Cardiff School of Sport

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CARDIFF METROPOLITAN UNIVERSITY
Prifysgol Fetropolitan Caerdydd

CARDIFF SCHOOL OF SPORT

DEGREE OF BACHELOR OF SCIENCE (HONOURS)

SPORT CONDITIONING, REHABILITATION AND MASSAGE

2013-4

The Effects of Pre-Competition Athlete Specific Anterior and Posterior Lower Limb Massage on 30 Meter Sprint Performance in Male Rugby Union Players

(Dissertation submitted under the discipline of SCRAM)

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ABSTRACT

This study is aimed at examining pre-competition massage and its effects on sprint performance in male Rugby Union players. Current research in the area of massage and sprint performance is limited and holds methodological flaws. The majority of studies have focused on populations as a whole and have not investigated specific sporting populations. There are very few studies that have looked at the effects of anterior and posterior lower limb massage prior to performance. Other limitations include the inconsistency and variation in findings and the clinical manner in which the studies have been conducted. This study aimed to adopt an ecologically valid approach in order to apply the findings to Rugby Union specific populations. 14 male participants (Age 22 ± 3 years) from Newbury Rugby Football Club completed the study and had played a minimum of three games during the 2013/ 2014 season. Prior to sprinting participants underwent two different conditions (Massage and No Massage) combined with a warm up. Both conditions were completed with a minimum gap of 48 hours. Participants completed a maximal sprint through electronic timing gates, after intervention, over a distance of 30m, with a 10m split.

Data analysis suggest that there are no significant differences between the testing conditions ($p>0.05$). This was the case over 10m ($p=0.104$) and 30m ($p=0.623$). The results obtained from this study suggests that pre-competition massage intervention prior to performance does not have a significant effect on performance.

CHAPTER I: INTRODUCTION

1. INTRODUCTION

Rugby Union is a sport played globally, the international Rugby Board (IRB) is the main governing body in Rugby Union consisting of more than 92 national unions. The game is players over two 40 minute halves separated by a ten minute interval. There are no stoppages during the game with the exception of injuries and intervention from television match officials. Rugby is a field based team sport which requires many different physiological responses due to its constant requirement for high intensity sprinting and its high frequency of physical contact Duthie, Pyne and Hooper (2003).

Since the beginning of the professional era in 1995 the characteristic of power, strength, body composition and speed of players has rapidly evolved. Consequently both speed and physicality of games has increased hugely. Players require a mixture of strength and power as well as speed acceleration and agility in order to become successful (Smart, Hopkins & Gill, 2013).

Massage has become widely used within sport at all levels, coaches, athletes and medical personnel believe, based on their own experiences and observations, that massage can provide the body with many different benefits. These include an increase in blood flow, a reduction in muscle tension and excitability and an increased sense of wellbeing (Weerapong, Hume & Kolt, 2005). Tabatha (2006) writes that massage and its many techniques and modalities work on the same or similar principles. Massage relaxes muscle fibres and improves circulation, this allows the blood to provide the muscles with more oxygen and nutrients. Massage can also help to filter out unwanted waste products as well as move lymphatic fluid and helping it drain (Tabatha, 2006).

In massage using the right combination and adjusting the time of the application of techniques may be useful when aiming to aid in exercise recovery, when reducing the risk of injury and preparing athletes for performance (Standley, Miller & Binkley, 2010). Due to the differences associated with pre and post activity massage and the way techniques and their application may vary at these different times, different approaches need to be considered depending on the desired results. One of the main ways massage is believed to be beneficial to performance is through improved musculo-tendinous compliance. Although there are also findings that suggest range

of movement can benefit from massage (Goodwin, Glaister, Howatson, Lockey & Mcinnes, 2007). Massage has been widely used as a therapeutic tool by many health care providers as a treatment for sports injuries, and as a vehicle to improve sports performance (Standley et al., 2010). It is claimed that massage can have both stimulating and calming properties, and therefore has the potential to be beneficial to athletic performance in many different scenarios. An example of this is how massage is used frequently, prior to athletic activity as a direct means to enhance performance, despite a lack of knowledge to support its use in this respect (Goodwin et al., 2007). Benjamin and Lamp (2005) believe massage can be used to enhance training programmes as well as, during and after competition to improve both performance and rate of recovery. They also believe that massage can be used to reduce a person's risk of injury and aid in the rehabilitation process.

Despite massage being a major component used by athletes, there are still only small amounts of evidence available to justify the use and confirm how efficient massage is at promoting recovery both physically and mentally and how it can affect performance (Hemmings, Smith, Graydon & Dyson, 2000). According to Brummit (2008) sports massage has been suggested as an aid to the preparation of an athlete prior to competition as well as a tool to enhance performance. Although massage is used frequently by physical therapists and other health care practitioners, its efficiency is questionable.

This study will aim to examine the effect that pre event posterior and anterior lower limb massage has on sprint performance in male rugby union players. Current studies by Rodenbury et al. (1994), Goodwin et al. (2007), Arabachi (2008) and Fletcher (2010) all look at pre event massage in males, however they use either posterior or anterior lower limb massage, not a combination of both. Currently there is very little literature available on how a combination of anterior and posterior massage can effect performance. Current research on the sprinting patterns in Rugby Union by Duthie et al. (2003), Duthie, Pyne, Marsh, and Hooper (2006) and West et al. (2013) show that players are unlikely to sprint for prolonged distances, the majority of sprints during games are performed over distances between 10m and 35m, therefore current studies have high ecological validity as they do not test players beyond these distances.

This study will utilise two different testing conditions, these are; a standardised warm up followed by a 30m sprint and a combination of pre event massage combined with the same warm up procedure followed by a 30m sprint. A cross over design will be used for this study as this allows for players to be compared against themselves. The testing for this study will take place at Newbury Rugby Football Club, this does not eliminate external factors which may vary such as wind and temperature however Rugby Union is a field sport and these conditions more accurately replicate real life situations. The chosen sprint distance for this study was 30m, sprint performance will be assessed over this distance by recording time. Based on the current research and the recommendations of Duthie et al. (2006) 30m sprints will be most relevant to Rugby Union and will be used in this study in order to improve the studies ecological validity. Before participants were tested over 30m they were required to complete one of the conditions during the first session and the alternate condition at the following session. Following the completion of testing, the collected data was analysed in order to find any significant difference between the two different testing conditions that could be attributed to massage. In the event that results do differ significantly then this may serve as an aid for both athletes and coaches in regard to their pre competition routines and how they approach pre performance massage in particular.

CHAPTER II: LITERATURE REVIEW

2. LITERATURE REVIEW

2.1 Sprinting in Rugby Union

According to Duthie et al. (2003) speed and acceleration are both vital requirements in the sport of rugby union, this is due to the fact that players are often required to accelerate in order to make a nearby position or cover large distances as quickly as possible. Similarly West et al. (2013) also wrote that speed is very often associated with successful performances in field sports. In another article by Duthie et al. (2006) they again reiterate the importance of speed and acceleration in rugby union, with speed over a short distance fundamental to achieving success.

