices may also help athletes identify patterns of regular responses to external cues and awareness and therefore help athletes become better equipped to choose the appropriate response to athletic demands (Gardner and Moore, 2004). Moreover, in addition to enhancing athletic performance, practicing the acceptance and awareness of the present moment has been shown to bring athletes greater enjoyment of their sports as well (Gardner & Moore, 2004, Bernier et al., 2009).

Given the many benefits of mindfulness practices that have been demonstrated in psychology, and its obvious potential in application to sports, the question arises: why have mindfulness practices, and mindfulness meditation more specifically, not been used in sports? Within sports psychology, the only published intervention studies that use mindfulness mediation as part of their mindfulness practice are the Mindfulness Acceptance Commitment (MAC) approach and Mindful Sports Performance Enhancement (MSPE) approach.

Gardner and Moore (2004, 2006, 2007) developed the Mindfulness Acceptance Commitment (MAC) approach. They merged relevant information from the Acceptance and Commitment Therapy (ACT) developed by Hayes and Wilson (1994) with mindfulness mediation to design the MAC approach. The MAC approach has since been used in numerous sports studies (i.e. Gardner & Moore, 2004; Lutkenhouse, 2007; Kee and Wang, 2008; Bernier et al., 2009;
Wolanin, 2005; Schwanhausser, 2009) to understand its effectiveness in enhancing sports performance. The MAC approach is divided into seven modules that can take seven or more sessions in accordance with clients’ needs. According to Moore (2009), some clients need more time on a particular module; therefore, the number of sessions in the program can be altered. The seven modules are: 1) Preparing the Client with Psychoeducation, 2) Introducing Mindfulness and Cognitive Defusion, 3) Introducing Values and Values-Driven Behavior, 4) Introducing Acceptance, 5) Enhancing Commitment, 6) Skill Consolidation and Poise—Combining Mindfulness, Acceptance, and Commitment, and 7) Maintaining and Enhancing Mindfulness, Acceptance, and Commitment (Moore, 2009). In addition, Moore (2009) identified an important advancement in the MAC approach, by adjusting language to suit different age groups.

To date, the MAC approach has been used in numerous sports case studies and research. For example, a case study conducted by Gardner and Moore (2004) highlights two athletes (one male swimmer and one female weight lifter) in order to evaluate the efficacy of the MAC approach. In both cases the athletes improved their concentration, increased their ability to accept the experience, and stated that they enjoyed engaging in their sport more. Another crucial finding was that both athletes demonstrated an increase in athletic performance, leading Gardner and Moore (2004) to suggest that more research needed to be done on the MAC approach. Another case study, by Lutkenhouse
(2007) evaluated the efficacy of the MAC approach on a Division I university lacrosse player. Like Gardner and Moore, Luthenhouse (2007) found that that (based on self-reporting and her coaches' reports), the athlete improved in behavior functioning and enhanced her own performance. Another case study conducted by Schwanhausser (2009), in which one elite swimmer was used to evaluate the utility of MAC approach, also supports these findings. This case study had similar results: an improvement in competitive performance, as well as an increase in mindfulness awareness, acceptance and attention. Even though these case studies are not enough to state conclusively that mindfulness is 100% effective they have been important in the early stages of MAC research and development.

The success of these case studies has led researchers to perform more extensive examination and research on the efficacy of the MAC approach. Research by Wolanin (2005) compared the MAC approach to a nonintervention group. The research used eleven Division I female field hockey and volleyball athletes, and similar to the prior case studies, the results were very promising about the utility of MAC approach. The findings stated that when comparing the intervention group to the nonintervention group, the intervention group demonstrated an increase in both self-reported and coach-reported ratings of athletic performance. In addition, the findings also demonstrated an increase in self-reported and coach-reported task-focused attention and practice intensity.
Further, Hasker (2010) using nineteen Division II university athletes from different sports compared the MAC approach with PST. The athletes in the PST group received goal setting, imagery, relaxation, self-talk and arousal control interventions. The other group received MAC approach. The findings stated that although there was only a small sample size with which to assess changes in performance, the MAC group demonstrated significant improvement in their ability to describe and be non-reactive in their internal experiences as well as in their increased experiential acceptance and increased ability to commit to behaviors directly related to achieving their athletic goals. In a similar study, Lutkenhouse, Gardner, and Moore (2007) compared the MAC approach with PST using 118 Division I university athletes from different sports. The athletes were split into two different groups: one MAC approach group and one PST approach group. Athletes who were in the MAC group showed a significantly greater improvement in coach ratings of performance than the athletes who were in the PST group. MAC athletes also demonstrated a significant increase in coach ratings on aggressive practice and competition behaviors, a highly significant reduction in avoidance, and a highly significant increase in flow stats. Since there was a much larger sample size with this research and the results show an improvement in performance similar to other MAC research findings, it is clear that MAC is a worthwhile approach to enhancing performance (Gardner and Moore, 2012).
In examining the research conducted on the utility of the MAC approach, it is important to look at two additional research studies that used the MAC approach but that did not necessarily focus on the MAC effect on performance. The research done by Kee and Wang (2008) looked at 182 student athletes and aimed to investigate the relationship between mindfulness, flow dispositions, and mental skills adoption. The researchers used a cluster analytical approach to demonstrate the results. It was found that Cluster Four, which was the group that had the most experience with mindfulness, was considerably more likely to achieve peak performance and experience the greatest levels of dispositional flow states. The initial data from this study indicates a relationship between mindfulness and the experience of peak performance and dispositional flow.

Peak performance and dispositional flow are also highly correlated with optimal performance (Nakamura & Csikszentmihalyi, 2005). A study by Beriner et al. (2009) used ten swimmers to investigate the relationship between mindfulness and acceptance with flow states using qualitative investigation. The study found that there is a relationship between mindfulness and flow states, and reinforced Kee and Wang’s (2008) earlier findings that suggested, that athletes who are more mindful are more likely to experience flow states. Bernier et al. (2009) also investigated a new PST program, which incorporated mindfulness and acceptance in its interventions, and a traditional PST program that studied the effect of PST techniques (control group) alone on seven elite golfers’ performance. These findings are consistent with the Gardner and Moore’s (2007)
results in indicating that mindfulness and acceptance approach can enhance performance. The findings stated that all the golfers in the new PST program enhanced their national ranking, while only two golfers in the control group did so. In addition, all golfers in the new PST program reached the goals they set at the beginning of the season. Although these studies cannot indicate a causal relationship (since they were both correlation studies), it can show that enhanced performance and mindfulness are associated with dispositional flow.

The other approach to studying mindfulness meditation within the sport psychology literature is called Mindful Sports Performance Enhancement (MSPE). Kaufman et al., (2009) developed the MSPE approach by combining elements of Kabat-Zinn’s (1990) Mindfulness Based Stress Reduction (MBSR) and Segal, Williams, and Teasdale's (2002) mindfulness based intervention. The MSPE approach has also been shown to enhance sports performance. This approach is a four-week program that is divided into four sessions as outlined in the Kaufman et al. (2009, p.355-356) research appendix. The first three sessions are two and a half hours long.

Session one is designed to achieve eight tasks. The tasks are:

A. Orientation and rationale, B. Group introductions, C. Raisin Exercise and discussion, D. Introductory mindful breathing exercise and discussion, E. Body Scan Meditation (45 min) and discussion, F. Wrap-up diaphragmatic breathing exercise (3 min), G. Discussion of home practice for the week, and H. Session
One summary and discussion (Kaufman et al., 2009, p.355).

Session two is designed to achieve six tasks, which are:

A. Body Scan Meditation (45 min) and discussion of home practice, B. Discussion of applications of meditation training to the sport of focus, C. Sitting Meditation exercise focusing on breath and body as a whole (15 min), D. Mindful Yoga practice (45 min) and discussion, E. Wrap-up diaphragmatic breathing exercise (3 min), F. Discussion of home practice for the week, and G. Session 2 summary and discussion (Kaufman et al., 2009, p.355).

Session three is designed to achieve six tasks. The tasks are:

A. Mindful Yoga practice (45 min) and discussion of home practice, B. Extended Sitting Meditation (45 min) and discussion, C. Walking Meditation with specific applications to the sport of focus, D. Wrap-up diaphragmatic breathing exercise (3 min), E. Discussion of home practice for the week, and F. Session 3 summary and discussion (Kaufman et al., 2009, p.355-356).

Finally session four is three hours long and is designed to cover five tasks, which finishes the program. The final tasks are:

A. Sitting Meditation practice (30 min) and discussion of home practice, B. Body Scan practice (45 min) and discussion, C. Walking Meditation applied to the sport of focus (10 min), D. Wrap-up diaphragmatic breathing exercise (3 min),
and E. Workshop conclusion and discussion of continued practice (Kaufman et al., 2009, p. 356).

The MSPE program outlined above has been shown to be effective in enhancing sports performance. For example, the research done by Kaufman et al. (2009) sought to investigate if flow states, performance, and psychological characteristics in thirty-two recreational athletes were affected when using the MSPE program. The results indicated that both archers and golfers experienced increases in confidence and mindfulness. The even more important finding, however, was the significant positive change achieved by the athletes in their levels of overall flow. As mentioned earlier, flow dimensions are correlated with enhanced performance, so there is, good reason to believe that the MSPE program may enhance athletic performance.

De Petrillo et al. (2009) also tested the MSPE program in a study involving twenty recreational long distance runners. Specifically, the study investigated the efficacy of the program on athletic performance, sports anxiety, and disruptive cognitions. Their results showed significant increases in athletes’ awareness and mindfulness. Furthermore, the athletes demonstrated a significant decrease in sports-related anxiety, worry, and frustration connected to self-expectations and parent criticism. At the end of this study eighty-one percent of the runners interviewed indicated that they would continue mindfulness practice based on the belief that it would improve their running times and help them deal with the stress
related to their daily lives. Because there was no direct evidence of enhanced performance during the study, however, the researchers hypothesized that four weeks of MSPE intervention was too little for athletes to effectively acquire and learn the appropriate skills. With this in mind, Thompson et al. (2011) investigated the long-term effects that Kaufman et al.'s (2009) and De Petrillo et al.'s (2009) research had on athletes. In 2011, Rachel Thompson and colleagues worked with Dr. Kaufman and Dr. De Petrillo to complete a one-year follow up study on various types of athletes. This study was made up of runners, golfers, and archers who had previously participated in Kaufman and De Petrillo’s research. Over the course of the year-long follow up, Thompson et al. (2011) saw significant improvement in the long-distance runners’ mile times and significant improvement in the golfers’ scores. More than half of the archers and golfers also reported greater enjoyment when playing their sport. These results suggest that the MSPE program could well be an effective intervention that enhances athletes’ performance in their respective sports.

Although the seven-module MAC approach and the four-session MSPE approach are the most commonly used approaches in the sports psychology area of mindfulness practices, they both treat mindfulness meditation as only one part of a comprehensive approach. Research by Aherne, Moran, and Lonsdale (2011), is the only research in this field that focuses solely on mindfulness meditation-based intervention in sports.
Aherne, Moran, and Lonsdale (2011) investigated the relationship between mindfulness training and the flow experience in athletes. Their study followed thirteen university athletes: seven of whom were assigned to the control group, six of whom were assigned to the experimental group. Aherne, Moran, and Lonsdale (2011) hypothesized that athletes who underwent mindfulness meditation training would experience greater flow than athletes who did not participate in the training, but the results of the study were mixed. The results showed that athletes who underwent mindfulness training reported an increase in global flow scores and in flow dimensions (specifically dimensions of “Clear Goals” and “Sense of Control”) (Aherne, Moran, & Lonsdale, 2011). The other subscales measured in the study by the Flow State Scale2, however, were not affected by the training. Aherne, Moran, & Lonsdale (2011) concluded that mindfulness meditation is beneficial for all athletes, not only athletes who are affected by anxiety, negative thoughts, or other negative mental aspects of their sports.

In summary, although mindfulness practices have been tested infrequently in sports, the limited research that has been done supports the hypothesis that these practices are effective in enhancing athletic performance. Gardner and Moore (2012) reviewed a decade of mindfulness practice studies and concluded that even though mindful practices have been gaining strength and recognition in sports, more research needs to be done in this area. Gardner and Moore point out that there are a great many aspects of mindfulness practices that are still
unknown and need to be learned. For example, research needs to incorporate more high-level athletes and pinpoint the amount of time required to see improvements in performance and neural outcomes. Indeed, in expanding the limited research that has been in this area, there are a number of factors that need to be tested. Among other things, research should be done with larger test populations and in different sports, and should experiment with different types of performance measurements. Aherne, Moran, and Lonsdale (2011) state that despite their findings of a significant increase in global flow with the use of mindfulness meditation training, additional research needs to be conducted before it can be empirically shown that mindfulness mediation training has an effect on flow. As a result, there is still a large gap between the efficacy mindfulness practices in the realm of sports performance.

**Conceptual Framework**

The goal of athletes in every sport is to improve their athletic performance. Therefore, the current research will provide tennis players with the mindfulness skills of acceptance, non-judgmental thinking, and awareness studied by Jon Kabat-Zinn, and measure the effect of this training on their athletic performance (Kabat-Zinn, 2003). Competition anxiety is very common among tennis players (See Fig. 1), and is “typically characterized by worry and rumination” (Frewen et al., 2007, p.759). Worry and rumination are typically automatic responses that cannot be controlled (Frewen et al., 2007). The inability to control these feelings
often causes tennis players to feel anxiety and experience negative thoughts about themselves and their performance. The goal of this research is to provide tennis players with mindfulness skills that will teach them the power of accepting anxiety being non-judgmental of their experiences, and becoming more mindfully aware.

One way to help lessen anxiety is to use mindfulness meditation training (MMT). As Frewen et al., (2007) writes,

“Cognitive theories of mindfulness (e.g., Breslin et al., 2002; Craske et al., 2002; Teasdale et al., 1995, 2002; Wells, 2002) describe this construct as a non-judging and de-centered form of awareness, and the practice of mindfulness involves observing but Letting-Go of (i.e., not reacting in any way to) one’s moment-to-moment experience, including to the occurrence of negative automatic thoughts” (Frewen et al, 2007, p.771).

Cognitive theories of mindfulness can be very useful in helping tennis players’ deal with anxiety, negative thoughts, and a sense of worry. For tennis players, the adoption of these techniques could play a key role in improving performance. By not reacting strongly to negative thoughts, athletes can identify the difference between thought and reality (de-centering) (see Frewen et al., 2007). This will help tennis players achieve a reduction in the rate of negative thoughts and an “increase the ability to let-go of negative thoughts” (Frewen, et al., 2007, p.770). The concept of mindfulness skills could become one of the most important sports psychology methods used to deal with competition anxiety.
Current Research

This research focuses on efforts to help tennis players’ and other performers enhance mindfulness skills with the goal of enhancing performance. It is designed to help tennis players accept negative thoughts and become more mindful by using mindfulness meditation training. This research employed similar mindfulness meditation training techniques to those used by Aherne, Moran, & Lonsdale (2011) in their research. Their research used Jon Kabat-Zinn’s co-authored CD entitled “Guided Meditation Practices” (Williams, Teasdale, Segal &
Kabat-Zinn, 2007) as their mindfulness meditation training. The research discussed in this paper also used a CD for mindfulness meditation training as the main intervention; however, the CD was designed by the researcher to make the CD more specific to tennis. In this research, one hundred amateur tennis players were recruited to use the mindfulness meditation training CD. The goal of the mindfulness meditation training CD was to help tennis players accept anxiety and negative thoughts, and enable them to be more mindful prior to and during competition.