Typically players sprint over a distance of 20m in rugby union, this implies that the ability to accelerate rapidly is essential to players, research has also shown that players complete the acceleration phase of sprinting earlier than sprinters who typically take up to 50m (Duthie et al., 2003). These factors mean that sprinting in team sports such as rugby union are quantitatively separate to track sprinting (Duthie et al., 2006). West et al. (2013) write that during competitive action field sport athletes are very unlikely to cover the distances required to reach their maximum speeds, because of this strength and conditioning research has focused primarily on identifying methods of training which improve an athlete's ability to accelerate. Backs can achieve similar sprint times to track sprinters over short distances such as 15m and 35m. Typically rugby union players sprint between 10m and 20m, however they have previously been tested to up to 100m (Duthie et al., 2003). In a more recent study by Duthie et al. (2006) the authors believe that a 30m sprint test will have the most relevance for rugby union, as well as other sports such as hockey and football because they all share similar sprint patterns and run similar distances.

2.2 Rugby Union Preparation

Preparation in Rugby Union is very important, Nicholls and Collard (2011) say that preparation refers to the process of ensuring that a player is ready for forthcoming activity, it begins in the days preceding activity and consist of dietary changes, physical training and psychological training such as mental imagery.

For match preparation Nicholls and Collard (2011) write that physical preparation is the process of ensuring the body is physically ready for a match, this involves being warmed up at the beginning of the game, having optimal energy levels at the start of the game and performing movements relevant to the sport, such as passing, tackling and catching. Gamble (2004) writes that general low intensity activity should precede all training sessions and matches, for training sessions this should be in the form submaximal running including rugby specific activities to maintain participant interest. Biscombe and Drewett (2009) write that before any exercise, including Rugby, it is important to follow a warm up which includes stretching, as this will aid in preparing the body for exercise. The authors say that warm up is exactly as the name suggests, a method of increasing bodily temperature to ready it for exercise. Gamble (2004) writes that warm up can be used to guard against muscle-tendon injuries, gym warm ups should use ergometers such as rowing machines as they are ideal methods to warm up because they incorporate whole body movements. The rationale behind a general warm up is that it reduces viscosity through the increase of core and muscle temperature.

Biscombe and Drewett (2009) say that warm ups should begin with light jogging over a short time period to increase body temperature, then a routine of stretches should be completed before more intense jogging to further increase body temperature, any tightness in the muscles that is felt during this jog should be addressed through localised stretching

Alsop, Morrison, Williams, Chalmers and Simpson (2005) looked at the effects of warm up on injury prevention, they investigated how duration of warm up could be used as a protective factor. The authors found that warm ups completed over 20 minutes were just as effected as those that were longer than 20 minutes. They found that warming up resulted in a small reduction of the risk of injury. Although the risk of

injury is only mildly reduced, this study still shows the importance of a warm up in injury prevention.

2.3 Physiological Effects of Massage

Goats (1994) says that massage has been used as a method of restoring normal function following injury, as well as an aid to achieving maximal performance. Massage can aid with blood clotting, oedema and lymphatic drainage by assisting arterial and venous blood flow. According to Standley et al. (2010) massage has been used to soothe sore muscles, increase local circulation, reduce muscle spasm and adhesions, stimulate muscles, reduce inflammatory response, relax muscle and increase circulation. Tiidus and Shoemaker (1995) say it is commonly assumed that massage can enhance muscle recovery after exercise, this occurs through an increase in blood flow. However they concluded in their study that these claims were incorrect and that massage was not able to enhance long term restoration of muscle strength. Mancinelli et al. (2006) say that through increased circulation and lymphatic flow, tissue repair can be aided. They write that massage is considered to have a number of psychological and physiological benefits.

According to Goats (1994) the therapeutic effects as well of the physiological effects of massage are often questioned. Massage is commonly referred to as a therapeutic art, however this claim is often made without scientific foundation. Mancinelli et al. (2006) write that little is known about massage and how it can enhance physical performance. The authors theorise that force output will be decreased due to muscle damage, in turn causing DOMS, and therefore performance will be decreased. Weerapong et al. (2005) say it is believed that massage may aid in the recovery and preparation of athletes, however there is very little scientific evidence to support this theory. They write that it is unclear what the effects on athletic performance are due to the fact that the mechanisms of each massage technique used have not been investigated in depth. Mancinelli et al. (2006) go on to say that studies have shown massage to have no effect on improving blood flow and reducing soreness, and that light jogging better serves as a method of improving blood flow and reducing soreness.

Standley et al. (2010) say that commonly used techniques for the enhancement of performance and injury recovery include; Effleurage, Petrissage, Tapotement, Friction and Vibration. Young, Gutnik, Moran and Thompson (2005) say that massage is widely used in sport with the aim of improving performance, recovery and reducing soreness post activity. Several studies have looked into the contradictory effects of massage on athletic performance, however there are few well controlled studies that have investigated massage and these have primarily focused on its potential to aid recovery from fatigue and enhance performance. Standley et al. (2010) say that there have been studies that have shown massage to be beneficial when aiming to enhance performance through the use of different combinations of techniques. Mancinelli et al. (2006) wrote that it is theoretically possible that massage may help to move fluid away from involved tissue aiding in recovery as well as improving sports performance, however these claims are yet to be substantiated fully.

2.4 Effect of Massage on Performance

Goodwin et al. (2007) found that combining massage and a traditional active warm up had no significantly greater effect over just performing a traditional warm up. Therefore at best this extra time spent receiving massage would be wasted and better spent performing more productive training modalities. Similarly Fletcher (2010) studied the effects of pre-competition massage on the kinematic parameters of 20m sprint performance, the author found that the inclusion of pre competition massage can be a waste of time in which an athlete could explore more beneficial training methods.

According to Fletcher (2010), no positive benefits can be directly attributed to massage, and therefore it should not be seen as imperative to a successful warm up. Fletcher (2010) also noted that any negative effects on performance that massage appeared to have may be time dependant. This idea is yet to be established in current literature, therefore it is recommended that massage is used as a recovery tool and it should be avoided in pre-competition. According to the results obtained in Arabaci (2008) massages should not be recommended for warm ups, in addition to massage, this study also employed rest and stretching as part of its interventions.

2.5 Effects of Massage on Sprinting

In a study done by Goodwin et al. (2007) on the effect of pre performance lower limb massage on 30m sprint running it was found that massage could result in more compliant tissue, this in turn could increase range of motion and step length improving performance, however it could result in reduced running mechanics required for a good step rate and high running speeds. Arabaci (2008) also found that massage can increase muscle compliance and this in turn may limit cross bridge coupling which will impact on vertical jump height, running speed and reaction time. Goodwin et al. (2007) also found that the more compliant muscle that can be attributed to massage is less likely to be able to store elastic energy in the rapid eccentric phase of sprinting. Due to this increased compliancy, force transfer from the muscle to the tendon becomes less efficient, this leads to a reduced rate of force production and contractile velocity, meaning it takes longer for the external force to be produced in powerful movements. The study found that this effect is not altered by including specific warm up exercises. Goodwin et al. (2007) also theorised that the increase in muscle compliance could cause a decrease in both step rate and knee velocity, characteristics which were observed after massage alone was used. They concluded that this may have led to a reduction in efficiency in adaptation to different loads and muscle lengths, again causing running mechanics to be altered, thus effecting power output.

Arabaci (2008) found that his data showed a significant decrease in performance which he directly attributes to the application of massage and stretching. Massage is still recommended however when other benefits may be placed upon the athlete, for example a reduction of muscle spasm and psychological stress.

In a study by Mancinelli et al. (2006), the effects of massage on female athletes was investigated at the start of their volleyball and basketball season. After intervention the authors found that vertical jump height and shuttle run times had significantly improved, they also found that the athlete’s levels of perceived soreness were significantly decreased. The results of this study suggest that if massage is performed at the most optimum point, functionality will be positively improved, these findings are contrary to many studies. Due to flaws in the studies design the results are questionable. Factors such as the small sample used, the inability to have

control over the athletes during their preseason conditioning as well as the reliance on the strength and conditioning coach to make accurate predictions as to when soreness will be at its peak.

2.6 Effects of Massage on Flexibility

In a study by Hopper et al. (2004), the authors found that massage could significantly change hamstring flexibility in the short term. Another study by Hooper et al. (2005) looked at hamstring length in female hockey players, athletes were randomly separated into two group's one receiving effleurage and petrissage over a period of eight minutes, the other group received dynamic soft tissue mobilisation. The results of the study showed that hamstring lengths significantly changed through the use of both techniques, however these changes were not maintained at 24 hours post intervention in either group. Brummit (2008) writes that although athletes may experience improvements in hamstring length and flexibility through massage, these results may be transient. If the short term goal of an athlete is to improve hamstring flexibility then there are more efficient methods. These methods are particularly useful when an athlete does not have access to massage. In a study by Barlow et al. (2004) they investigated the immediate effects that massage had on hamstring flexibility in active men. The authors concluded that the single application of massage did not significantly affect sit and reach performance. Although they did not find any significant change amongst the small sample they used, they did discover that participants who had poor initial scores had a greater percentage of change in reach when compared to the participants who scored better in their original tests.

2.7 Post Activity Massage

Tabatha (2006) reviewed a study done in Scotland where ten male participants were required to complete leg extensions after 30 minutes of either receiving lower limb massage or resting. From this activity they discovered that the application of massage significantly decreased lower limb extension strength. Tabatha concluded that because of this negative effect on performance, massage should be used post activity. In the article Tabatha also writes about another unidentified study that found participants who received massage on the hamstrings after performing leg curls experienced a reduction in discomfort and pain in the following 48 hours. Rodenbury et al. (1994) found that using a combination of warm up, stretching and massage can

reduce the negative effects of eccentric exercise, however their results were inconsistent. They found that some parameters were significantly affected through treatment where as others had little effect, despite the expected effects and the efficiency of using the combined treatments. Brooks, Woodruff, Wright and Donatelli (2005) investigated how massage can effect power grip performance in healthy adults, post maximal exercise. The authors found that massage was significantly better when compared to the other two interventions for post exercise grip performance. They also found that grip performance was significantly greater in the non-dominant hand when compared to the dominant hand post intervention. However In Hemmings et al. (2000), the authors studied the effects of massage on physiological restoration, perceived recovery and repeated sports performance, their results showed no significant differences in performance between the groups used in the study. These finding question the benefits of massage for physical recovery post exercise and sports performance.

2.8 Summary

The research of Standley et al. (2010) in to the effects of massage on injury, recovery and performance present the benefits of massage therapy, they say that massage should be used as a therapeutic tool by strength and conditioning specialists. Within their findings they outlined the importance of using the right massage techniques at the appropriate time and with the right combinations for injury recovery, injury limitation and the preparation of an athlete for sports performance.

Within Weerapong et al. (2012) study of the mechanisms of massage and how they affect sports performance, they discovered several limitations of previous research about massage and how it can influence performance and injury prevention that have resulted in inconclusive findings. They conclude that further research is required to establish the potential benefits of massage. The majority of massage techniques have not been examined in depth and therefore their neurological effects have not been established. Thus there is no evidence that supports the claim that certain techniques increase neuromuscular excitability. Similarly to Standley et al. (2010) they believe that more research must be carried out to determine whether

massage is in fact beneficial for enhancing sports performance, recovery time from injury and reducing the risk of muscle injury.

In a study examining the acute effects of pre event lower limb massage on explosive and high speed motor capabilities and flexibility by Arabaci (2008), the findings show that performance is significantly degraded by ten minutes posterior and five minutes anterior lower limb massage applied after a warm up. However, although Goodwin et al. (2007) believes it is non beneficial to have pre event massage the study does not find massage to have any negative effects. Their study finds that massage should not be used as a warm up replacement as it does not improve performance beyond what an active warm up achieves, despite this they also found it not to have any detrimental effects on performance.

Other than Arabaci (2008) no other studies have examined the effects of combined pre event posterior and anterior massage on the lower limbs, and how together they may affect vertical jump performance, sprint time, reaction time and flexibility. Prior studies more frequently used posterior massage or less frequently anterior massage of the lower limbs.

Field (1998) wrote that much of the current literature regarding massage focuses mainly on clinical conditions, only a handful of studies are based on clinical trials. Typically, sampling issues occur through the failure to have control groups and the lack of randomly assigned treatment and control conditions. The use of within subject designs allow for results to be questionable because the effects may be justified in other ways, placebo effects, statistical regression and spontaneous recovery are all ways of justifying changes that may have occurred through these treatment interventions.

Another problem with many of the studies is the sample size, the majority use small samples and the treatment groups also received more than one type of treatment. The initial level of the participants can also cause potential problems, participants performing at a high level of athletic competition are likely to use massage as part of their training and therefore may be less influenced by the treatment they received. This could be used as an explanation of the mixed and varied findings in many of the studies. The use of statistical processes are a problem, a meta-analysis would be ideal, however because the studies do not use comparable methods and have

varying standards as well as utilising many different and varying massage techniques this is very difficult to do so. The majority of studies do not perform follow up studies in order to assess any long term changes that massage may have caused. Field (1998) believes that there may also be a bias towards the publication of more favourable positive results, and negative results often go unpublished.

After reviewing current literature, Brummit (2008) writes that in future, research should investigate which athletes would be ideal for the use of massage as an intervention and how long the intervention should be applied for as well as the length of time of the application in order to gain more permanent changes. Brummit (2008) also writes that there is a poor understanding and appreciation of the effectiveness of massage in a clinical environment. There are some unique studies which were designed with the aim of investigating the effects that sports massage has, however the author believes that further investigation is required.