In terms of the structure of the study, 100 tennis players were randomly divided into either an intervention group or the control group. The intervention group was asked to listen to mindfulness meditation training CD, while the control group listened to strategy CD. In addition, each tennis player in the intervention group and control group was required to listen to their CD four times a week and log the times that she did so. The tennis players were also asked to complete three scales at three separate points throughout the training. The first three scales prior to the start of the intervention. The scale completion took place at week four, and the final scale was completed after the intervention. The scales include: The Mindful Attention and Awareness Scale (MAAS developed by Brown and Ryan, 2003), The Kentucky Inventory of Mindfulness Skills (KIMS developed by Baer et al., 2004), and the University of British Columbia Cognitive Inventory-‘Letting-Go’ Revised Version (UBC-CI-LG modified by Frewen et al., 2007). These scales allowed the research to measure four things. The first is each
athlete’s state of mindfulness (MAAS). The second is their ability and understanding of the four mindfulness skills (KIMS- Observing, Describing, Acting With Awareness, and Accepting Without Judgment). The third is the frequency with which each athlete experiences negative thoughts. Finally, the degree to which the individual is able to let-go of each thought if it does occur.

Tennis players were required to fill out three scales prior to the start of the intervention. The intervention group then had eight weeks of mindfulness meditation CD training while the control group will be given eight weeks of strategy CD. Next, both groups were required to fill out the same three scales once again in week four. Finally, each player filled out the same three scales one last time at the end of week eight, which concluded the training. Using data from the eight-week training, the research sought to determine if there was any improvement in tennis performance when the two groups were compared. The participants’ performance was also investigated for an additional eight weeks after the training since training needed to be completed before the investigation of performance can occur. The performance of the intervention group was compared to that of the control group, as measured by winning percentage of matches, sets, and games. The research also investigated whether the intervention group was better able to accept anxiety and negative thoughts prior to the competition, whether the intervention group experienced a reduction in the amount and frequency of negative thoughts, and whether they experienced an increased ability to be more mindful than the control group.
Statement of Problem

The purpose of the present research is to investigate if there is an improvement in tennis players’ performance when using the mindfulness meditation training. Over the past thirty years numerous PST techniques that have been researched for their ability to help athletes improve performance. This research focuses specifically on mindfulness meditation training. The training study outlined proposes to help advance the sports psychology literature on performance enhancement and on mindfulness meditation in sports, and to further address some of the inconsistent and contradictory research conducted to date on PST techniques. As mentioned above, many PST techniques demonstrate significant discrepancies in their findings, and display issues having to do with the design and goals of their interventions. There is consequently a need for unique techniques that might be more suitable for enhancing performance.

There are numerous aspects of mindfulness interventions that have yet to be studied. To date few studies utilized larger sample sizes which can lead to greater reliability, and research to identify the amount and dosage of mindfulness interventions that is needed to produce enhanced performance is still required. Mindfulness practices should be investigated with different ability of athletes such as professional, youth and amateurs, as well. To date, there has been no research conducted on the effect of mindfulness practices on tennis players’ performance.
Hypothesis

This dissertation hypothesizes that:

1. There will be a positive effect on performance when tennis players use mindfulness meditation training.
2. Mindfulness meditation training will help athletes to better accept anxiety.
3. Mindfulness meditation training will decrease the frequency of negative thoughts and provide athletes with the ability to let-go of negative thoughts when they do occur.
4. Mindfulness meditation training will allow tennis players to be more mindful and present in the moment (aware), which will directly improve performance.
CHAPTER 2
REVIEW OF THE LITERATURE

Tennis Performance

There are many ways to look at improving tennis performance. For example, there are physiological ways to improve performance. As shown in Kovacs (2006) review, it is important to have the right type of workout for tennis performance. Another way is to establish the right diet, which could also benefit tennis players. Mental training techniques have also been an established part of sports training for over thirty years. The research discussed in this paper will focus on the mental aspect of the tennis game.

In most cases, performance is assessed by the wins or loses an individual accumulates over time; nevertheless, in the research realm it has been difficult to assess performance as it consists of several factors, not just wins or losses. Mamassis and Doganis (2004), for example, investigated the impact of season-long Mental Training Program (MTP) on nine tennis players. The MTP program they designed incorporated five skills: goal setting, positive thinking and self-talk, concentration and routines, arousal regulation techniques, and imagery. Their research provided an in-depth analysis of two athletes, but stated that all participants in the MTP group experienced a greater increase in performance than the control group. One of the main reasons for this outcome was that the MTP group showed the greatest difference in self-confidence (one of the factors
of the Competitive Anxiety Inventory-2 test), which positively correlates with performance.

Another study by Hatzigeorgiadis et al., (2009) investigated the mechanisms underlying self-talk and performance. This research involved seventy-two tennis players and tested their anxiety, self-confidence, and performance. The study tested performance on the Broer–Miller Forehand Drive test (see, Barrow, McGee, & Tritschler, 1989), and found that self-talk has a positive effect on task performance. Moreover, their research found that self-talk increased self-confidence and reduced cognitive anxiety. They concluded that the increase in task performance was likely due to an increase in self-confidence. Similarly, Landin and Herbert, (1999) investigated the influence of self-talk on the volleying skills of five female NCAA division I tennis players. Their research helped support other research studies on self-talk. Their findings about self-talk suggested that self-talk helped engage and maintain athletes focus, and therefore helped improve performance.

Performance improvements were also seen in imagery research done by Guillot, Genevois, Desliens, Saieb, and Rogowski. (2012). Guillot, studied twenty-two tennis players to investigate the motor imagery and ‘placebo-racquet effects’ in tennis server performance. The motor imagery group used imagery and practice, meaning they would imagine a serve and then actually practice performing the serve. The ‘placebo-racquet effect’ group solely used imagery by having the researchers ask players to describe their racquet (visual, feel, and
auditory), whereas the control group did not receive any instruction. Members of the control group carried out their normal tennis and practice routines. The results found that both the motor imagery group and ‘placebo-racquet effect’ group significantly increased in serve accuracy, ratio, and regularity of successful serves. Furthermore, ‘placebo-racquet effect’ group showed a greater increase in serve accuracy than the motor skill group. Researchers stated that athletes’ perceptions and beliefs regarding serve ability in the ‘placebo-racquet effect’ group especially helped increase serve accuracy.

Coelho et al., (2008) conducted a similar study that looked at imagery and found similar results. The purpose of their research was to assess an imagery training intervention program effect on tennis serve performance (precision target and without precision). The research tested forty-six junior male tennis players ranging from fourteen to sixteen years old, and randomly assigned them to either technical practice only (the control group) or imagery group with technical supports (the experimental group). The results showed that there was significant difference between the experimental and control groups when they were testing “service without precision,” but not when they were testing “service with precision.” With these results, the researchers could still conclude that imagery is an effective way to improve tennis performance. The conclusion of Coelho et al., (2008) that imagery improves self-confidence coincides with other research in imagery that finds self-confidence to be one of the factors that helps improve performance.
To athletes it is very important to enhance performance. Most tennis players would be open to trying different mental skills if they believe that it will enhance their performance. As noted above, MTP, self-talk, and imagery are just few of the many techniques used in tennis to help enhance performance. One of the goals of the current research, however, is to introduce another technique called mindfulness meditation training that could also be used by tennis players to enhance their performance. The current research not only expands the field of sports psychology, but also gives tennis players and other athletes another approach they can consider when trying to enhance performance.

**Cognitive Behavioral Strategies/Psychological Skills Training**

Cognitive behavioral strategies have had a significant influence on the evolution and research of sports psychology. These strategies include both Cognitive Behavior Therapy (CBT) and Cognitive Behavioral Modification (CBM) (Robinson et al., 1999). The goals of these strategies are to help individuals identify their behavior, and focus on changing that behavior using thoughtful problem-solving strategies. Both strategies incorporate components of behavior therapy and cognitive approaches. Examples of behavior therapy include modeling, feedback and reinforcement; examples of cognitive approaches include problem solving, self-monitoring, self-awareness, and relaxation. The reason for incorporating both behavior therapy and cognitive approaches into the present study is to help educate and enable individuals to: notice problematic conditions, possess the ability to consider possible solutions, and, most
importantly, be able to select the most suitable solution for the problem (Robinson et al., 1999).

The turn to cognitive behavioral strategies for athletes was inspired by the work of Bendura (1977) on social cognitive theory and Meichenbaum (1977) on the development of cognitive behavioral modification. Since then, athletes have developed and used these strategies (in sports referred to psychological skills training, PST) to try to obtain greater self-control of their emotions and thoughts in the hope of enhancing performance (Hardy, Jones, & Gould, 1996).

Even though many researchers have found that psychological skill training (PST) helps enhance athletic performance, they have also continuously reported the inconsistency of such approaches when it comes to reliably enhancing performance (Burton, Naylor, Holliday, 2001; Gould & Udry, 1994; Williams & Leffingwell, 2002; Zaichkowsky & Baltzell, 2001). For a long time after the development and introduction of PST it was believed that the reduction of negative emotions and thoughts, and the increase of positive cognitions and confidence, were directly correlated with enhanced performance (Hardy, et al., 1996). It was believed that most successful athletes were less anxious, that they experienced fewer negative emotions and thoughts, and that they were more confident than less successful athletes (Gould, Eklund, & Jackson, 1992; Orlick & Partington, 1988). As a result, it was no leap to believe that if athletes could replace negative thoughts with positive thoughts, and try to decrease or eliminate anxiety, then such measures would directly influence performance.
Research conducted over the past few years, however, has cast doubt upon the assumption that most successful athletes are less anxious, experience fewer negative emotions, and are more confident, and that these mental states are part of what leads to better performance. The research done on the Catastrophe model (Hardy & Fazey, 1987), for example, does not support the conclusion that less anxiety or the experience of less anxiety always improves performance. Their model predicts that an increase in physiological arousal and anxiety will lead to enhanced performance, but only up to a certain point, and in the case of athletes who exceed that point, the athlete will experience a catastrophic decline in performance (Hardy et al., 1996). On the other hand, research conducted by Cohen, Pargman, & Tenenbaum (2003) that used the Mental Readiness Form- Likert (MRF-L; Krane, 1994) to monitor dart-throwing task fluctuations in anxiety did not support the catastrophe model predications. Their findings suggested that there was no catastrophic decline in performance even when athletes experienced increased levels of anxiety and physiological arousal. It further stated that performance could be increased or maintained even under high levels of anxiety and physiological arousal. Based on the results of these studies, it seems that the assumption that one needs to eliminate anxiety to enhance performance is not accurate.

Despite the research finding that the belief of PST (high levels of anxiety decrease performance) is not accurate, athletes and researchers continue to use PST when trying to improve performance. This phenomenon inspired Craft et al.
(2003) to conduct a meta-analysis on the relationship between components of anxiety (cognitive anxiety, somatic anxiety, and self-confidence) and performance. After a review of a number of studies, the findings did not support the finding that there is a negative relationship between cognitive anxiety and performance. Instead they found there to be a small (close to zero) relationship with somatic anxiety, self-confidence, and performance. Based on these results, competitive anxiety and self-confidence have a very small, almost zero degree, correlation with performance. After attaining these findings, Moore (2003) indicated that PST does not show any significant importance for increasing performance and therefore should not be used when its main purpose is to try to enhance performance.

There are numerous studies that support Moore’s (2003) statement that PST has a negligible effect on performance. In addition, the research on PST shows that there are widely variable findings for different PST techniques, such as: self-talk, imagery, arousal regulations, and even goal setting. The research on PST will be discussed below and opposing findings in each technique will be identified.

**Self-Talk**

Self-Talk is the act of talking to oneself, which has been alternatively seen as both detrimental and beneficial in sports. This technique is most often used to break a bad habit, focus one’s attention, build confidence, prepare for competition, and even change moods (Botterill & Patrick, 1996; Nideffer,
Research done by Van Raalte, Brewer, Cornelius, Petitpas (2006) investigated the idea that athletes seen using positive self-talk would be perceived more favorably than the same athletes seen engaging in negative self-talk. The studies consisted of ninety-four undergraduate psychology students and found that athletes who used positive self-talk were perceived more favorably than athletes using negative self-talk. A further indication of the beneficial effect of positive self-talk beyond the studies that find a positive influence tennis player performance and on the perception of those players by observers, is another study by Van Raalte, Cornelius, Britton and Hatten (2000). The Van Raalte (1994) study looked at eighteen tennis players to investigate both the antecedents and consequences of self-talk during competitive tennis performance. The findings reveal that all of the athletes used some amount self-talk and gestures during competition and suggest that match circumstances naturally contribute to the generation of self-talk. Therefore, if coaches encourage players to use positive self-talk they could help players obtain positive circumstances. The Van Raalte study also suggests that using positive self-talk is one of the most widely used and effective performance enhancing techniques.

Another supporting study on self-talk was conducted by Dagrou, Gauvin, and Halliwell (1992). They studied forty-six male and female darts throwers to investigate the influence of self-talk on motor performance. The subjects were randomly split into three groups: the positive self-talk group, the negative self-talk
group, and the control group. The positive group was asked to repeat positive self-talk between throws, whereas the negative groups were asked to repeat negative self-talk between throws. The results indicated that the positive self-talk group significantly outperformed the control group, and the control groups significantly outperformed the negative self-talk group. This suggests that self-talk is a very effective strategy for improving performance.

A contrary study, by Rotella, Gansneder, Ojala, Billing (1980) investigated the effect of self-talk on downhill skiers using two questionnaires developed for the study (Coping and Attentional Inventory, CAI; & Mahoney-Avener Inventory). Both the findings based on these two questionnaires, as well as the skiers’ performance indicated that there was no difference between successful and less successful skiers in terms of self-talk. Another study by Highlen and Bennett, (1983) investigated elite swimmers and wrestlers to determine type and effect of self-talk used during competition. Their findings are similar to those of Rotella et al., (1980). Elite swimmer who used more content-based self-talk and less positive self-talk qualified for the Pan American Games more than athletes who used more positive self-talk. Likewise, wrestlers who qualified for the Pan American Games also reported using more critical self-talk during competition, which suggests that positive self-talk is not always correlated with positive performance. One suggestion by Van Raalte et al., (1994) for this finding was that negative self-talk could be used by athletes to increase motivation and therefore achieve improved performance.
The findings concerning the efficacy of self-talk for athletes are inconclusive. In order for research to determine whether self-talk is effective, there are many components that need to be looked at in greater detail before this technique is implemented. Generally, self-talk is more widely viewed as a positive technique and still remains one of the most common techniques implemented by coaches and athletes.

**Imagery**

Imagery is another technique that is widely practiced by athletes in various sports to enhance performance. Imagery can be defined as a mental image that an athlete uses to try to visualize success in their athletic event or performance. The goal of the mental image is to use one’s senses (touch, sight, hearing, smell) to make the image as real and accurate as possible. It is believed that if athletes can recreate the experience they have visualized, then they can be more successful in their sports. A few examples of areas where imagery has been implemented are: when athletes try to perfect skills, reduce negative thoughts, refocus, motivate and visualize success. There are more than 200 published studies that have looked at the efficacy of imagery as a technique to enhance performance.

A meta-analysis conducted by Driskell, Copper, and Moran (1994) sought to review the literature on mental practice (imagery and visualization is called mental practice in the study) to see if there was an effect on performance and investigate the conditions under which mental practice is most effective. The
results of the research indicate that there is a significant positive effect between mental practice and performance. Therefore, mental practice should be used when trying to enhance performance. The research findings also mention that mental practice is most effective in improving tasks, especially tasks that involve cognitive elements. The findings also suggest that the benefits of mental practice will decline over time, and that more mental practice will not necessarily be better.

Similar research by Nordin and Cumming (2005) looked at fourteen elite dancers to investigate the four W's (Where, When, What, and Why) on imagery, and how imagery affected performance. Their findings are similar to other imagery literature, in revealing that dancers use imagery for training, performance, cognitive and motivational reasons. Even though dancers use different types of imagery than those mentioned in sports, they still use them to help enhance performance. Nordin and Cumming’s research also found that positive imagery is used to help with negative performance feedback on self-efficacy and is used to maintain consistent performance, whereas negative imagery negatively affects performance and self-efficacy. Another study worth looking at was done by Nicholls, Polman, and Holt (2005). They used four high performance golfers to investigate the effect of imagery on intensity and frequency of flow states and golf performance. Again, this research supports the results of the studies mentioned above; in finding that imagery helps improve performance, as all four golfers improved their putting scores. This study found
that all four golfers demonstrated an increase in mean global flow frequency and that three out of four demonstrated an increase in global flow intensity, which are both part of flow experience.

On the other hand, there is also research that does not support imagery as an effective technique for improving performance. Research conducted by Lamirand and Rainey (1994), for example, investigated eighteen female basketball players to see whether either imagery or relaxation techniques could improve foul shooting performance. The findings show that after four training sessions over the course of three weeks, the imagery group experienced a decrease in foul shooting performance. For the relaxation group, shooting performance did improve slightly but not significantly.

A similar research study by Lerner, Ostrow, Yura, and Etzel, (1996) looked at twelve female basketball players to investigate the effects on foul shooting of imagery and goal setting, both individually and in combination. In this study, four athletes were assigned to each group, and the findings show that three out of the four athletes in the goal setting group, as well as one athlete in the combined goal setting and imagery group, improved their foul shooting scores. However, three out of the four athletes in the group that used solely imagery showed a decrease in performance.

A third study, conducted by Jordet (2005) also sought to determine whether imagery could affect perception (ability to perceive what’s taking place on the field and future actions) in three elite soccer players. The findings are
similar to the basketball foul shooting research recounted above, in showing that two of the three participants displayed improved perception, but only one athlete demonstrated slightly improved performance. Therefore, the findings of these three studies taken together, suggests that imagery is not an effective technique for enhancing athletic performance.

To date, imagery and self-talk research studies have produced inconsistent results, sometimes suggesting a positive effect on performance, sometimes a negative effect. Despite an inconclusive answer to whether imagery helps or hurts performance, however, many athletes and coaches continue to use this technique. Because the research is not consistent, it is all the more important that athletes and coaches consider appropriate time, designs, and protocols, when implementing imagery techniques to enhance performance.

Goal-Setting

Another technique that has been widely used by researchers to enhance performance is goal setting. Goal setting is a technique that requires athletes to consciously think of what they would like to achieve (Kaufman, 2008), and set long-term and short-term goals to attain their goals. Goal setting has been gaining in popularity ever since a 1985 study by Locke and Latham encouraged sports psychologist to start investigating the efficacy of this technique. Prior to their research, goal setting was virtually non-existent in the field of sports psychology. Their research found that athletes who set goals do experience enhanced performance, and furthermore, that athletes who focused on setting
both long-term and short-term goals showed the most improvement in performance.

Support for the Locke and Latham (1985) findings was provided by research done by Tenenbaum, Weinberg, Pinchas, Elbaz, and Bar-Eli (1991). Tenenbaum et al., (1991) used 214 students to investigate whether “sit-up” performance was improved when participants used short-term, long-term, and combined short-term/long-term goals. The results were consistent with the results first achieved by Locke and Latham in finding that “sit-up” performance increased when study participants set either short-term or long-term goals. In addition, the study observed the greatest improvement in performance among participants who set a combination of both short-term and long-term goals.

Further support for these finding came in the form of research conducted by Weinberg, Bruya, Longino, and Jackson (1988). The Weinberg research studied 255 elementary school children in physical education classes and found that the goal setting groups significantly outperformed control groups who were simply told to do their best. Participants in this study performed sit-ups over a ten-week period, and findings indicated that there was an improvement in sit-ups performance, with the most improvement seen near the end of period.

Another research study by Goudas, Laparidis, and Theodorakis (2007) tested the effects of goal setting on the endurance performance of seventy-five female cycle athletes (as measured by average heart rate during cycle riding). The participants were split into four groups, each with different goals. Group 1
had both verbal and written goals for lowering average heart rate. Group 2 participants set up personal goals for lowering average heart rate and for improving performance time. Group 3 set goals only to improve performance in terms of time. Finally, Group 4, the control group, had no goals set and was simply told to do their best. The results showed that there was an overall improvement in the average heart rate across all three goal-setting groups, and no improvement in average heart rate in control group (Group 4).

In contrast to the results of the Goudas et al. (2007) study, there is also research that shows that goal setting does not have an effect on performance. A research study done by Weinberg, Bruya and Jackson (1985), for example, showed no significant effect between goal setting groups and a control group. The research investigated the efficacy of goal setting on “sit-up” performance for a group of ninety-six college students over a five-week period. The subjects were assigned to either one of the goal setting groups, which had specific goals, or to a control group, where participants were simply asked to do their best. Unlike in the study by Goudas et al. (2007), there was no difference in performance between the three goal-setting groups and control group.

Another study by Lane and Streeter (2003) also aimed to investigate the effectiveness of goal setting on performance. They observed seventy-two basketball players engaged in a two-minute shooting test in which the participants tried to make as many shots as possible. After the first trial run, the participants were assigned to one of four groups: the easy goal group, the
difficult goal group, the unrealistic goal group, or the no goal group. In the easy group, the goal was reached if a player made just four baskets. In the difficult group, the goal was reached with eight baskets. In the unrealistic group, the goal was reached with twelve baskets. The findings indicate that there was no significant effect on the number of shots made, regardless of the group, which indicates that goals had no significant effect on performance.

As we have seen with imagery and self-talk, the goal setting technique has had mixed results when it comes to enhancing performance. Also similar to self-talk and imagery, however, despite the mixed trial results, goal setting is still widely used in sports today.

Moreover, when we look at the research on all of the PST techniques combined, there are still mixed findings. Research that has measured the effects of two or more PST strategies combined, has found that even among those techniques that have been found to be effective, there are still mixed findings. Moore (2003) reviewed twelve empirical studies that have used more than one strategy and found that only six of those studies showed improvement in sports (for further review see, Moore 2003; Gardner and Moore 2006). Given these inconsistent findings, Moore suggested that these single or package interventions should only be used in experimental settings.

In conclusion, sports psychologists have used psychological skill training (PST) techniques derived mostly from cognitive behavioral strategies to assist athletes enhance their performance. They believed that athletic performance
could be improved if athletes were capable of reducing their anxiety and negative thoughts or increasing their self-confidence. Moreover, some of these PST techniques were designed to help athletes recognize ineffective thoughts (by building awareness), thereby allowing them to look for possible solutions to correct them (Robinson, 1999; Bernier et al., 2009; Orlick, 2008). It was believed that the ability to reduce anxiety or achieve awareness and correct or replace an ineffective thought would increase performance.

Besides the research on PST techniques being inconsistent and disappointing, it has also been suggested that athletes may not benefit from techniques that encourage suppressing or replacing anxiety and negative thoughts. A number of research publications have indicated that the suppression and replacement of these states could in fact increase the frequency and amount of those negative states (Thompson et al., 2011, p.100; see, Beilock, Afremow, Rabe, & Carr, 2001; Gardner & Moore, 2006; Janelle, 1999; Wegner, 1994). As Thompson et al. found in their 2011 study: “A large body of evidence suggests that attempts to suppress unwanted thoughts may lead to cognitive interference, as thought suppression paradoxically increases the frequency of the thoughts the person wishes to avoid”(Thompson et al., 2011, p.111; see Wegner 1994).

One of the alternatives to PST techniques that has been the most adopted by sports psychology consultants and gained empirical support is Mindfulness. As discussed earlier, Mindfulness is the ability to accept one’s thoughts and experiences without being judgmental, which can in turn enhance athletic ability
(see, Gardner & Moore, 2004, 2006, 2007; Moore, 2009, Thompson et al. 2011). Thompson et al. (2011) finds that in addition to enhancing performance, Mindfulness improves athletes’ ability to accept worries, anxiety, and negative thoughts (as well as other concerns that can sidetrack awareness) and thereby reduce the frequency with which athletes experience anxious and negative thoughts.

**Mindfulness Meditation**

Jon Kabat-Zinn (2003) defines mindfulness as, “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmental to the unfolding of experience moment by moment” (p.145). By practicing mindfulness meditation, one trains one’s mind to be less irritable and more secure (Kabat-Zinn, 1990). Kabat-Zinn (1990) further describes mindfulness as the ability to become aware of each moment, to notice each thought as it comes to mind, and to not give one thought more value than another. In other words, the goal of mindfulness training is to become non-judgmental about one’s thoughts. In this way one builds a stronger mind by developing the ability to become more aware of the present moment. Each time someone who practices mindfulness notices that her mind is wandering, she can bring her focus back to center, by focusing on something like breathing (focal point). In this way it is possible to build a stronger and more effective mind by learning to accept each thought that enters one’s mind, and as the mind becomes stronger, working with resistance rather than struggling against the
resistance. Kabat-Zinn (1990) also discusses how one develops patience and non-judgmental practices by learning to accept wandering thoughts without blame or self-criticism.

While meditative practices exist in virtually all religious traditions (Walsh & Shapiro, 2006), mindfulness meditation is primarily based in Buddhism, though it has also been widely represented in Tibetan meditation. Mindfulness meditation is one of the two traditionally identified forms of meditative practice, along with concentrative meditation (Goleman, 1988). Mindfulness meditation, also referred to as "insight meditation" or "Vipassana practice," is playing an increasingly large role in defining how meditation can contribute to therapeutic growth and personal development (Kristeller, 2007). Until recently, mindfulness meditation was not seen in Western culture, but over the past four years, more than 150 research articles and 20 books have been published on mindfulness meditation methods. Many Westerners have taken up mindfulness meditation methods and have begun practicing both on their own and in teacher-led groups (see, Kabat-Zinn, 2003).

*Impact of Mindfulness in General Psychology*

Research by Randolph, Caldera, Tacone, and Greak (1999) measured the effects of mindfulness meditation training on pain reduction, by providing an eight-week Mindfulness Based Stress Reduction (MBSR) intervention to seventy-eight chronic pain patients. The research investigated the pre and post intervention findings and found significant improvements in rating of pain and
management of pain, indicating that mindfulness-based stress reduction interventions help with chronic pain.

Another research study by Shapiro, Schwartz, and Bonner (1998) studied the effects of an eight-week mindfulness meditation-based stress reduction (MBSR) program on seventy-three pre-medical and medical students using an experimental group and a wait list control group. For both groups—the experimental group and wait list control group—the findings show there was a reduction in self-reported state anxiety and trait anxiety as well as an increase in empathy levels and a reduction in depression. A similar study by Reibel, Greeson, Brainard, and Rosenzweig (2001) investigated the effects of MBSR intervention pre- and post-training on 121 medical patients with variety of medical diagnoses, and found significant improvements in both medical and psychological symptoms.

In addition to the research mentioned above, additional evidence for the effectiveness of mindfulness mediation practices in the medical field has been extensively reviewed by Baer (2003). In his research review, Baer finds support for the belief that mindfulness-based interventions help improve psychological functions, relieve a wide range of chronic pain issues, and reduce mental health problems. In addition, Baer’s findings suggest that most participants in mindfulness interventions complete the intervention despite the considerable amount homework involved, and continue using the intervention techniques long after they finish the program.
Duration of Mindfulness Meditation Training

The present research used an eight-week mindfulness meditation training to help participants in the intervention group achieve enhanced performance. Numerous research studies have demonstrated that eight weeks of mindfulness meditation intervention can change the brain and immune functions in ways that help participants with stress and anxiety.

A longitudinal MRI study by Hölzel, Carmody, Evans, Hoge, Dusek, Morgan, Pitman, and Lazar, (2010) examined the effects of the Mindfulness Based Stress Reduction (MBSR) program on twenty-seven participants. The research investigated the correlation between changes in perceived stress and changes in amygdaloidal gray matter density. The findings were consistent with the researchers’ hypothesis that there is a significant correlation between perceived stress and changes in the amygdaloidal gray matter. Furthermore, the study also found that the greater the decrease in stress level, the greater the decrease in gray matter density in the right amygdala. The researchers indicate the importance of these findings in pointing out that the amygdala is one of the most important limbic structures, which receives sensory information. When the amygdala receives this information it sends it to other subcortical structures. As mentioned by LeDoux (2000), in this way the amygdala allows participants to mediate “stress related behavior and physiological effects,” such as stress-hormone release, increased blood pressure, and facial expression showing fear.

Another study by Hölzel, Carmody, Vangel, Congleton, Yerramsetti, Gard,
and Lazar (2011), looked at thirteen participants to investigate the brain regions that change during the eight-week MBSR intervention. The findings were very similar to the findings in the Hölzel et al., (2010) study. The eight-week intervention was seen to produce longitudinal changes in brain gray matter concentration when the mindfulness group was compared to the control group. The main increase in the gray matter concentration was found in the posterior cingulate cortex, the left temporo-parietal junction, and the cerebellum. These brain regions are important for emotional and cognition regulation, self-referential, learning and memory processes, social cognition, and conscious experience of the self.

Similar research by Davidson et al., (2003) used forty-one participants to investigate the effects of an eight-week meditation program on brain and immune functions. The study split the participants into two groups: a mediation group (n=25) and a wait list group (n=16). The findings were astounding. The research indicated that meditation training led to significant changes in anterior activation asymmetry. This means that if mindfulness meditation can increase left-side anterior activation, then mindfulness mediation can produce more adaptive responses to anxiety and stress. It can also increase the positive effects by reducing anxiety and other negative effects. These affects are directly associated with left-side anterior activation.