In general massage has failed to produce positive effects on sports performance. Study's that do show massage to influence performance positively often have design flaws which allow the conclusions to be questionable. Much of the current literature does demonstrate an association between massage and short term or temporary changes it may cause mainly in hamstring flexibility. These studies with positive short term outcomes do not predict or attempt to direct future study or sports performance, when they should be aiming to provide guidance for future investigations. Brummit (2008) concludes that additional research needs to be aimed at performing massage immediately prior to performance. Barlow et al. (2004) suggest that in future a larger sample should be used, as well as the need to investigate flexibility and how it is effected through the application of both proximal and distal massage on the targeted tissue.

2.9 Hypothesis

Based on existing literature and studies such as Hemmings et al. (2000), Barlow et al (2004), Goodwin et al. (2007) and Fletcher (2010) who all found massage to have little or no effect on sprint performance. As well as that of Brooks et al. (2005), Tabatha (2006), Arabaci (2008) and Brummit (2008) who believe massage has some negative effects on performance. The hypothesis for the current study is; pre competition massage will have no significant effect on sprint performance.

CHAPTER III: METHODS

3. METHODS

3. 1 Introduction

The purpose of this study is to gain a better understanding of the effects of pre competition massage on the sprinting performance of male Rugby Union players. In order to obtain the information that is needed for this study quantitative data was collected. Roberts, Priest and Traynor (2006) say that quantitative research is the conduct of investigations using methods that gain primarily numerical data, whereas qualitative research generally uses exploratory approaches in order to gain textual data as opposed to numbers or measurements. The use of numerical data allows for direct comparisons between sets of numbers to find relationships between them, therefore a quantitative approach to data collection is most appropriate because sprint performance can be measured using time. Using quantitative data does have its draw backs, this method fails to take into account the psychological thoughts and feelings of the participants and how they felt during testing and massage. In order to gain this information a qualitative approach to data collection would be required however because of the importance of time as a measure of performance in this study a quantitative approach was of most benefit.

For this study a cross over design was used, this allows for participants to be compared against themselves. According to Delaney and Suissa (2009) a cross over study design is an efficient alternative to a case control approach, the use of this design allows for within subject comparisons.

The data required for the study was obtained from male Rugby Union players at Newbury RFC, Berkshire, a group of players completed two 30m sprints under the two different testing conditions; warm up alone and massage and a warm up combined, testing was completed over one week at two different training sessions. Both sprints were recorded on the training pitch at Newbury RFC using Smartspeed (FusionSport, Australia) electronic timing gates.

3.2 Participants

14 male Rugby Union players (Age 22 ± 3 years) from Newbury RFC volunteered for the study which was approved by the Cardiff Metropolitan ethical committee. Participants all had first team playing experience at Newbury RFC and had played a minimum of three games during the 2013/ 2014 season. Each participant was free from musculo-skeletal injury for one month prior to testing and completed an average of 6.5 ± 2.3 hours of participation in Rugby Union training and playing per week. Any player information collected was kept anonymous in order to remain confidential. Participants were provided with an information sheet (Appendix B), which informed them of the testing procedures and inherent risks associated with the study before they provided written consent (Appendix C), to participate in the study. Each participant also completed a short verbal screening process following set questions to assess their suitability for massage and ensure they were not contraindicated (Appendix D). Prior to testing participants were requested to refrain if possible from excessive activity in the 24 hours preceding each testing session and to not eat in the hour prior to testing. Finally participants were informed of their right to withdraw from the study at any time without having to provide reasoning.

3.3 Instruments

Throughout the study the instruments being used remained the same, individual participants testing procedures were be kept the same along with pre testing procedures to ensure high levels of validity and reliability. The two massage tables used for each test were not change and the same Chemodis Chemovine Massage Oil was used to prevent any effects from different massage mediums from being an issue. During the testing stage Smartspeed (FusionSport, Australia) timing gates were used to ensure the highest possible levels of accuracy and to allow software to be immediately uploaded onto a computer, the sprint distances were measured using a 50m tape measure. During testing all participants must wore boots and all the data was collected from players running on the training pitch at Newbury RFC.

3.4 Procedure

During the initial stages of testing participants completed a verbal client assessment before they received massage, they were also required to provide informed consent in the form of a signature to be able to continue with testing. Next participants were given an information sheet providing them with information about the testing procedure and how it progressed. It will also gave them an insight into why the study was being carried out. During the first testing session half of the participants rested for 15 minutes prior to completing a standardised warm up, the other half received a 15 minute lower limb massage on the Anterior and Posterior sides of their lower limbs with five minutes being spent on each muscle group (Quadriceps, Hamstrings, and Calves), the massage will include a variety of effleurage techniques progressing from superficial to deep, combined with Petrissage. The speed and intensity of the massage was progressive finishing off vigorously in order to stimulate the client and prepare them for activity. The designed protocol was done by massage practitioners with the aim of having the greatest effect on the participants sprinting performance. During the massage the masseur explained what techniques were being used and their physiological effects. After the completion of the massage the participants followed a 10 minute warm up before taking part in the sprint tests. The two groups then swapped and the process will then be repeated in the following session which took place a minimum of 48 hours after the initial session.

All sprints were performed on grass with participants wearing foot wear appropriate to Rugby Union such as moulded or studded boots. Players were instructed to sprint maximally for the entire length of the course ensuring they stay within the Smartspeed (FusionSport, Australia) electronic timing gates which were placed approximately two meters apart. Participants began each sprint from a marker 1.5m behind the first Smartspeed (FusionSport, Australia) gate, in a three point stance, players were instructed to begin their sprint in their own time when they felt ready. Each participant performed one repetition of the sprint over 30m. For each participant the time taken to cover the first 10m was recorded as well as the time taken to cover the full 30m course.

3.4.1 Massage Condition

The massage protocol consisted of commonly used techniques, namely effleurage and petrissage (Appendix E). The pace of delivery was progressive starting off slowly and superficially progressing to faster deeper strokes, the increase in pace was designed to create a stimulatory effect and ready the participant for competition. The massage was administered by two qualified sports massage practitioners, who prior to the commencement of the study colluded in order to familiarise themselves with the techniques and their application. The massage protocol consisted of massage being delivered first to the quadriceps, next the hamstrings and finally the calves over a period of 15 minutes with approximately five minutes of contact for each muscle group. The total time for each massage was 15 minutes with no allocation of time for the application of oil or the turning of the participant. After the application of the Chemodis Chemovine Massage Oil each of the muscle groups received approximately 2.5 minutes of massage. This treatment comprised of approximately two minutes of effleurage and when possible thirty seconds of petrissage, however due to variations in the size of participants it was not possible to apply petrissage to each muscle group for every participant, Table 1 Shows the specific techniques used and their order of application.

Table 1. Techniques and order of Application.