In summary, mindfulness meditation practices have been shown to have a positive effect on psychological well being. These practices help build and
improve brain and immune functions that are crucial for dealing with stress and anxiety. Specifically, the brain functions that are increased help regulate emotion, improve cognitive function, and raise awareness and attentions, among other effects. All the research reviewed here used an eight-week training program in mindfulness meditation and demonstrated that an eight-week training period has longitudinal effects on brain and immune functions. Accordingly, eight-weeks has been shown to allow enough time forebrain functions to change and for study participants to learn and adapt to mindfulness meditation goals. Based on these findings, the research study discussed below also employed an eight-week mindfulness mediation training program for the intervention group enough time to allow participants’ brains to change and absorb the positive effects of the training.
CHAPTER 3
METHODS

Participants

The participants in this research study consisted of one hundred female amateur tennis players who were recruited from Boston area women’s tennis leagues and who compete at large tennis clubs. These participants have been playing in tennis leagues for at least five years, most have been playing tennis for ten or more years. The age range is 40 to 60 years old, with an average age of 50. In order to eliminate participants who might have artificially swayed the results, each participant was asked five exclusion questions. The first four exclusion questions pertained to whether or not the subject had any relevant experience using sports psychology techniques as a means of improving performance during tennis matches. Prospective participants who indicate that they had used meditation techniques on these questions were excluded from the study (See Appendix A). Furthermore, participants who answered, “yes” to question number five, which was: “Are you currently suffering from an injury that could prevent you from competing for at least the next month,” were also automatically excluded, as gathering relevant data and determining accurate results required that subjects compete on a regular basis over the course of an entire tennis season.

The inclusion criteria for study participants, on the other hand, required
that they be able to compete in the women’s tennis league for the duration of the six-month study. This was essential in order to observe whether participants experienced any relevant change in competition performance following their mindfulness training. Another criterion for inclusion required that participants sign and approve the informed consent form prior to the start of the research. Participants who failed to sign the informed consent form were excluded from the research (See Appendix B).

Protection of Human Subjects

All participants were required to sign informed consent forms (IC) before the start of the research and before any data collection was conducted. The research did not begin until each participant understood, signed, and returned the informed consent form (see Appendix B). An application filed with the Institutional Review Board received approval to go ahead with the research.

Procedures

Participants in this research study were recruited from women’s league teams at various Boston-area tennis clubs. During recruitment the researcher did not mention mindfulness meditation but instead only used general sports psychology terminology. The researcher attended either a pre-season team meeting or the first practice for those teams that had members who were interested participating. The researcher then handed out informed consent (IC) forms (appendix B), asked the participants to sign the forms, and gave each participant the first, introductory training CD.
Each participant was asked to fill out three scales—The Mindful Attention and Awareness Scale (MAAS), The Kentucky Inventory of Mindfulness Skills (KIMS), and The University of British Columbia Cognition Inventory (‘Letting-Go’ Revised Version UBC-CI-LG)—the day before her first match (on Tuesday of Week 1 of the study), at the mid-point of training (Week 4) and at the end of training (Week 8). The three scales will be accessible via email (participants’ email addresses and phone numbers were obtained on the IC forms). The email included a link to the Boston University Qualtrics Survey (see, Boston University Qualtrics Survey Account section), where each participant was able to find the three scales (MAAS, KIMS, UBC-CI-LG) and complete the corresponding information.

Participants who received a CD from the researcher were randomly assigned to either the intervention group or a control group. The intervention group received Mindfulness Meditation Training (MMT) CD that served as their mindfulness training. The MMT CD was designed to help participants increase awareness of breathing and body sensations, and help participants recover awareness when their minds wander (appendix D). The mindfulness meditation techniques on the CD are designed to train participants in awareness and acceptance, and in being non-judgmental in each moment. The control group received a doubles strategy CD. The doubles strategy CD reviewed three tactics that the participants already knew. The three tactics were: playing the lobbing game, playing the middle of the court, and a situation of playing poorly (appendix
E). All participants assumed that they were receiving the same sports psychology CD training. Both groups were then asked to listen to their CDs four times a week and to fill out log time sheets, designed to ensure that participants recorded the time they listened to their CDs (appendix C). The CD training session lasted eight weeks, bringing the total number of sessions participants were expected to listen to their CDs to thirty-two. All participants, regardless of their assigned group, were informed that the CD that they received was a sports psychology training CD. Neither mindfulness meditation training nor tennis strategy was mentioned.

The sixteen weeks of the research was conducted as follows:

**Week 1 (A)- Baseline**

After each participant signed the informed consent form, they were randomly assigned to either the intervention group that received an MMT CD, or the control group that received a Tennis Strategy CD. Moreover, to assess baseline measurements, each participant was asked to fill out three scales (MAAS, KIMS, UBC-CI-LG) the day before her first match (on Tuesday of Week 1 of the study). The scales were provided via email, with instructions as follows: “Please sit quietly and fill out the three scales that are provided to you.” Subjects were then asked to click on a link that took them to the Boston University Qualtrics Survey website where the scales were hosted. In addition, they also received another email that asked them to click on a link that again took them to the Boston University Qualtrics Survey website, where their log time sheets (See
appendix C) were located. The instructions from the researcher on the website stated: “During your participation in this research, I would like you to listen to the sports psychology training CD four times a week, in advance of your match. You are also asked to log the times that you have listened to the CD. The training research will fall short of necessary information if the log entries are not filled out completely, four times a week, for a total of 32 log entries over the eight week training.” Baseline measurements were a crucial part of the research, providing data that reflected each participant’s individual starting point in their training.

**Week 1 (B)**

The training itself began during stage Week 1 (B), with participants expected to listen to the CD on their own and provide the researcher with their log time sheets through the Boston University Qualtrics Survey website. During each week of training the participants were reminded via text message or email three times a week (Thursday, Saturday, and Monday) with the following message: “Please take 10 minutes of your time today to listen to the sports psychology training CD.” Finally, the day before matches (Tuesday) participants received an additional text message with the following message: “Please finish your log sheets detailing each of the four times that you have listened to the sports psychology CD this week. The deadline to finish your log sheets is tomorrow morning.” Participants then filled out their log sheets on the Boston University Qualtrics Survey website and their answers were then forwarded
directly to the researcher. As a result, the researcher received all log sheets by Wednesday morning of every week.

**Weeks 2 & 3**

The second and third week followed the same procedure as Week 1 (B). The Wednesday morning deadline (prior to participants’ matches) remained in place.

**Week 4**

During the fourth week, participants received the following text message or email (according to the participant’s stated preference) on Thursday, Saturday, Monday and Tuesday morning: “Reminder, this week you have two tasks: First, please fill out the three scales. This will be the second time you will have filled out the scales. Again, you will be provided a link via email that takes you directly to the scales, on Thursday morning. Additionally, please fill out the log time sheets of your sports psychology training CD for this week.” This was the mid-point of the training for this study.

**Weeks 5, 6, & 7**

In Week 5, Week 6 and Week 7, the participants followed the same procedure as in Week 2 and Week 3. The deadline for log sheets was always the Wednesday morning prior to participants’ next match.

**Week 8 –Final**

Upon completion of the eight-week sports psychology training CD, the participants were asked to complete a final scale entry (similar to the entry
completed at the beginning and halfway mark of the study), following the same procedures as in Week 4.

**Week 9-16**

Once the eight-week training session was concluded, the following eight weeks of research were dedicated to collecting the performance data (Weeks 9-16). The results were retrieved by the researcher from the official website of the team’s league, where the scores were posted by team captains after their matches were completed (see, section Measures for details on how performance data was measured).

**Boston University Qualtrics Survey Account**

The researcher posted the three scales and log time sheets for participants using the Boston University Qualtrics Survey. Once the researcher posted the three scales and log time sheets, the researcher entered all of the participants’ email addresses on the website. Once the emails were entered, the researcher sent out a group email stating, “Please click on the link below and fill out the three scales and log time sheets that are provided to you.” The participants were then taken directly to the three scales and log time sheets when they clicked on the link. After the participants filled out the scales and log time sheets they clicked on the “Done” button at the bottom of the link and the researcher was notified that the scales and log time sheets had been completed. This notification, which was received by the researcher on the Boston University Qualtrics survey account, let the researcher know who filled out the scales and
log sheets and when they were completed. The researcher was able to access and view the data from all of the participants using the Boston University Qualtrics Survey account.

**Measures**

**Dependent Variables**

Solely the number of matches won cannot accurately indicate the strength of a tennis player’s performance. Another indicator, namely the number of games within each set that were won over the course of a tennis season was also an important indicator of strength and improvement. Therefore, these two different factors - matches won, and games won –were used to evaluate the subjects’ performance. This data, for both the intervention group and control group, was collected from the official website of the Boston women’s tennis team league, from Week 9 to Week 16.

**Independent Variables**

The Mindful Attention and Awareness Scale (MAAS) is a fifteen-item scale that measures the extent to which participants are aware of and pay attention to experiential moments. The MAAS scale, developed by Brown and Ryan (2003), is based on a six-point Likert scale ranging from 1 (almost never) to 6 (almost always). The participants choose a point on the scale that specifies as nearly as possible the frequency with which each statement is faced and experienced (Brown & Ryan, 2003). As mentioned in the Brown and Ryan (2003) research, the items that are presented in the scale fall in the emotional, cognitive, physical,
interpersonal and general domains (see, p.825). In addition, participants are asked to relate to each statement precisely, rather than relating to each statement according to how they think they should, in order to control for socially desirable responses (see, Brown & Ryan, 2003). Examples of the MAAS item scales include: “I find it difficult to stay focused on what's happening in the present,” “I rush through activities without being really attentive to them,” and, “I find myself preoccupied with the future or the past.”

Confirmatory Factor Analysis for the MAAS scale was done with a student sample (n=327) and general adult sample (non-college adults) (n=239) (see, Brown & Ryan, 2003). All fifteen items in the scale for both samples were significantly related to the latent factor, and thus have good internal consistency (reliability), with a student sample alpha of 0.82 and a general adult sample alpha of 0.87 (Brown & Ryan, 2003, p.827). The MAAS scale also demonstrates convergent and discriminant validity, which was consistent with the theory and hypothesis in the Brown and Ryan (2003) research. The Brown and Ryan (2003) research (n=1,253) found that the MAAS scale: (1) has modest positive correlations with NEO-PI (Openness to Experience) and NEO-FFI (Openness to Experience), (2) is correlated with MMS (Mindfulness/Mindlessness Scale), (3) is positively related to PANAS (Positive and Negative Affect Schedule) scale and hedonic tone, and (4) is inversely related to CES-D (Center for Epidemiologic Studies Depression Scale) and BDI (Beck Depression Inventory) measures of depression, as well as STAI (State–Trait Anxiety Inventory) and POMS (Profile of
Mood States) measures of anxiety. Finally, it has been shown that participants with higher scores on the MAAS scale show higher degrees of mindful awareness and attention to experiential moments and behavior. Moreover, since these individuals are more aware/mindful of their behavior, they are better equipped to alter their states. On the other hand, individuals with low scores on the MAAS scale are more likely to be anxious and ruminative.

The Kentucky Inventory of Mindfulness Skills (KIMS), developed by Baer et al. (2004), is a thirty-nine-item scale that focuses on evaluation of four mindfulness skills: observing, describing, acting with awareness, and accepting without judgment. The first skill “observing,” consists of twelve items and measures the degree to which one observes, notices, and attends to internal stimuli (e.g., bodily sensations, cognitions) and external stimuli (e.g., smells, sounds). An example of observing would be: “I pay attention to whether my muscles are tense or relaxed.” The second skill, “describing,” consists of eight items and measures the degree to which one is able to describe, label, and notice observations in a non-judgmental way. An example of describing is: “I can easily put my beliefs, opinions, and expectations into words.” The third skill, “acting with awareness,” consists of ten items and measures the degree to which participants consciously pay full attention to their activity. A participant who exhibits “acting with awareness” would say, “When I’m reading, I focus all my attention on what I’m reading.” The fourth and final skill is “accepting without judgment,” which consists of nine items and measures the degree to which one
notices reality without judging, avoiding, changing, or escaping. An example of “accepting without judgment” would be, “I tend to evaluate whether my perceptions are right or wrong” (see, Ciarrochi & Bilich, 2006; Frewen et al., 2007).

For the KIMS scale, participants were asked to use a 5-point Likert scale, ranging from 1 (never or very rarely) to 5 (almost always or always true). The higher the scale score, the more mindful the participants. The KIMS scale has a strong internal consistency, as shown by research by Baer et al. (2004). In their research, a sample of 205 undergraduates completed the seventy-seven-item version of the KIMS scale, and found high alpha coefficients for all four skills. An alpha coefficient of 0.91, 0.84, 0.83, and 0.87 was calculated for Observe, Describe, Act With Awareness, and Accept Without Judgment, respectively. Furthermore, a second study, which had a slightly larger sample size of 215 undergraduates, also found high alpha coefficients. The research by Baer et al. (2004) also indicated strong test-retest reliability, as evidenced by the high alpha coefficients for all four skills. These scores were 0.65 for Observing, 0.81 for Describing, 0.086 for Acting With Awareness and 0.83 for Accepting Without Judgment.

In addition to the KIMS scale’s strong reliability, the research by Baer et al. (2004) also indicates that the KIMS scale has strong content validity, especially when correlated with the MAAS scale (see, Baer et al., 2004, p. 202). In contrast, the KIMS scale has a negative correlation with the neuroticism scale of the NEO
Five Factor Inventory (NEO-FFI). The Acceptance and Action Questionnaire (AAQ), which measures experimental avoidance, also shows a significant negative correlation with the KIMS scale (with the exception of the Observe skill). Finally, the Toronto Alexithymia Scale (TAS), similar to the AAQ scale, shows a significant negative correlation with KIMS. However, KIMS has a positive correlation with Openness and Conscientiousness scale of NEO-FFI. KIMS also has a significant positive correlation with emotional intelligence in the Trait Meta-Mood Scale, especially with the Describe skill.

Due to the fact that the KIMS scale is strongly correlated with the MAAS scale, the current research will have strong reliability and validity when investigating each participant’s degree of mindfulness.

The University of British Columbia Cognitive Inventory- ‘Letting-Go’ Revised Version (UBC-CI-LG) scale was modified from the University of British Columbia Cognition Inventory (UBC-CI) that was developed by Woody, Taylor, McLean and Knock (1998). The UBC-CI scale is a seventy-seven-item instrument that was developed to “maximize the specificity of cognitive content and to assess a wide variety of cognitions” (Dobson, 2009, p.141). The cognitions are arranged into six subscales: (1) Panic, which consists of eleven items on the scale (e.g., “I am going to suffocate”), (2) Worry, which consists of eight items on the scale (e.g., “I am afraid I will lose my job”), (3) Obsessive-Compulsive, which consists of twelve items on the scale (e.g., “I think terrible things”), (4) Somatic Preoccupation which consists of twelve items on the scale
(e.g., “My muscles feel weak or paralyzed”), (5) Depression which consists of nineteen items on the scale (e.g., “I’m a loser”), and (6) Social Fears which consists of fifteen items on the scale (e.g., “I am going to be embarrassed”). These six subscales were used on a weekly basis to identify the extent to which participants were disturbed and bothered by each thought.

For the research undertaken in the present study, a modified version of the UBC-CI scale was administered. The modified scale that was used is called the University of British Columbia Cognition Inventory- ‘Letting-Go’ Revised Version (UBC-CI-LG). Frewen et al. modified this scale in 2007 to better target the research question that was being investigated. The modified UBC-CI-LG scale was used in this study because it targets the research hypothesis that mindfulness meditation training would be an effective strategy for decreasing the frequency of negative thoughts and helping participants with the ability to let-go of negative thoughts.

The revised scale asked participants two important question: to identify the frequency with which they encounter each thought, and to rate their ability to ‘let-go’ of these thoughts if they did occur. The researcher then gave participants the exact instructions from the UBC-CI-LG scale, which followed the original UBC-CI instructions and asked: “Please also indicate how troublesome each thought has been for you, that is, how difficult it has been to ‘let-go of’ (not get stuck on, not keep thinking about) the thought if it occurred”(Frewen, et al., 2007, p.761). This research used the “frequency” and “Letting-Go” ratings devised by
Frewen et al. (2007). The “frequency” scale used scores from 0-4, ranging from “not at all” to “all the time.” The “difficulty of Letting-Go” scale also used scores from 0-4, ranging from “not at all” to “extremely.” Following the research of Frewen et al. (2007), after the participants accrued a score on these subscales, the scores were added together. In order to establish independence over certain variables, this research also used “the sum of difficulty letting-go ratings and average over the number of negative automatic thoughts frequency items that the Letting-Go ratings were based upon” (Frewen et al., 2007, p.761). This research mainly focused on three subscales, the same subscales used in the 2007 study by Frewen et al. These were worry, depression, and social fear frequency and Letting-Go scales. Frewen et al. (2007) explains that these three subscales were chosen because they are appropriate to a typical sample and will “provide a means of reducing risk of Type I error as a result of the conduct of multiple statistical tests” (Frewen et al., 2007, p.761).

**Training Design**

This research study used a mindfulness meditation training CD developed expressly for this research. As explained earlier, the intervention group used this mindfulness meditation training CD (appendix D for the script used in the MMT CD) for eight weeks of the training. The CD was based on scripts that train mindfulness of the “Breath” and mindfulness of “Thoughts, Feelings and Physiological Sensations” (see, Khazan, 2013).
These two scripts were central to the training as they are the main focus of Gardner and Moore’s research (2004), which suggests that the certain use of "Breath" and "Bodily Sensations" are mindfulness techniques that can increase awareness and attention, and can in turn enhance performance (Gardner and Moore, 2004). In addition, by learning these mindfulness techniques, participants could experience their thoughts, without judgment, in the present moment, whether they were negative or positive. The goal of mindfulness is not to avoid or suppress negative thoughts, but rather to become more aware, accepting, focused, and non-judgmental of those thoughts as they arrive from moment to moment. Hence, the training was intended to provide participants with an approach that differs from more common strategies that encourage avoidance and suppression. The researcher also developed the doubles tennis strategy training CD (See appendix E for the script used in the Tennis Strategy CD). The goal of the doubles tennis strategy training CD was to give the control group as well, but to ensure that this CD would not tap into any mindfulness meditation skills. The strategies that are explained on the CD are doubles strategies that the participants were already knowledgeable about, and had already been practicing for numerous years. In this way, both groups had a CD that they used for training. In addition, participants did not know whether they were in the intervention group versus the control group. As mentioned above, both training CDs were explained to the participants as being sports psychology training CDs.
Research Design and Plan for Analysis

The research used the JMP Pro statistical analysis program. The multivariate analysis of variance (MANOVA) was the first statistical analysis conducted. The MANOVA was used because the research has more than one dependent variable and the research wanted to investigate if there is a relationship between the dependent and independent variables, and to investigate if the independent variable has a significant effect on any of the dependent variables. Moreover, MANOVA omnibus test purpose is to determine if the analysis should proceed with further tests. A statistically significant finding (p value less than 0.05) with the MANOVA would indicate that the Mindfulness Meditation Training (treatment) has significant effect on at least one of the dependent variables and would therefore warrant follow up ANOVAs.

If the ANOVA indicated significant differences in mindfulness and performance that occurred during the time of the intervention (Week 1 to Week 4 to Week 8) in the intervention group or control group, then follow up t-tests would be conducted to determine the specific time interval where significant differences were found (i.e., Week 1 to Week 4, Week 1 to Week 8, or Week 4 to Week 8). Three hypotheses were tested: 1) That MMT would help tennis players to accept anxiety and negative thoughts. 2) That MMT would allow tennis players to be more mindful and present in the moment (more aware). Finally, 3) That MMT would decrease the frequency of negative thoughts and provide tennis players with the ability to let-go of negative thoughts.
A second statistical analysis was also conducted after the eight-week training. This analysis was conducted to investigate if there was an association between mindfulness and the frequency of negative thoughts and perception of difficulty of letting them go, as measured by the UBC-CI-LG (depression, worry, social fear) scale. To do this, the mindfulness meditation scales (MAAS and KIMS) were correlated with the UBC-CI-LG scale. The correlation analysis examined associations between participants 'letting-go' scores and mindfulness measures after controlling for negative thoughts. This analysis tested to see if MMT meditation training decreased the frequency of negative thoughts and provided participants with the ability to let-go of these thoughts if they did occur. Furthermore, this analysis also provided data concerning the effectiveness of MMT, as it was hypothesized that there would be a negative correlation for the intervention group between MAAS and KIMS scales, when correlated with the UBC-CI-LG scale. This correlation would provide evidence that as participants’ mindfulness meditation training ability increases, they would experience a decrease in the frequency and amount of negative thoughts.

The third analysis was conducted after the completion of the sixteen weeks of research and compared participants’ tennis results from Week 9-16. The goal of the final analysis was to indicate whether MMT enhances tennis performance. This analysis used Independent samples t-tests to compare the number of games and matches won and lost by both groups. The reasons for using Independent samples t-tests are as follows: First, the research had only
one intervention group (MMT); second, the participants were randomly assigned to either the intervention or control group; and finally, the research compared two different samples of participants. These factors permit the use of this analysis in order to indicate if there was a significant difference between the two groups. Independent samples t-test compared the mean number of matches and games won and lost between the two groups to see if there was a significant difference between the two groups and indicate whether MMT helps enhance performance.

The final statistical analysis that was done at the completion of the research was the Multiple Regression Analysis for the intervention group. The Multiple Regression Analysis examined the relationship between matches won, matches lost, games won, or games lost, and any of the three scales (MAAS, KIMS, UBC-CI-LG). If there is a relationship between any dependent variable and independent variable, Single Regression Analysis will be computed to show which scale indicates greatest relationship with any one of the dependent variables.

**Contributions of the present research**

There are a few contributions that the present research will be able to accomplish. First of all, the present research introduces a unique script for Mindfulness Meditation technique to help athletes improve performance, and advances the sports psychology literature. Although physiological skills training techniques have been used for decades to try to enhance athletic performance, PST research to date indicates that these techniques have contradictory and
inconsistent results. Furthermore, research on some of PST strategies suggests that the suppression and avoidance of negative thoughts could actually increase the amount and frequency of these thoughts. Therefore, this research could lead to new directions or techniques that athletes use when they are trying to enhance performance.

In addition, this research will help advance the limited research conducted so far on mindfulness meditation interventions in sports, and the effects it has on performance. Finally, this research will be the first to test the effect of mindfulness meditation training on tennis players’ performance.
CHAPTER 4
RESULTS

The research concluded with n=80 participants from a total of n=100 participants that were recruited. Table 1, below, represents the participants’ average age, years of experience playing tennis, number of times they listened to the CD, and level at which they compete (1 being highest to 4 being lowest). In Week 1, all 100 participants filled out the scales and there was no difference in age, experience, or competition level between the intervention and control groups. The same was observed at Week 8, after n=8 participants in the intervention group and n=12 participants in the control group dropped out. However, a small difference was observed in the number of times participants in each group listened to the CD in both Week 1 and Week 8, which was that the intervention group listened to their CD more than the control group. One possible explanation for this difference is that the intervention group had never before received Mindfulness Meditation Training and so may have been more interested in it. The control group, in contrast, listened to a sports strategy CD, which they may have memorized or become bored with and so did not bother listening to at same rate.

The dropout rate for the intervention group was a total of 16% (n=8), which indicated that the group overall was highly interested in the training. The dropout rate for the control group, on the other hand, was 24% (n=12), which was slightly
higher, but still demonstrates an interest in the training. One reason why these participants dropped out was that the research study only gave the participants one week to fill out all three scales. The scales included a total of over 150 questions, and if participants did not complete the task on time they were taken out of the study. The intervention group had n=5 participants who did not fill out the scales on time, while the control group had n=8. Another reason participants dropped out was injury; n=1 participant in the intervention group and n=2 participants in the control group chose to leave the research for this reason. A final reason for dropping out was that the participants left for vacation, which prohibited them from finishing the research. There were n=1 participants in the intervention group and n=3 participants in the control group who dropped out of the study for this reason. All told, 42 participants in the intervention group and 38 participants in the control group completed the research, and the research data was based on those 80 participants.
Table 1- Demographics for Intervention and Control groups at Week 1 and Week 8

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention Group n=50 (female)</th>
<th>Control Group n=50 (female)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>95% CI</td>
</tr>
<tr>
<td>Age</td>
<td>50.66</td>
<td>48.95-52.37</td>
</tr>
<tr>
<td>Listens to CD (8)</td>
<td>7.08 (89%)</td>
<td>6.76-7.4</td>
</tr>
<tr>
<td>Level</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Probability</td>
<td>0.3 0.28 0.24 0.18</td>
<td>0.32 0.28 0.2 0.2</td>
</tr>
<tr>
<td>Drop Out Rate</td>
<td>16% (n=8)</td>
<td>24% (n=12)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Intervention Group n=42 (female)</th>
<th>Control Group n=38 (female)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>95% CI</td>
</tr>
<tr>
<td>Age</td>
<td>49.1</td>
<td>47.46-50.73</td>
</tr>
<tr>
<td>Experience</td>
<td>16.12</td>
<td>13.71-18.52</td>
</tr>
<tr>
<td>Listens to CD (32)</td>
<td>29.64 (93%)</td>
<td>28.94-30.34</td>
</tr>
<tr>
<td>Level</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Probability</td>
<td>0.33 0.29 0.19 0.19</td>
<td>0.29 0.24 0.26 0.21</td>
</tr>
</tbody>
</table>

The goal of the present research was to evaluate the following hypotheses. The first hypothesis presented and evaluated was that mindfulness meditation training would help tennis players become more mindful and aware of the present moment. The second hypothesis was that mindfulness meditation training would help athletes accept anxiety prior to and during competition. The third hypothesis that was evaluated was that mindfulness meditation training would help reduce the frequency of negative thoughts and, if tennis players do experience negative thoughts that the training would help improve their ability to ‘let-go’ of those thoughts. The final and main hypothesis of the research that was
evaluated was that mindfulness meditation training would have a positive effect on performance for tennis players.

**Statistical Analyses for Mindfulness**

In order to investigate the effect between dependent and independent variables and to investigate if any of the independent variables have significant effect on any of the dependent variables a MANOVA omnibus test was conducted. In addition, MANOVA omnibus test purpose is to determine if the research should proceed with further tests. MANOVA omnibus test results indicated that Mindfulness Meditation Training had a significant effect on at least some dependent variables ($F = 5.29, p < .001$). Follow up ANOVA tests were conducted to examine differences in mindfulness and negative thoughts between the intervention group and the control group.

The sections and tables below display and discuss the differences and similarities in scores between the two groups.

**MAAS statistics for mindfulness**

**Intervention Group**

The ANOVA test for the intervention group found significant difference in participants’ mindfulness scores from Week 1 to Week 4 to Week 8 with $F(125) = 4.05$ and $p < .05$. Follow up t-tests indicated statistically significant difference in mindfulness scores between Week 1 and Week 4 with $t(123) = 2.02$ and $p < .05$. In addition, significant difference were also found between Week 1 and Week 8
with \( t(123) = 2.75 \) and \( p < .05 \). These results demonstrate that there was a significant increase in the participants' level of mindfulness during the eight-week training for the intervention group. For more information please refer to Table 2.

**Control group**

The ANOVA test for the control group found no significant differences in mindfulness scores from Week 1 to Week 4 to Week 8. This indicates no increase in the participants' level of mindfulness during the eight-week training. Therefore no follow up t-tests were administered. For more information please refer to Table 2.
Table 2- Difference between Intervention Group and Control Group scores on The Mindful Attention and Awareness Scale (MAAS)

<table>
<thead>
<tr>
<th>MAAS</th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>57.97 (12.57)</td>
<td>63.29 (12.25)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125)=4.05</td>
<td>F(113)=0.03</td>
</tr>
<tr>
<td>P-value</td>
<td>0.02</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>57.97 (12.57)</td>
<td>63.29 (12.25)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)=2.02</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 8</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>57.97 (12.57)</td>
<td>65.21 (11.32)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)=2.75</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Week 4</td>
<td>Week 8</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>63.29 (12.26)</td>
<td>65.21 (11.32)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)=0.73</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.47</td>
<td></td>
</tr>
</tbody>
</table>

Note: Means are represented with Standard Deviations in brackets (standard deviation). Degrees of freedom are represented by (df). Bolded scores represent statistically significant differences.

**KIMS- Observing statistics for mindfulness**

The ANOVA test for both intervention group and the control group found no significant differences from Week 1 to Week 4 to Week 8. This indicates that the participants showed no change in ability to notice and attend to internal and external experiences, such as thoughts and sounds during tennis matches. Therefore no follow up t-tests were administered. For more information please refer to Table 3.
Table 3- Difference between Intervention Group and Control Group scores on The Kentucky Inventory of Mindfulness Skills (KIMS), first skill Observing

<table>
<thead>
<tr>
<th>KIMS-Observing</th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>39.26 (6.03)</td>
<td>40.64 (7.5)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125)= 1.24</td>
<td>F(113)= 1.29</td>
</tr>
<tr>
<td>P-value</td>
<td>0.292</td>
<td>0.278</td>
</tr>
</tbody>
</table>

Note: Means are represented with Standard Deviations in brackets (standard deviation). Degrees of freedom are represented by (df). Bolded scores represent statistically significant differences.

**KIMS- Describing statistics for mindfulness**

The ANOVA test for the intervention group and the control group found no significant difference in scores from Week 1 to Week 4 to Week 8. This indicates that the participants showed no change in ability to describe and label their experiences in a non-judgmental manner. Therefore no follow up t-tests were administered. For more information please refer to Table 4.

Table 4- Difference between Intervention Group and Control Group scores on The Kentucky Inventory of Mindfulness Skills (KIMS), second skill Describing

<table>
<thead>
<tr>
<th>KIMS-Describing</th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>23.86 (2.4)</td>
<td>24.31 (1.97)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125)= 2.6</td>
<td>F(113)= 0.58</td>
</tr>
<tr>
<td>P-value</td>
<td>0.078</td>
<td>0.562</td>
</tr>
</tbody>
</table>

Note: Means are represented with Standard Deviations in brackets (standard deviation). Degrees of freedom are represented by (df). Bolded scores represent statistically significant differences.
KIMS- Acting With Awareness statistics for mindfulness

The ANOVA test for the intervention group and the control group found no significant differences in scores from Week 1 to Week 4 to Week 8. This indicates that the participants showed no change in ability to be attentive and engage fully in playing tennis. Therefore no follow up t-tests were administered. For more information please refer to Table 5.

Table 5 - Difference between Intervention Group and Control Group scores on The Kentucky Inventory of Mindfulness Skills (KIMS), third skill Acting With Awareness

<table>
<thead>
<tr>
<th>KIMS-AWA</th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>31.21  (2.96)</td>
<td>30.48 (2.55)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125)= 0.77</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.467</td>
<td></td>
</tr>
</tbody>
</table>

Note: Means are represented with Standard Deviations in brackets (standard deviation). Degrees of freedom are represented by (df). Bolded scores represent statistically significant differences.