Massage Order of Techniques
Effleurage
Half Moon Flat Hand 'V' Rotary Cam & Spindle Forearm Glide Butterfly
Petrissage (Two hands move inwardly moving circles which intersect)

3.4.2 Warm-up Procedure

After receiving massage each participant was instructed to complete a warm up of approximately ten minutes in duration in order to ensure they were ready for competition and to reduce the risk of any injuries being sustained during testing. The warm up consisted of a self-paced jog around a full sized rugby pitch, which immediately preceded three slow jogs over 10m, for the first of these participants were instructed to do heel flicks, the second high knees, and the third walking lunges. Following this participants performed three 30m practice runs of varying effort, the first of which they were instructed to sprint at no more that 60% of their maximal effort, next 80% of maximal effort and finally 100% of maximal effort. Following this participants rested for five minutes and were specifically instructed not to perform any stretches as they may have an influence on sprint performance.

3.5 Statistical Analysis

Statistical analysis for the study will be done using SPSS (Statistical Package for Social Sciences) software with the significant value set at $p<0.05$, all values were expressed as mean +SD. The statistical processes used for this study was a one way repeated measures ANOVA, Salkind (2004) says that analysis of variance is a test to find the differences between two or more means. This process will show treatment effects on performance, if any, for participants times over 30m as well as the 10m split time. Microsoft Excel was also used to provide values in a general descriptive manner, such as standard deviation and mean.

3.6 Reliability, Validity, Ethical Concerns and Ecological Validity

3.6.1 Reliability

According to Roberts et al. (2006) reliability is the amount of variability in a measured score that has occurred because of the variability in the true score. Segal (2006) says that reliability refers to the stability and/ or the consistency of measurements. Therefore a test with good reliability means that test scores will stay the same when they are repeated, as long as no other factors affect the score. Reliability is of upmost importance because evidence of reliability is generally the first step in gaining scientific acceptance and therefore it is a good measure of how useful a test is. Segal (2006) also says that the validity of a test can be evaluated once reliability

has been established. This study addresses reliability by using a clearly defined massage protocol and fully describing the testing procedure in detail. The use of a familiarisation session prior to testing also allowed the practitioners to understand what was required by them and to feel confident and comfortable with the protocol, this allowed for the protocol to be more repeatable due to the familiarisation of the routine.

3.6.2 Validity

According to Leighton (2008) validity is how empirical evidence and theory support the interpretations and inferences of test scores and their particular uses. Validity is considered to be the most fundamentally important component when developing and evaluating educational and psychological tests. Gallesty (2008) defines validity as the extent to which something does what it is intended. Leighton (2008) also says that validity involves the accumulation of theoretical justification and evidence for claims made about attributes such as achievement or abilities.

This study investigated the effects of pre-event massage and how it can effect sprint performance in male Rugby Union players, the method was designed to ensure high levels of validity. Cash (1996) provides general guidelines for pre event massage which were used to design the massage protocol utilised in this study. These guidelines aided in ensuring that the massage protocol was in fact pre event and not inter or post competition. The sprint distances used within the study closely replicate those that a player may actually complete during a match, this improves validity in relation to actual competition. The use of Smartspeed (FusionSport, Australia) electronic timing gates allowed for sprint times to be recorded with the highest degree of accuracy and served as a valid method of recording speed and performance.

3.6.3 Ethical concerns

Ethical concerns are associated with all studies, to prevent these concerns causing issues this study used methods to allow for ensured confidentiality of participants, safety of participants and also practitioner safety. Participant safety was assured through the use of a verbal client assessment which followed strict guidelines and questions (Appendix D) this assessment was used to ensure that all participants partaking in the study were fit to do so and did not suffer from any issues that maybe affected or aggravated by the procedures used. All participants followed a warm up routine which meant the risk of injury was reduced. Confidentiality of participants was ensured through the use of password protected data files and computers, as well as through the use of client identification codes as opposed to the use of names. Information such as addresses and contact details were not taken again to ensure confidentiality is respected. Safety of the practitioners was ensured through the use of a familiarisation session where the practitioners were encouraged to use proper technique and posture when administering techniques. The use of a safe clear environment, re assessment on test days (Appendix D) and adjusting bed height to ensure it was appropriate all aided in reducing the ethical concerns associated with the study.

3.6.4 Ecological Validity

Blankenship and Wegener (2007) say ecological validity is how research findings generalize to settings in everyday life. This study was conceived with the aim of reproducing the real life situation as closely as possible whist still being able to gain quantitative data. Much of the current research in massage follows a strict protocol, and although this may improve validity of a study it does not reflect what actually goes on in the field. Therefore it is possible to argue that the use of a strictly controlled protocol may not be beneficial to participants as it does not replicate what happens in real life situations where a different response may occur. Ecological validity was addressed in this study through the use of accurate sprint distances that are relevant to rugby union, the use of a warm up that was also implementable in rugby union and a massage protocol that allowed for some scope and variation depending on specific player needs.

CHAPTER IV*:* RESULTS

4. RESULTS

14 participants (Age 22 ± 3 years) completed the testing procedure with no associated complications or problems. The height and weight of the participants was not recorded as this was deemed to be of little relevance to the study. All data has been reported as mean ± standard deviation, significance was accepted as $p<0.05$. The study results indicated that there are no significant differences between the two testing conditions (Warm up alone vs Massage and Warm up combined) over ether of the recorded distances.

Figure 1 shows both the mean and standard deviations for 10m and 30m split times through both interventions, this data is displayed in the form of a bar chart. The mean time for 10m split times were recorded as 10m WU Only (warm up only) (1.859 ± 0.058 seconds) and 10m WU and Massage (warm up and massage) (1.891 ± 0.039 seconds). These figures show that there is very little variation between the two testing conditions in both standard deviations and sprint times. The mean time for 30m split times are also shown in Figure 1, these were recorded as 30m WU Only (warm up only) (4.530 ± 0.138 seconds) and 30m WU and Massage (Warm up and massage) (5.542 ± 0.138 seconds) Again both of these figures show there is very little difference between the results of both testing procedures.