KIMS- Accepting Without Judgment statistics for mindfulness

The ANOVA test for the intervention group found significant differences in scores from Week 1 to Week 4 to Week 8 with F(125) = 3.67 and p < .05. Follow up t-tests were administered and significant difference was found in Accepting without Judgment scores from Week 1 to Week 4 with t(123) = -2.05. In addition, significant difference was also found between scores from Week 1 and Week 8 with t(123) = -2.56 and p < .05. These results indicate that the participants experienced an increase in the rate with which they applied labels such as “bad”
after losing a tennis match, and were not able to abstain from labeling the “reality as is” without judgment or avoidance.

For the control group the ANOVA test found no significant differences from Week 1 to Week 4 to Week 8. This indicates that participants showed no change in ability to accept their experience as is without judgment. Therefore no follow up t-tests were administered. For more information please refer to Table 6.

Table 6- Difference between Intervention Group and Control Group scores on The Kentucky Inventory of Mindfulness Skills (KIMS), fourth skill Accepting Without Judgment

<table>
<thead>
<tr>
<th>KIMS-AWJ</th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>21.9 (6.57)</td>
<td>19 (6.25)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125)= 3.67</td>
<td>F(113)= 2.25</td>
</tr>
<tr>
<td>P-value</td>
<td>0.028</td>
<td>0.11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Week 1</th>
<th>Week 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>21.9 (6.57)</td>
<td>19 (6.25)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)= -2.05</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.042</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Week 1</th>
<th>Week 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>21.9 (6.57)</td>
<td>18.29 (6.62)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)= -2.56</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.012</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Week 4</th>
<th>Week 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>19 (6.25)</td>
<td>18.29 (6.62)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)= -0.51</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.614</td>
<td></td>
</tr>
</tbody>
</table>

Note: Means are represented with Standard Deviations in brackets (standard deviation). Degrees of freedom are represented by (df). Bolded scores represent statistically significant differences.
Comparison between intervention and control group in Mindfulness

A comparison of the differences between the two groups reveals that the intervention group increased in their level of mindfulness whereas the control group did not. The MAAS scale shows a significant difference in the level of mindfulness for the intervention group, whereas for the control group there was no significant difference. Moreover, there was no significant difference between the levels of mindfulness on the three KIMS subscales (Observing, Describing, and Acting With Awareness) for both groups, in addition, control group showed no significant difference in the fourth subscale of Accepting Without Judgment. The only subscale where the intervention group exhibited a significant change was Accepting Without Judgment. Scores on this subscale decreased in the intervention groups during the 8-week training.

Statistical Analysis for Negative Thoughts

In order to compare differences in the frequency of negative thoughts and the ability to ‘let-go’ of these thoughts if they did occur between the intervention group and the control group ANOVA tests were conducted.

UBC-CI-LG--‘Worry’ Frequency and Letting- Go statistics

Intervention Group

The results of the ANOVA for the intervention group revealed a significant difference in scores from Week 1 to Week 4 to Week 8 for Frequency of Worry thoughts with $F(125) = 3.19$ and $p < .05$. Follow up t-tests were administered and
significant difference was found in scores from Week 1 and Week 4 with t(123) = -2.51 and p < .05. No other significant differences were found for the frequency of Worry thoughts. Furthermore, no significant differences for Letting-Go of Worry thoughts were found and no follow up t-tests were administered. For more information please refer to Table 7.

**Control Group**

The ANOVA test for the control group revealed a significant difference in scores from Week 1 to Week 4 to Week 8 for Frequency of Worry thoughts with F(113) = 3.3 and p < .05. Follow up t-tests were administered and significant difference was found in scores from Week 1 and Week 4 with t(111) = -2.1 and p < .05. In addition, significant difference was found in scores from Week 1 and Week 8 with t(111) = -2.33 and p < .05. Furthermore, the ANOVA test revealed no significant difference for Letting-Go of Worry thoughts and no follow up t-tests were administered. For more information please refer to Table 7.
Table 7- Difference between Intervention Group and Control Group scores (Frequency and ‘Letting-Go’) on The University of British Columbia Cognitive Inventory- ‘Letting-Go’ Revised Version (UBC-CI-LG)-subscale Worry

<table>
<thead>
<tr>
<th>UBC-CI-LG Worry Frequency/ ‘Letting-Go’</th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>13.14 (3.68)</td>
<td>11.24 (3.11)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125)= 3.19/ 2.94</td>
<td>F(113)= 3.3/ 2.3</td>
</tr>
<tr>
<td>P-value</td>
<td>0.045/ 0.057</td>
<td>0.041/ 0.105</td>
</tr>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>13.14 (3.68)</td>
<td>11.24 (3.11)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)= -2.51/ -----</td>
<td>t(113)= -2.1/ -----</td>
</tr>
<tr>
<td>P-value</td>
<td>0.013/ -----</td>
<td>0.038/ -----</td>
</tr>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 8</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>13.14 (3.68)</td>
<td>12.02 (3.61)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)= -1.48/ -----</td>
<td>t(113)= -2.33/ -----</td>
</tr>
<tr>
<td>P-value</td>
<td>0.143/ -----</td>
<td>0.022/ -----</td>
</tr>
<tr>
<td></td>
<td>Week 4</td>
<td>Week 8</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>11.24 (3.11)</td>
<td>12.02 (3.61)</td>
</tr>
<tr>
<td>T-statistic (df)</td>
<td>t(123)= 1.04/ -----</td>
<td>t(113)= -0.23/ -----</td>
</tr>
<tr>
<td>P-value</td>
<td>0.302/ -----</td>
<td>0.819/ -----</td>
</tr>
</tbody>
</table>

Note: Means are represented with Standard Deviations in brackets (standard deviation). Degrees of freedom are represented by (df). Bolded scores represent statistically significant differences. Frequency scores and Letting-Go scores are separated by (/) in each Week box.

UBC-CI-LG-‘Depression’ Frequency and Letting-Go statistics

**Intervention Group**

The ANOVA test for the intervention group found no significant differences in scores from Week 1 to Week 4 to Week 8 on both Frequency and Letting-Go
scales. Therefore no follow up t-tests were administered. For more information please refer to Table 8.

Control Group

The ANOVA test for the control group found no significant differences in scores from Week 1 to Week 4 to Week 8 on both Frequency and Letting-Go scales. Therefore no follow up t-tests were administered. For more information please refer to Table 8.

Table 8- Difference between Intervention Group and Control Group scores (Frequency and ‘Letting-Go’) on The University of British Columbia Cognitive Inventory- ‘Letting-Go’ Revised Version (UBC-CI-LG)-subscale Depression

<table>
<thead>
<tr>
<th>UBC-CI-LG</th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency/ ‘Letting-Go’</td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>21.48 (4.72)</td>
<td>19.57 (3.95)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125) = 2.28/2.35</td>
<td>F(113) = 0.22/0.32</td>
</tr>
<tr>
<td>P-value</td>
<td>0.107/0.1</td>
<td>0.802/0.728</td>
</tr>
</tbody>
</table>

Note: Means are represented with Standard Deviations in brackets (standard deviation). Degrees of freedom are represented by (df). Bolded scores represent statistically significant differences. Frequency scores and Letting-Go scores are separated by (‘) in each Week box.
**UBC-CI-LG-‘Social Fear’ Frequency and Letting-Go statistics**

**Intervention Group**

The ANOVA test for the intervention group revealed a significant difference in scores from Week 1 to Week 4 to Week 8 on the Frequency scale with $F(125) = 4.81$ and $p < .05$. Follow up t-tests were administered and significant difference was found between Week 1 and Week 4 on the Frequency scale with $t(123) = -2.45$ and $p < .05$. In addition, significant difference was also found from Week 1 to Week 8 on the Frequency scale with $t(90) = -2.87$ and $p < .05$. For more information please refer to Table 9.

**Control Group**

The ANOVA test for the control group indicated no significant differences in scores from Week 1 to Week 4 to Week 8 on both Frequency and Letting-Go scales. Therefore no follow up t-tests were administered. For more information please refer to Table 9.
Table 9- Difference between Intervention Group and Control Group scores (Frequency and ‘Letting-Go’) on The University of British Columbia Cognitive Inventory- ‘Letting-Go’ Revised Version (UBC-CI-LG)-subscale Social Fear

<table>
<thead>
<tr>
<th></th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 4</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>29.52 (7.95)</td>
<td>25.74 (6.57)</td>
</tr>
<tr>
<td></td>
<td>(26.66 (8.41)</td>
<td>24.79 (7.39)</td>
</tr>
<tr>
<td>F-statistic (df)</td>
<td>F(125) = 4.81/2.31</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.01/0.104</td>
<td></td>
</tr>
</tbody>
</table>

Comparison between intervention and control group in Negative Thoughts

A comparison between the two groups revealed that the intervention group and the control both experienced lesser frequency of Worry thoughts. However, only the intervention group experienced less Social Fear type thoughts. Neither the intervention group nor the control group experienced lesser
frequency of Depression type thoughts. This indicates that the intervention group (MMT group) experienced less frequent negative thoughts. On the other hand, both the intervention group and the control group experienced no change in ability to let-go of the negative thoughts if they did occur.

**Correlations between mindfulness and negative thoughts for the intervention group**

Table 10, below, indicates the correlation between mindfulness and negative thoughts for the intervention group. It was hypothesized that the UBC-CI-LG subscales that measured the Frequency of participants' Worry, Depression, and Social Fear thoughts, as well as their Letting-Go scores, would all be negatively correlated with the results of the MAAS scale and the four subscales on the KIMS scale. The results of UBC-CI-LG subscale that measured the Frequency of Worry indicated statistically significant association with the KIMS subscale of Observing in the predicted direction, $r = -0.026$ and $p < .05$. The Letting-go of Worry subscale was also significantly correlated, with Observing subscale $r = -0.005$ and Describing subscale $r = -0.019$ and $p < .05$ on the KIMS scale. Furthermore, the UBC-CI-LG subscale that measured the Frequency of Depression was significantly correlated with a KIMS subscale of Observing $r = -0.026$ and $p < .05$. Finally, the scores for UBC-CI-LG subscale that measured Frequency and Letting-go of Social Fear thoughts were significantly correlated with the KIMS subscale of Observing $r = -0.021$ and $r = -0.011$ respectively and $p < .05$. These statistically significant results indicate that
there is a relationship between the KIMS subscale of Observing and most of the UBC-CI-LG Frequency and Letting-go subscales. There was no correlation between any of the UBC-CI-LG subscales and the KIMS subscales of Acting with Awareness and Accepting without Judgment. Similarly there was no relationship between any of the UBC-CI-LG subscales and the MAAS scale. For more information please refer to Table 10.

Table 10- Associations between Mindfulness Scales (MAAS and KIMS) with the UBC-CI-LG scale subscales of Worry, Depression and Social Fear (Frequency and ‘Letting-Go’)

<table>
<thead>
<tr>
<th></th>
<th>MAAS</th>
<th>KIMS-Observing</th>
<th>KIMS-Describing</th>
<th>KIMS-AWA</th>
<th>KIMS-AWJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBC-CI-LG Worry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>-0.21</td>
<td>-0.026</td>
<td>-0.089</td>
<td>0.081</td>
<td>0.059</td>
</tr>
<tr>
<td>Letting-go</td>
<td>-0.208</td>
<td>-0.008</td>
<td>-0.019</td>
<td>0.11</td>
<td>0.131</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>-0.23</td>
<td>-0.026</td>
<td>0.0216</td>
<td>0.014</td>
<td>0.102</td>
</tr>
<tr>
<td>Letting-go</td>
<td>-0.207</td>
<td>-0.092</td>
<td>0.075</td>
<td>0.019</td>
<td>0.162</td>
</tr>
<tr>
<td>Social Fears</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>-0.11</td>
<td>-0.021</td>
<td>0.029</td>
<td>0.057</td>
<td>0.109</td>
</tr>
<tr>
<td>Letting-go</td>
<td>-0.13</td>
<td>-0.011</td>
<td>0.1</td>
<td>0.076</td>
<td>0.155</td>
</tr>
</tbody>
</table>

Note: Bolded scores represent statistically significant differences.

**Tennis results**

Upon collecting tennis performance data, there was an astounding difference between the intervention group and the control group. As shown in Fig.2, the intervention group won a total of 211 matches, while the control group won 99. Due to the fact that there was such a large difference between the
number of matches won by the two groups, there was also a very big difference in the games won, with the intervention group winning a total of 449 games and the control group winning a total of 242 games. As would be expected, the opposite was seen when looking at the losses column. The intervention group lost a total of 120 matches, whereas the control group lost 205. The same was observed with the games lost, where the intervention group lost 188 and the control group lost 428. Therefore, when looking at matches and games won versus matches and games lost, the two groups achieved nearly opposite results the intervention group won more and lost considerably less than the control group.

The independent samples t-test analysis revealed a statistically significant difference between the performance of the two groups (Table 11). Statistically significant differences were found in the number of wins (t=5.58, p < .001), losses (t=-5.95, p < .001), games won (t=5.43, p < .001), and games lost (t=-5.75, p < .001). These results indicate that the intervention group had a statistically significant greater number of matches and games won, and statistically significant fewer matches and games lost than the control group. These results demonstrate that the intervention group that received mindfulness meditation training clearly outperformed the control group as measured by tennis performance.
Table 11- Difference in Wins, Losses, Games Won and Games Lost when comparing Intervention Group versus Control Group

<table>
<thead>
<tr>
<th></th>
<th>Intervention Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matches Won</td>
<td>211</td>
<td>99</td>
</tr>
<tr>
<td>Matches Lost</td>
<td>120</td>
<td>205</td>
</tr>
<tr>
<td>Games Won</td>
<td>449</td>
<td>242</td>
</tr>
<tr>
<td>Games Lost</td>
<td>188</td>
<td>428</td>
</tr>
</tbody>
</table>

Intervention Group vs. Control Group (Wins and Losses)

<table>
<thead>
<tr>
<th>T-Tests</th>
<th>Wins</th>
<th>Losses</th>
<th>Games Won</th>
<th>Games Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-value</td>
<td>5.578</td>
<td>-5.946</td>
<td>5.431</td>
<td>-5.745</td>
</tr>
<tr>
<td>P-value</td>
<td>P&lt;0.001</td>
<td>P&lt;0.001</td>
<td>P&lt;0.001</td>
<td>P&lt;0.001</td>
</tr>
</tbody>
</table>

Figure 2- Difference in number of Wins, Losses, Games Won and Games Lost when comparing Intervention Group versus Control Group
Regression Analysis

Multiple Regression Analysis indicated that there was a relationship between dependent variables and independent variables. Therefore, Single Regression Analysis was computed for the intervention group to investigate the relationship between matches won, matches lost, games won, or games lost, and any of the three scales (MAAS, KIMS, UBC-CI-LG). The findings (Table 12) indicate an R squared value of 0.8, which shows that mindfulness scores explain 80% of variance in matches won. The F-statistic of 170 and the p value <0.00 also indicate that there is a relationship between matches won and performance on the MAAS scale. Furthermore, the MAAS t-statistic was 13.04 and the p value was <0.001, indicating a statistically significant relationship. Therefore, the regression indicates that for every point scored higher on the MAAS scale, the intervention group had an average of 0.07 more match wins.
Table 12- Regression analysis for Matches Won and representation of the relationship with the MAAS scale

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>df</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Standard Error</th>
<th>T-stat</th>
<th>P-value</th>
<th>Lower 95%</th>
<th>Upper 95%</th>
<th>Lower 95.0%</th>
<th>Upper 95.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAAS</td>
<td>0.074</td>
<td>0.006</td>
<td>13.039</td>
<td>3.56E-16</td>
<td>0.063</td>
<td>0.086</td>
<td>0.063</td>
</tr>
</tbody>
</table>

There was also a statistically significant result when testing the relationship between matches lost and performance on the UBC-CI-LG subscale of Social Fear Frequency Table 13). The R squared value of 0.8 indicates that Social Fear Frequency scores explain 80% of matches lost. Furthermore, the regression shows an F statistic of 77.56 and a p-value of <0.001 and t-statistic of 8.81 and p-value of <0.001, which indicates that for every point scored higher on the UBC-CI-LG Social Fear Frequency, the intervention group had an average of 0.11 more losses. Due to the fact that the intervention group had low scores on the UBC-CI-LG Social Fear Frequency scale, they had fewer matches lost.
Like the relationship between the MAAS scale of performance and matches won (Table 14), the regression analysis of games won revealed an F-statistic 205.86 and a p-value <0.001, which also indicates a statistically significant relationship with the MAAS scale. Furthermore, the MAAS scale had a t-statistic of 14.35 and a p-value <0.001, which again indicates a statistically significant relationship between MAAS scale results and games won, and can be interpreted to show that for every point scored higher on the MAAS scale the intervention group had an average of 0.158 more game wins. Furthermore, the R squared value of 0.83 indicates that mindfulness scores explain 83% of variance in games won.
Finally, a regression analysis of games lost and the UBC-CI-LG subscale of Social Fear Frequency (Table 15) demonstrated a statistically significant difference, with an F value of 135.46 and a p-value <0.001. Furthermore, Social Fear Frequency had a t-statistic of 11.64 and a p-value <0.001, which indicates a statistically significant relationship. Therefore, for every point scored higher by participants on Social Fear Frequency they lost an average of 0.269 more games. It is also important to mention that an R squared value of 0.83, means that social fear frequency scores explains 83% of variance in games lost. This represents the same results as with matches lost, and implies that the
intervention group lost fewer games because they performed better on Social Fear Frequency (by scoring lower on the Social Fear Frequency test).