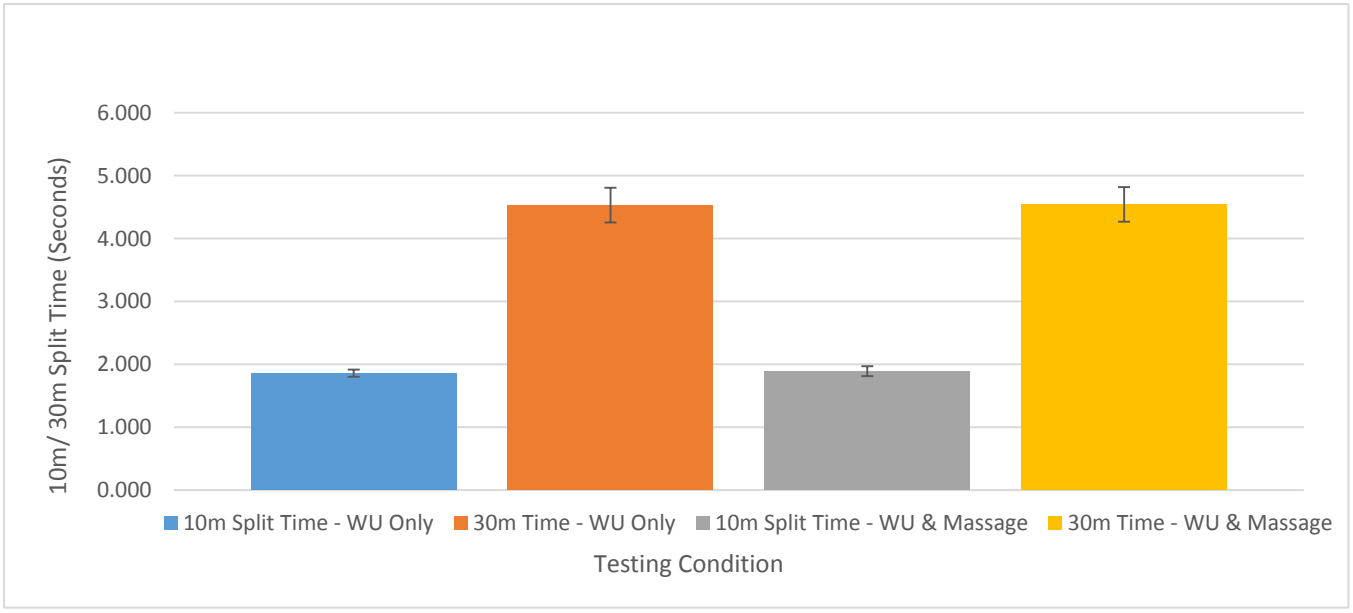

Figure 1, Mean and Standard Deviations for 10m and 30m Split Times

Table 2 shows the levels of significance for both testing conditions over 10m and 30m. The significance value for 10m was 0.104 this is well above the value of significance, set at $p<0.05$, there for it is assumed that there is no significant difference between the results for the two testing conditions. Similarly the significance value for 30m was 0.623, this again is well above the value of significance, $p<0.05$, this again suggests high levels of non-significance.

Table 2, Significance Values for Both Testing Conditions over 10m and 30m

Distance	Warm-Up Condition	Significance Value
10m	Massage and No Massage	0.104
30m	Massage and No Massage	0.623

The individual times for each participant were also recorded and shown in a line chart, figure 2, this chart shows participant times for both 10m split and 30m split times. These results again show that there is very little difference between the testing conditions, there is little difference between each intervention as the time difference for each participant is minute. The Lines of the graph also follow very similar patterns for each split time, this suggests the times are similar and there is no major difference between them.

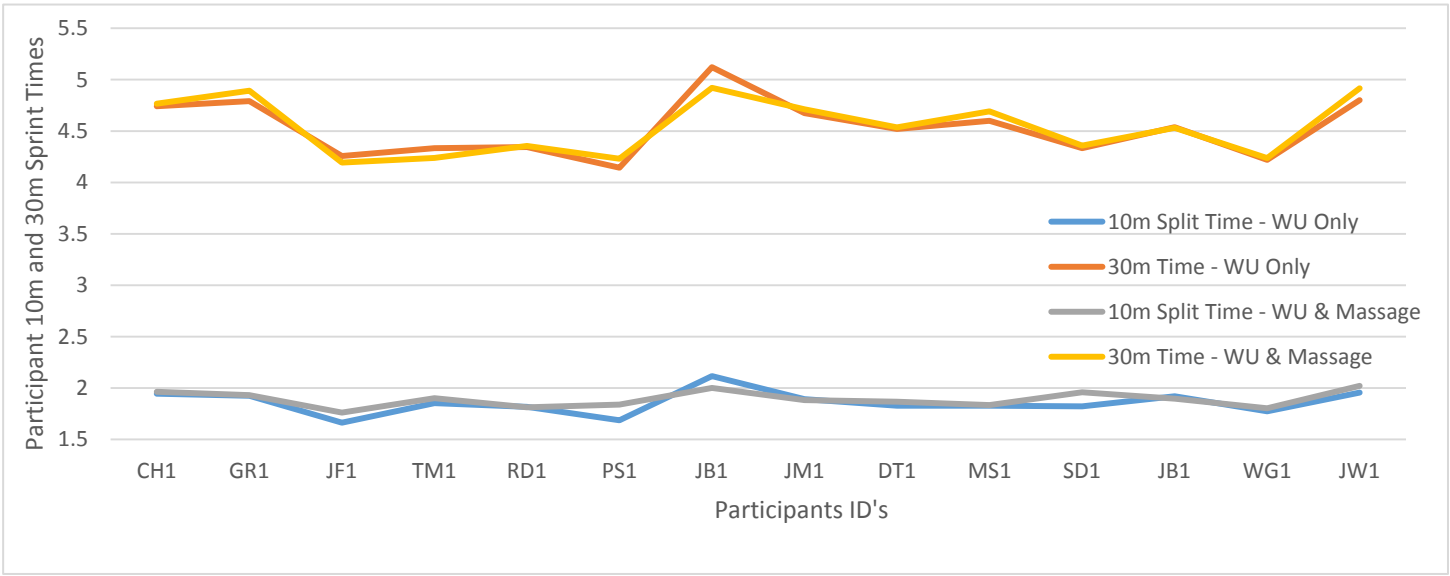

Figure 2, Participant Times Over 10m and 30m

CHAPTER V: DISCUSSION

5. DISCUSSION

5.1 Findings

The purpose of this study was to investigate the potential benefits pre event massage combined with a warm up may have on sprinting performance in male Rugby Union players. The study was developed following the identification of limitations within current literature in the massage field, and looked to ascertain the effects the intervention has on performance. Analysis of the data elicited results to show that massage did not significantly affect performance; as there were no significant differences between the two testing protocols and their results. These results, therefore, confirm the hypothesis. The lack of significant differences between scores was evident over all of the results analysed (10m & 30m), and suggested similar patterns for all stages of testing/ sprinting. Whilst massage was observed to increase sprint times, the data produced times which differed so slightly that they were deemed statistically insignificant. The results indicate that the massage condition had a minor negative effect on performance (+0.032 seconds and +0.011 seconds in the 10m and 30m conditions respectively); although these times are not deemed statistically significant, they may be relevant within certain sports, whereby the difference between winning and losing can be fractions of a second. Kyndt and Rowell (2012) argue that athletes are constantly looking for ways to develop, and gain even the smallest advances that will help them be competitive.

The data analysed for the study was collected at two points of a maximal 30m sprint Cronin and Hansen (2006) highlight that the acceleration phase of sprinting is between 0-10m, however it can last up to 30m. A one way repeated measures ANOVA was completed in order to find any statistically significant differences between the two sets of data over 10m and 30m. The results from the ANOVA suggest that massage combined with warm up had neither positive nor negative effects on sprint performance when compared to warm up alone, as no significant difference between the two protocols was observed ($p>0.05$). Due to these findings, sports performers, more specifically Rugby Union players, may seek alternative methods in combination with their warm up in order to enhance performance. Self-imagery has been suggested by Beauchamp, Bray, and Albinson (2002) to be effective in enhancing performance, whereas Young (2007) argued that static stretch

may be effective in preparing an athlete. The modality of choice is individual to each sportsperson, and will vary depending on the level of competition and personal preference. Visually, the results suggest the testing conditions produce very similar effects, due to the trends demonstrated following a comparable trend. Causality cannot be assumed in this instance, however.