Table 15- Regression analysis for Games Lost and the relationship with the UBC-CI-LG subscale of Social Fear Frequency

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>ANOVA</th>
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</thead>
<tbody>
<tr>
<td>df</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Standard Error</th>
<th>T-stat</th>
<th>P-value</th>
<th>Lower 95%</th>
<th>Upper 95%</th>
<th>Lower 95.0%</th>
<th>Upper 95.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UBC Social</td>
<td>0.269</td>
<td>0.023</td>
<td>11.639</td>
<td>0.222</td>
<td>0.315</td>
<td>0.222</td>
<td>0.315</td>
</tr>
<tr>
<td>Fear</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
CHAPTER 5
DISCUSSION

The first purpose of the present research was to investigate if Mindfulness Meditation Training (MMT) helps tennis players improve their performance. Numerous studies suggest that different Mindfulness Meditation methods may help increase performance (e.g. Gardner & Moore, 2004; Lutkenhouse, Gardner, & Moore 2007; Lutkenhouse, 2007; Schwanhausser 2009; Wolanin, 2005). However, many of these references are case studies involving small sample sizes, while others indicated increased improvement as measured by coach ratings and self-ratings, but did not focus on actual sport results. The present research includes all of the participants’ tennis results and draws conclusions based on those real-life results.

Similar to a number of case studies (e.g. Gardner & Moore, 2004; Lutkenhouse, 2007; Schwanhausser, 2009; Wolanin, 2005) and research findings (e.g. Lutkenhouse, Gardner, & Moore 2007; Thompson, Kaufman, De Petrillo, Glass, and Arnkoff, 2011) that found improved performance by athletes using Mindfulness Meditation methods, the results of this research indicated that the intervention group, which practiced Mindfulness Meditation Training, significantly outperformed the control group as measured by tennis results. The intervention group won more games and matches than the control group and lost fewer games and matches than the control group. This indicates that Mindfulness
Meditation Training helps tennis players’ performance and should be considered an important technique by athletes who are trying to improve their performance.

There is also a relationship between research participants’ mindfulness as measured by the MAAS scale and participants’ tennis results, which indicate that for every point scored higher on the MAAS scale by the intervention group, more matches and games were won. Furthermore, the regressions indicate that mindfulness explains 80% and 83% of variance in matches and games won respectively. These findings lead the research to address another purpose that evaluated whether MMT would allow tennis players to be more mindful and present in the moment (aware), and whether this would improve performance. This was strongly supported by the results of the MAAS scale, on which the intervention group showed a significant increase in the level of mindfulness and the control group showed no improvement. These results indicate that the intervention group was able to become more mindful and present during their experiences over the course of the research, a result that was also indicated by their improved tennis results. In other words, on average, the higher a participant’s score on the MAAS scale (which demonstrates an increased level of mindfulness and an increased level of awareness), the more wins that participant achieved.

Lastly, another purpose of this research was to investigate if Mindfulness Meditation Training (MMT) helps athletes accept anxiety. Acceptance is an important element of mindfulness as defined by Kabat-Zinn (1993). Rather than
evaluate the effect of trying to fight or suppress anxiety and negative thoughts, this research sought to investigate the effect on performance when athletes were directed to accept these experiences. MMT resulted in significant improvement in the intervention group whereas the control group, which received no MMT, demonstrated no significant improvement over the eight-week training on the MAAS scale.

Furthermore, the design and setup of the research that investigated how to help athletes accept anxiety also allowed the researcher to examine whether MMT training can decrease the frequency of negative thoughts and provide athletes with an increased ability to ‘let-go’ of negative thoughts when they do occur. The findings were supported and the tennis players experienced a decrease in the frequency of negative thoughts. The intervention group experienced fewer negative thoughts than the control group. The UBC-CI-LG subscales showed that the intervention group experienced Worry and Social Fear thoughts less frequently over the course of the study, whereas the control group only experienced a drop in the frequency of Worry thoughts during the eight-week intervention. These results indicate that athletes who practice MMT experience fewer negative thoughts, which in turn helped them change their relationship to anxiety.

Notwithstanding the differences discussed above, both groups showed no levels of improvement in participants’ ability to ‘Let-Go’ of Worry, Depression, and Social Fear thoughts. These findings may have been due to the fact that
exposure to eight weeks of competition may have helped both groups regardless of the intervention. Another explanation might be that since both groups received a CD, this could have helped the intervention group focus on mindfulness and the control group focus on tennis strategy, thereby not allowing them to experience as many thoughts about their game. Finally, one more explanation to consider for the intervention group’s lack of improvement in these areas could be that because they experienced fewer Worry and Social Fear thoughts, they may not have needed to ‘let-go’ of as many of those thoughts.

It is important to note that the KIMS scale found no significant difference in three out of four subscales (Observing, Describing, and Acting With Awareness) for the intervention group and no significant difference in all four subscales (Observing, Describing, Acting With Awareness, and Accepting Without Judgment) for the control group. One possible reason there was no significant difference in the KIMS skills, with the exception of the intervention group’s skill of Accepting Without Judgment, could be that the KIMS scale is predominantly used for clinical populations and not as a measure for athletes. The statements that are on the scale are more geared to the clinical population and might not resonate as well with tennis players. For example, Baer, Smith, and Allen (2004) tested the KIMS scale and showed great internal validity and test-retest reliability, but recommended use of the scale for different mental health issues, not sports psychology. Furthermore, research by Frewen et al. (2007) showed negative correlations between the four KIMS skills and the UBC-CI-LG subscales of
Worry, Depression, and Social Fear (frequency and ‘Letting-Go’). In this research only the KIMS skill of Observing showed statistically significant negative correlations with all three UBC-CI-LG frequency scales, as well as the Worry and Social Fear letting-go scales. In addition, the KIMS subscale of Describing showed only one statistically significant negative difference with UBC-CI-LG Letting-go of Worry thoughts scale. Therefore when taking a look at correlations, this research suggests that the KIMS scale does not seem to be an effective test for athletes, and that more research is necessary in order to investigate the efficacy of the KIMS scale for different populations.

The KIMS skill Accepting Without Judgment showed a statistically significant decrease for the intervention group. These results indicate that after the eight-week research study the participants in the intervention group had a lower ability to refrain from labeling their experience. One potential explanation for this result is that Mindfulness Meditation Training may have taught participants in the intervention group to label, which in a way that was not necessarily judgment. What the participants may have been doing was labeling, and the results might have come out as judgment. This can be seen especially when looking at questions ten and fourteen on the Accepting Without Judgment KIMS scale. For example, question 10 is as follows: “I’m good at thinking of words to express my perceptions, such as how things taste, smell, or sound.” Question 14 reads: “It’s hard for me to find the words to describe what I’m thinking.” For both questions, it is entirely possible that the participants were
simply labeling their experiences. Meditation scripts used by the mindfulness intervention group taught the participants to label their experiences, but to do so in non-judgmental ways. Some of the items, such as the two questions reproduced above, ask about labeling, which the mindfulness group was taught to do. This may have lead to a decrease in Accepting Without Judgment. Another possible reason to be considered for the decrease in Accepting Without Judgment is that the consistent competition participants took part in may have had an impact on their judgments.

An additional conclusion worth mentioning is the importance of dose and duration. The research indicates that all significant improvement that the intervention group experienced was seen within the first four weeks of the research, which indicates that athletes who are interested in using this training should see the most improvement quickly. This finding may also suggest that future research on Mindfulness Meditation methods for athletes should be investigated in shorter durations. If additional studies also find no significant improvement beyond Week 4, there might not be a reason to keep up with the same training for longer than four weeks. The improvement in this study was shown to last throughout the eight weeks of training even though no increase was seen between Week 4 and Week 8. This suggests that Mindfulness Meditation Training changes athletes’ brains within the first four weeks of training and remains with athletes for long after, and may indicate that the duration of the training is long-lasting and worthwhile.
As far as dose, it seems that short, ten-minute recordings listened to four times a week make a big impact on improvement. Moreover, the short duration of these recordings could attract more athletes to use this training. Most athletes have limited time for training, and if there were a short, quick way to improve performance, then they would probably be more apt to try it out. In conclusion, short, ten-minute recordings listened to four times a week for a total of four weeks should result in performance improvement.

Finally, it is worthwhile to discuss the implications that MMT could have on coach education. Not only does this training provide coaches with a different technique to help athletes with sports psychology and performance, it also suggests a different approach to dealing with negative thoughts and anxiety. MMT techniques provide coaches with the chance to teach athletes to accept negative thoughts and not fight or try to suppress these thoughts. The research here clearly demonstrates that awareness and acceptance of these thoughts will decrease the frequency of these thoughts. Therefore, instead of teaching athletes to fight them or suppress them, coaches should help athletes become more aware of them and accept them. Coaches should teach athletes that even top athletes experience negative thoughts, but they understand that it is just a thought, not a true representation of their abilities. Teaching these lessons to youth athletes in the world today could equip these athletes to become stronger-minded athletes and people.
LIMITATIONS

There are a few limitations that this research must acknowledge and address for future research in Mindfulness Meditation Training or other mindfulness meditation methods. First of all, this research study used all amateur athletes; future research should consider conducting these trainings on professional athletes. Another limitation is that this research consisted entirely of female participants in the age range of forty to sixty years old. In order to measure the effectiveness of this type of training, future research should use youth athletes, athletes playing in college or playing semi-professionally, and male athletes of all ages as well. If the effectiveness of mindfulness meditation training is borne out in future research that includes athletes of different ages and levels and of both sexes, this type of training could become one of the most widespread training exercises for athletes around the world.

Even though there were limitations to this research study, it is important to indicate that the sample size was large enough that Mindfulness Meditation Training should be considered a great tool for athletes when trying to improve their performance. More specifically, tennis players could be encouraged to start using this type of training to help them deal with the pressure they face during competition. The current research supports the use of Mindfulness Meditation training methods in sports. Since there is a limited amount of research in this area, this research is a notable contribution to this field. It is also the first
research study of mindfulness meditation methods that has been done with tennis players. Because it shows an improvement in tennis players’ performance, hopefully this study will encourage more tennis players to use Mindfulness Meditation Training to help them perform better. Likewise, hopefully the results of this study will encourage an expansion of the research conducted here to additional sports and to tennis players of additional levels and ages, and lead to the introduction of unique Mindfulness meditation technique referred in this research as Mindfulness Meditation Training. Additional Mindfulness Meditation Training will be an important step towards helping tennis players and athletes in many different sports become more successful.
Appendix A

Informed Consent Questions- Sports Psychology Training

Please respond to the following questions. In addition, please review and sign the informed consent form.

Please respond to these questions to the best of your ability. In the following questions, training will be defined as more than one class, seminar, or session with a professional (professor, licensed therapist, and psychologist).

1) Have you ever received any training in relaxation techniques?  
   Yes  No  
   If yes, what type (circle all that apply)  
   - Progressive Muscle Relaxation  
   - Imagery for Relaxation  
   - Breathing for Relaxation  
   - Music for Relaxation  
   - Other__________________________  
   And was it for Tennis?  Yes  No

2) Did you receive any training in self-talk techniques?  
   Yes  No  
   If yes, what type (circle all that apply)  
   - Changing inner monologue  
   - Changing beliefs  
   - General upbeat, optimism  
   - Other__________________________  
   And was it for Tennis?  Yes  No

3) Did you receive any training in imagery techniques?  
   Yes  No  
   If yes, what type (circle all that apply)  
   - Imagery of skills  
   - Imagery of strategies and/or routines  
   - Imagery of goals (motivational imagery)  
   - Imagery for stress, anxiety and arousal  
   - Imagery of belief, mental toughness, and focus  
   - Other__________________________  
   And was it for Tennis?  Yes  No
4) Did you receive any training techniques for stress and/or anxiety? Yes No
   If yes, what type (circle all that apply)
   - Breathing
   - Visualization
   - Positive thinking
   - Meditation
   - Massage
   - Other_________________________
   And was it for Tennis?  Yes  No

5) Are you currently suffering from an injury that could take you out of playing
tennis for the next one to six months?  Yes  No
Appendix B

Sports Psychology Training - Informed Consent

Dejan Stankovic ("Researcher")

I. Summary: You are asked to take part in a sports psychology training research study. The goal of this research study is to achieve better mental preparation before and during tennis matches. You will be assigned by chance (like a coin toss) to either the sports psychology-training group or the control group. Therefore, there will be two different CD recordings, one for the sports psychology-training group and one for the control group. The procedures for both groups will be the same. The researcher of this research study is Dejan Stankovic, a student at Boston University.

II. Explanation of procedures:

Week 1 (A)- Baseline- Upon signing this form you will be given a CD. To assess baseline measurements, you will be asked to fill out three scales (MAAS, KIMS, UBC-CI-LG) the day before your first match (on Tuesday). The scales will be provided via email. Instructions are as follows: “Please sit quietly and fill out the three scales that are provided to you. Click on the link that will take you to the Boston University Qualtrics Survey website where the scales are located. You will be asked to sit quietly and fill out the three scales that are provided to you.” Further instructions are as follows: “During your participation in this research, I would like you to listen to the CD four times a week, in advance of your match. You are also asked to log the times that you have listened to the CD. The training research will fall short of the necessary information if the log entries are not filled out completely, four times a week for a total of 32 log entries over the eight-week training.”