5.2 Comparison to Literature

Much of the current literature regarding massage and its effects on performance have gained similar outcomes to the current study, and similarly conclude that massage has little or no effect on sprint performance. The combined use of massage and warm up did not significantly affect sprint times over 30m when compared to the use of massage alone. The current study uses a similar massage protocol as the one used by Goodwin et al. (2007); the protocol was based around literature on massage by Cash (1996). There were, however, marked differences between the protocols. Where Goodwin et al. (2007) uses a well-defined method, the current study allows for adaptation and change depending on the needs and requirements of the specific athlete. Previous studies (Brooks et al., 2005; Goodwin et al., 2007; Arabaci, 2008; Fletcher, 2010; Standley et al., 2010) use less specific populations for their research; the current study applies a similar methodology but uses a specific population sample, in which there is very limited research to date. Due to the findings of the study, it can be suggested that massage has little benefit to Rugby Union players when looking at modalities to enhance their sprinting ability. A similar protocol would need to be applied to a variety of populations to see if this finding is a common theme.

The current findings are similar to those of Goodwin et al. (2007), Fletcher (2010) and Hemmings et al. (2000) who all found massage to have no effect on sprint performance. Similar to the current study, previous results suggest there are no significant differences between the testing procedures used. The similarities between the studies occurred despite the use of different sprint distances; Fletcher (2010) recorded times over 20m, Goodwin et al. (2007) over 30m. Due to this, the current study used distances over 10m and 30m to monitor performance. The results suggest that distance is not relevant when assessing the effects of massage on sprint performance.

Whilst Rodenbury et al. (1994) looked at the massage effects on eccentric exercise, and Mancinelli et al. (2006) investigated how massage affects vertical jump height, previous research to date has not focused solely on the effects of massage on sprint performance. Research into the effects of massage on hamstring length and flexibility is plentiful; Arabaci (2008), Hooper et al. (2004), Hooper et al. (2005) and Mancinelli et al. (2006) all argue that massage improves hamstring flexibility. This is an interesting point to consider when looking at the results from the current study. It would be important to establish the amount of hamstring flexibility gained from these studies, as this may affect stride length, and, consequently, positively affect sprint times. This would be important to note during future studies, as a combination of variables would elicit more detailed results from which conclusions can be drawn. By using the current methodology to assess performance, and recording changes in hamstring flexibility, it can be noted whether massage positively affects stride length, and consequently reduces sprint times.

Goodwin et al. (2007) argue that the effects of massage resulted in tissue alteration which reduced running mechanics in healthy adult male subjects. Arabaci (2008) supported this claim, arguing that massage may limit cross bridge coupling, impacting negatively on speed. Goodwin et al. (2007) also found that this tissue alteration reduces the ability of the tissue to store elastic energy in the musculotendenous junction, affecting the elastic recoil observed in the rapid eccentric phase of sprinting. This would, subsequently, reduce rate of force production and cause a decrease in step rate and knee velocity (Goodwin et al., 2007). This would be of great importance to coaches looking to enhance their athlete's sprinting potential, and is an area that requires future development. It must be noted, however, that the results shown within Goodwin et al. (2007) are elicited from a specific population, so generalisation of these findings, in agreement with the current study, must be done with caution.

5.3 Scientific Reasoning

According to Goats (1994) and Standley et al. (2010) the physiological effects of massage include the stimulation of muscles aiding performance. Following these views, it can be assumed that massage has the ability to improve performance; however, these assumptions are based on perceived physiological effects and there is little evidence to substantiate them. The majority of the previous literature suggests results to the contrary that massage can actually cause negative effects on performance. In a study by Arabachi (2008), the data gained suggested that massage caused significant decreases in performance, similar to the results of Tabatha (2006). These findings may be due to the fact that the suggested effects of massage do not reflect the scientific effects. Mancinelli et al. (2006) and Goats (1994) question the scientific foundations of claims about the physiological effects of massage, and report that there is little research on this subject. Weerapong et al. (2005) argue that massage may aid athlete preparation; however, the authors conclude that there is little scientific evidence to support this theory and that the physiological effects of different techniques require further research. The findings from the current study would suggest that further research is required within this field in order to establish if physiological changes occur before and after massage. Consequently, it would be prudent to establish what effect, if any, this has on sprinting performance.

The effects of massage may not be long lasting and this may serve as an explanation as to why massage has no effect on performance. Goodwin et al. (2007) found that rapid stimulatory massage had no significant effects on sprint performance; the authors hypothesise that any negative effects associated with the massage may have dissipated after warm-up has been completed. Similarly, Fletcher (2010) reported that negative effects of massage may be time dependant, although this idea has not yet been established in current literature. Goodwin et al. (2007) recommend that this idea should be explored further, and future research should be aimed at gaining a better understanding of this area.

It is important to be mindful of the fact that this study found no significant effects, suggesting massage is neither derogatory to performance nor does it provide any physiological benefits. Aforementioned views and ideas, such as those discussed by Mancinelli et al. (2006), Goodwin et al. (2007), Arabaci (2008) and Fletcher (2010), merely provide suggestions as to why massage has no effect on performance. As previously highlighted, massage can produce similar effects to stretching, such as improved muscle length, but without the negative effects associated with stretching. On this basis, massage may be a better alternative to stretching protocols for pre event preparation, contradictory to the views of Fletcher (2010) who recommends that massage should be avoided in pre-competition; similarly, Arabaci (2008) recommends that long massages should not be used during warm ups.

Following these conflicting views, athletes and coaches should consider time constraints and facilities available to them when deciding the modalities of choice during their pre performance preparation. This is particularly relevant in team games, such as Rugby Union, when space and time dedicated to individuals is often minimal. It is also important to consider the 'placebo' and psychological effects that may be associated with massage, and how they can influence an athlete. This could be argued to be one of the main reasons why massage is continually used within a pre competition setting. Future research could be aimed at finding advantages and disadvantages of massage in a psychological way, as there is limited literature regarding this. It would also be important to study whether a combination of physiological and psychological methods affect performance.

5.4 Practical Implications

Based on the findings of Goodwin et al. (2007) and Arabaci (2008), as well as the conclusions of Brummit (2008) who says that future research should be aimed at performing massage immediately prior to sports performance, the current study has aimed to address areas identified by these authors. The use of an in depth review of literature allowed the study to be aimed specifically at Rugby Union players and made it more relevant for this specific population. This also addressed ecological validity of the study though the use of a sprinting distance which is likely to occur within Rugby Union. The study's findings show that there were no significant statistical differences between the uses of massage and warm up and warm up

alone; this may have implications for the use of massage by both coaches and athletes. Coaches and athletes may seek other modalities that can be utilised pre performance due to the inconclusive findings of this study. These findings do not suggest that massage should be disregarded entirely in a sports setting; a study by Andersen et al. (2013) found that massage could significantly reduce delayed onset muscle soreness. Whilst literature exists into how massage may affect the recovery of an athlete, future research may wish to concentrate on whether massage can help to prevent delayed onset muscle soreness. Although inconclusive as to the effects on performance, massage has many practical benefits within a sporting setting.