Week 1 (B)- In part (B), you are expected to listen to the CD and provide the researcher with your log time sheets through the Boston University Qualtrics Survey website. During each week of the training you will be reminded by text message or email three times a week (Thursday, Saturday, and Monday) with the following message: “Please take 10 minutes of your time today to listen to the CD.” Finally, the day before your match (Tuesday) you will get one more text message with the following message: “Please finish your log sheets detailing each of the four times that you have listened to the CD this week. The deadline to finish your log sheets is tomorrow morning.” Please fill out the log sheets on the Boston University Qualtrics Survey website, which will then be forwarded directly to the researcher.
Week 2 & 3- The second and third week will be the same as Week 1 (B). The Wednesday morning deadline (prior to their matches) will remain in place.

Week 4-During the fourth week, you will receive the following text message on Thursday, Saturday, Monday and Tuesday morning: “Reminder, this week you have two tasks: First, please fill out the three scales. This will be the second time you will have filled out the scales. Again, you will be provided a link via email that takes you directly to the scales, on Thursday morning. Additionally, please fill out the log time sheets of your CD for this week.” This will be the mid-point of the training for this research.

Week 5 & 6& 7-In weeks five, six, and seven, you will follow the same procedure as in weeks 2 and 3.

Week 8 –Final - Follow Week 4 procedure.

III. Possible Benefits: There are no direct benefits from participating in this research, but you may improve your tennis performance. Also, you may learn a unique skill to deal with negative thoughts before, during, and after a tennis match, which is crucial for all tennis athletes.

IV. Confidentiality: Only the researcher will have the data from the research. No one else will be provided with identifiable research data. Research data will be stored on a separate flash drive that will be stored at the researcher’s home. The researcher will make sure that there is a password security code that will be used to access this data (for protection purposes). The researcher will be the only person who knows this code. Your data will be deleted from the flash drive after the study concludes.

Withdrawal: Taking part in the research study is your choice. You are free to withdraw from the research study at any time. You may choose not to be in the study or to stop being in the study at any time before it is over. This will not affect your status in the Boston Area Tennis League. You will not be offered or receive any special consideration if you take part in this research study.

Cost/Payments: There is no cost or payment for the Training.
Questions: If you have any questions, concerns, or complaints about the training, please contact Researcher, Dejan Stankovic, by email at: stankod@bu.edu or by phone 857-383-9858.

Legal rights: You do not waive any of your legal rights by signing this informed consent document. Your signature below indicates that you agree to participate in the Training. You will receive a copy of this signed document. You may also contact my faculty advisor, Dr. Amy Baltzell, at baltzell@bu.edu. You may obtain further information about your rights as a research subject by calling the BU CRC IRB office at 617-358-6115.

____________________  ______________________  ____________________
Name, Email, and Phone number of Participant                   Date

____________________                                     __________________
Signature of Participant                                       Date

____________________                                     __________________
Signature of Researcher                                          Date
Appendix C

Log Time Sheets- For Sports Psychology Training

Please log the time and date when you listened to the Training CD over the last week. In addition, please put a check or an X in the completion column if you listened to the training for the full amount of time, which was part of the instructions.

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Appendix D

Mindfulness Meditation Training

Find a quiet comfortable place to sit, please sit upright, feet flat on the floor, arms and legs uncrossed, hands resting on your lap, palms up or down, as is most comfortable for you. Allow your eyes to close, either fully or partially.

Now bring your awareness to the position of your body and to the sensations inside your body. What do you notice? Perhaps you notice vibrations or pulsation, warmth or coolness, ease or tension. Fully feel your body. And just let it be as it is, whatever the sensations are.

Now see where you can discover your breath most strongly and most easily. Where do you feel your breathing? Do you feel it in your nostrils as the air goes in and out of your nose? Do you feel it in your chest as a rising and falling of your chest? Or do you feel your breathing in your abdomen as expansion and contraction? Where do you notice your breathing most easily and most strongly? If you can feel your breath in many areas, pick one. Allow your attention to stay on that location of your body, where you feel the breath most strongly. Allow yourself to feel the breath. Feel the breath and its sensations in your body. As you breathe, you will notice that your mind wanders from time to time. This is what human minds do. Your mind wandering off is just part of the process. All you have to do is gently return your attention back to the breath when you notice that it has wandered off. It does not matter how many times your mind wanders, just bring it back with kindness, back to your breath, every time. Letting-Go of any thoughts or judgments that may come along the way. Gently return your attention back to your breath, feeling the sensations of your breath in your body. Just feel the breath.

Now bring your attention to the sensations of the inhalation. Notice what the sensations of the inhalation are in the part of your body where you feel your breath most strongly and most easily. Then notice the sensations of the exhalation. Notice what the sensations of the exhalation are in the part of your body where you feel your breath most strongly and most easily. Take a moment to wait until your body inhales again. Don’t rush the inhalation, let yourself exhale fully and let the inhalation happen all on its own. There is no need to make the inhalation happen. Your body will do that for you, all on its own. Notice any thoughts or feelings that come to you during the transition from the exhalation into the inhalation or from the inhalation into the exhalation.

Sooner or later your mind will wander away from your breath to other thoughts, ideas, worries, concerns, images, daydreams, or it may just drift along. This is what human minds do. When you notice your mind has wandered off, this is the
time when you have once again become aware of your experience. You may want to acknowledge where your mind has been – “there is thinking” or “there is feeling.” Then gently guide your attention back to the sensation of the breath coming in and going out. As best you can, bring kindness and compassion to your awareness, perhaps seeing the repeated wanderings of your mind as opportunities to bring patience and gentle curiosity to your experience.

When you become aware of any tension, discomfort, or other physical sensations in a particular part of the body, notice them, acknowledge their presence, and see if you can make space for them. Do not try to hold on to them or make them go away, see if you can make some room for the discomfort or tension, just allowing them to be there. Watch the sensations change from moment to moment.

If you ever notice that you are unable to focus on your breathing, because of intense physical sensation in any part of your body or because of an intense emotion, let-go of the focus on the breath and shift your attention to the place of physical discomfort in your body or the place in your body where you feel the emotion most strongly. Gently direct your attention to the discomfort and stay with it no matter how bad it seems. Take a look at it; what does it really feel like? Again, see if you can make room for the discomfort, allow it to be there and be willing to stay with it.

Along with physical sensations in your body, you may also notice thoughts about the sensations and thoughts about the thoughts. You may notice your mind judging your experience, or coming up with evaluations such as “dangerous” or “unpleasant.” You may notice your mind coming up with predictions of what will happen next, or questions about how things will turn out. When you notice evaluations, or judgments, predictions, or questions, acknowledge them, and return to the present experience as it is, not as your mind says it is, noticing thoughts as thoughts, physical sensations as physical sensation, feelings as feelings, nothing more, nothing less. If you notice questions, gently answer them with “I don’t know” and return to your present experience, just as it is.

To help you bring some distance between yourself and your thoughts and feelings, you can label the thoughts and feeling as you notice them. For example, if you notice yourself worrying, silently say to yourself “worry, there is worry.” Observe the worry without engaging with it, allowing it to stay. If you find yourself judging, notice that and label “judging, there is judging.” Observe the judgment with kindness and compassion. You can do the same with other thoughts and feelings, just naming them: there is planning, or remembering, or wishing, or dreading, or whatever your experience may be. Label your thoughts or emotions, and move on. Notice how thoughts and feelings come and go in your mind and body. You are not what those thoughts and feelings say, not matter how intense
or persistent they may be.

As this time for formal practice comes to an end, gradually widen your attention to take in the sounds around you. Take as much time as you’d like to pay attention to the sensations of your body, and then whenever you are ready, open your eyes and once again become aware of your surroundings.
Appendix E

Tennis Strategy Script

Please take moment to sit down and attend to the following tennis tactics. Allow yourself to take few minutes to understand and follow the instructions of the current training.

The following training emphasizes sound doubles tennis tactics. The CD will serve as a reminder of the tactics that can be considered while playing tennis matches.

To start, we will clarify a few common terms that describe you and your doubles partner’s positioning on the court: two up, two back, and one up-one back.

When we use the term:
- “two up” that means the position when both your doubles partner and you are at the net
When we use the term:
- “two back” that means the position when both your doubles partner and you are at the baseline
And lastly, when we use the term:
- “one up-one back” that means the position when one of you is at the net and the other is at the baseline.

Let’s Review: The 3 basic positions you can play from in doubles tennis are what?

(Give them a few seconds pause so they can think about the answer.

That’s right. Two up, two back, and one up-one back.

Now that we are familiar with the basic positions we can play from, let us consider some likely scenarios that you will see when you play from each positioning configuration:

“Two Up” Scenario
Playing aggressive and smart tennis has been proven to win more matches. Therefore, let’s talk about the tactics of playing aggressive tennis that are most often seen when playing “two up.”

Imagine your doubles partner and you are at the net. Since you are close to the net, you can angle the ball more easily or hit down the middle of the court, which can win you a lot of points. However, here is a scenario that is most often
encountered when playing “two up,” Both your partner and you know what is coming! “THE LOBS.” Lobs make most players frustrated as it slows down the game and neutralizes the aggressiveness.

(PAUSE- few second pause for them to imagine the scenario)

Now that your doubles partner and you are encountering lobs, let’s answer the important question of: how does one handle playing lobbers?

Pause for 2 seconds

**Tactic to consider when playing the Lobbing game**

When faced with lobs pick either option one (swinging volleys) or option two (regular short volleys), according to which volley you can hit better and feel more comfortable in executing.

1) Option one, Swinging volleys. This means coming to the net and taking the ball out of the air and hitting a forehand or a backhand before the ball bounces. Swinging volleys can be hit at the net opponent to get a short ball back, in the doubles alley of the net opponent to win the point (as she does not have time to react), or in the middle of the court to confuse the opponents and open the court up for your next shot.

PAUSE for 2 seconds before we go to next option!

2) Option two, “Regular Short Volley.” This is the same as the above example, but instead of swinging at the ball with your forehand or backhand, just place a short volley back over the net in the direction of the baseline opponent. The goal of the short volley is to try to make the ball bounce before the service line. This forces the opponent at the baseline to move up to the net, and once the opponent is at the net that eliminates the opponent’s ability to hit effective lobs. The opponent has to either hit a groundstroke back or a volley. This forces the opponent to play your game of volleying and playing aggressive at the net.

PAUSE for 2 seconds before we go on to reviewing!

Let's Review: What are the two options that you could use when playing lobbers?

(Short pause to let them think about the answer).

That’s right. Swinging Volleys or Regular Short Volleys! Now that we know how to handle lobbers, let’s proceed to the second scenario to consider.
“One Up One Back” or “Two Up” Scenario
Another tactic to consider is playing the MIDDLE of the court. If your partner and you are in either “both up” position or “one up one back” position, playing the middle of the court is a very effective tactic.

1) Imagine that both your opponents and you are in the “one up one back” position. To be successful you (the back person) should be trying to set your partner up to finish the point, since she is closer to the net.

Pause for a few seconds to let them imagine the scenario.

How do you set your partner up?
In order to set your partner up, hit the ball down the middle of the court. Remember, when you play the “one up one back” position the goal for you (the back person) is to be patient, consistent, and wait for your opportunity to hit the ball to the middle of the court to set you partner up to finish the point.

Pause for a few seconds to let them absorb the information.

When playing the middle to set your partner up, what are two options that your opponents have when they are returning your middle shot?
1) Option one, they can hit the ball back to the middle of your court.
2) Option two, they can hit a lob back to the middle of the court.
Therefore, your partner and you should position to cover those options.

Few seconds break.

Let’s Review: When playing “one up one back,” what is the goal of the back person?

Few seconds.

That’s right! The goal is to set up your partner at the net by playing down the middle of the court.

Few seconds.

When you (the back person) hit the ball down the middle of the court, what are the only two places your opponents can return your shot?
Few seconds.

That’s right! They can return the ball down the middle of the court or lob down the middle of the court.
Few seconds.

Remember an important doubles tennis saying: When playing middle the return will be middle!

2) Continuing with playing the middle of the court. Now, imagine that your partner and you are playing in the “two-up” position rather than in “one up one back” position.

Where should your partner and you hit your first volley? The same place as in the above explanation—in the middle of the court.

Few seconds.

Why does hitting the first volley up the middle work?

1) Reason one: there could be confusion on the opponents' side about who should return the ball. They could both go for the ball, or both leave the ball causing an error and frustration on their side.

2) Reason two: the only place the opponent could hit the volley is back up the middle of the court. Therefore, your doubles partner and you should position yourselves to cover the middle of the court.

Few seconds.

Let’s review: If you are in the “two up” position where should your partner and you hit the first volley?

Few seconds.

That’s right! In the middle of the court.

Few seconds.

Why does hitting the first volley up the middle work?

Few seconds.

That’s right! There could be confusion on the opponents’ side and the opponents’ only option is to return the ball back up the middle of the court.

After knowing how to handle lobbers and the importance of playing down the middle of the court, we should consider one more important scenario.
**Two Back Scenario**

Lastly, it is important to consider a tactic that could be used when your partner and you are playing poorly.

Pause for a few seconds.

What can your partner and you do when playing poorly? It is important to remember to slow the game down either by taking longer breaks between games or between the points. In addition, consider the “two back” position.

Few seconds.

The “two back” position allows your partner and you to have more time to react to the ball. It also makes the points last longer. During longer points the opponents could start to make mistakes and get frustrated.

Pause for a few seconds.

Coaching point to remember: To make the “two back” position effective, your partner and you need to make the points last longer by being very patient and consistent.

: What should your partner and you consider when playing poorly?

Few seconds.

That’s right! Consider the “two back” position and play very patiently and consistently.

In conclusion, keep in mind these important tactics when playing your matches, as this will allow your partner and you to become more successful.
REFERENCES


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EDUCATION

2009-2015 BOSTON UNIVERSITY SCHOOL OF EDUCATION Boston, MA
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2003-2007 ST. BONAVENTURE UNIVERSITY St. Bonaventure, NY
B. A., Psychology
  · Psychology Major. GPA of 3.7/4.00; Dean’s List freshman through senior years.
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2012–Present BOSTON UNIVERSITY Boston, MA
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2013–current BOARD CERTIFIED IN BIOFEEDBACK

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RESEARCH PROJECTS

2009 BOSTON UNIVERSITY SCHOOL OF EDUCATION Boston, MA
  · Biofeedback project was presented at American Association of
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2003-2007 ST. BONAVENTURE UNIVERSITY St. Bonaventure, NY
  · Senior Thesis: Coaching Styles Preferred by Athletes Depending on
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  · Research Paper pending publication: Athlete’s Personalities and
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    organized and developed his skills in sports.

LEADERSHIP ACTIVITIES

2003-2007 ST. BONAVENTURE UNIVERSITY St. Bonaventure, NY
  · Captain, Men’s Division I Tennis Team (Atlantic 10 Conference)
  · Student Representative, The Academic Standards Committee
  · “Rookie of the Week”—two-time recipient
  · Secretary, International Student Association
  · Participant – professional tennis tournaments (Canada, USA)

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  · Interests- Tennis, Football, Chess, Travel