5.5 Study Limitations

As is the case with any research process, there are associated weaknesses and imitations. In this instance, sample size is one of the main limitations as the study comprised of 14 participants from one rugby club; generalisation of findings may be limited by small samples sizes. Through an increase in participant numbers, and through the collection of results from a wider population spanning all of the tiers of English Rugby Union, a more representative sample population can be provided; from this, the significance of relationships and differences between the data can become easier to portray. Goodwin et al. (2007) and Fletcher (2010) use 20 and 37 participants respectively, highlighting the need for larger samples.

Another major limitation of the study is the environment that testing was completed in; the testing took part outside, where it is almost impossible to regulate factors such as wind and temperature. These factors may have influenced sprint times, with Ward-Smith (1999) arguing that sprinting performance is significantly influenced by a head wind as it increases drag, causing the athlete to move slower over the ground. These problems were difficult to overcome due to the fact that indoor facilities that have similar surfaces to that Rugby Union is played on were not available for the study. This factor could have been over come through the use of an indoor facility that did not replicate the surface that Rugby Union is played on, however this would have reduced ecological validity, which was a very important aspect for this study.

The lack of monitoring of participants during the periods outside of testing could be considered another limitation to this study. Participants' diet, outside activities and training were not controlled during the testing period. Participants were asked to avoid activity in the 24 hours prior to testing and not to eat 60 minutes prior to testing; however, no other guidelines were imposed on them. This limitation could have been avoided through the use of a much more controlled laboratory based study, which could have monitored preceding activities with the aim of reducing the effects they may have had on the study. A laboratory based study was not used because of the requirement to make the study applicable in 'real life' situations to improve ecological validity.

5.6 Study Strengths

This study has addressed gaps in current literature available on pre event massage. There is very little literature that has looked at massage and how it can effect sprint performance particularly in Rugby Union players. One of the main strengths of the study was the ecologically valid testing procedure; this procedure replicated a specific aspect of Rugby Union, incorporating a distance relevant to the sport, an environment which exactly replicated that of which Rugby Union is played on, the ensured use of Rugby appropriate footwear, the use of a warm up which could be used in Rugby Union and the application of a massage protocol which could be adjusted during its application to meet the needs of each individual. All of these elements help to boost ecological validity and allow the study and its results to be easily interpreted by coaches and players. The use of a specific population, in this case Rugby Union allows for comparisons to be made with previous studies such as Goodwin et al. (2007), Arabachi (2008) and Fletcher (2010) which have taken a more general approach.

CHAPTER VI: CONCLUSION

6. CONCLUSION

6.1 Conclusion

The study was conceived following an extensive review of literature into pre competition massage and its effects on sprint performance. There was a clear gap regarding literature in Rugby Union and how pre performance massage can affect sprinting within the sport. The aim of the study was to determine whether the use of pre competition massage combined with a warm up had any significant benefits to performance when compared to a warm up alone. The findings show that massage has no significant benefits to sprint performance in male Rugby union players over 10m and 30m, concurring with Goodwin et al. (2007) and Fletcher (2010). It may be beneficial to investigate why massage does not have significant benefits to performance in future studies, as the scientific reasoning for this lack of effect are not clear. Massage, however, should not be disregarded in a sporting environment, as it has many other applications that athletes may benefit from. This is an area which needs to be investigated further and could guide future research.

6.2 Future Research

In future, research could be guided based on the previously limitations. Sample size could be increased in order to improve the statistical reliability of results and gain a better understanding of the Rugby Union population as a whole, as opposed to collecting data from a single middle tier team. The testing environment could be adjusted in order to limit the effect of weather and temperature on test results, and can be achieved through the sourcing of appropriate indoor facilities that aim to replicate outdoor playing surfaces. The study could also implement laboratory based conditions such as dietary monitory and training guidelines in order to limit the effect that these factors may have on results. Incorporating these factors could improve the current study and reduce the current limitations.

The collection of qualitative data alongside quantitative data could also be used in future testing in order to gain a better understanding of the psychological effects of massage, and how these may influence performance. In a study by Arroyo-Morales et al. (2011), massage was found to positively affect pre event mood state, and found to be particularly beneficial to athletes competing in individual sports where

they are prone to pre event tension. Psychological factors can influence performance massively, therefore, future research could focus on the psychological effects of pre event massage.

Testing the effects of pre performance massage over longer distances would be beneficial, as it is possible for rugby players to sprint over distances of up to 100m. Testing over longer distance will allow for more split times to be measured, giving a more comprehensive view of how massage can effect sprinting in Rugby Union players. Adjustments to the massage protocol may also have a greater influence on sprinting performance; the use of deeper techniques applied over longer periods of time would possibly have more influence on sprint performance. This, however, has associated risks of reducing ecological validity because such techniques may not be used in a sports setting.

CHAPTER VII: REFERENCES

7. REFERENCES

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CHAPTER VII: APPENDICES

8. APPENDICIES

APPENDIX A

ETHICAL APPROVAL LETTER

Date: 10/03/14

To: Thomas Sanders

Project reference number: 13/5/336U

Your project was recommended for approval by myself as supervisor and formally approved at the Cardiff School of Sport Research Ethics Committee meeting of 27th November 2013.

Yours sincerely

Catrin Rowlands

Supervisor

APPENDIX B

PROJECT INFORMATION SHEET

Title of Project: The Effects of Pre-Competition Athlete Specific Anterior and Posterior Lower Limb Massage on 30 Meter Sprint Performance in Male Rugby Union Players

Information Sheet

Background

This project is an attempt to understand the effects of massage on sports performance, specifically sprinting, it is being undertaken at the Cardiff School of Sport at Cardiff Metropolitan University, as well as Newbury RFC to gain data.

The project is concerned with finding out if the application of pre event massage along with a standardised RAMP warm up has any significant effects on performance in sprinting and what these effects are whether positive or negative.

The evaluation may be used as a report and might also be published.

You have been invited to take part in the study because it is thought you may benefit from its results, you will gain a better understanding of massage and how it may effect performance.

If you agree to join the study you will be asked to participate in no more than two 30 minute sessions where sprinting performance will be assessed either with or without the application of massage.

Are there any risks?

There are not any significant risks associated with the project, however with all sporting activities there are inherent risks of injury. You will not be asked to do anything that you may not want to do and if at any point you are unhappy about the project you may cease you involvement immediately.

Your rights

Joining the programme does not mean that you have to give up any legal rights. In the very unlikely event of something going wrong during the evaluation, CardiffMet fully indemnifies its staff, and participants are covered by its insurance.

What happens to the results of the evaluation?

The data that is collected during both bouts of testing will stored securely on a locked computer, each participant will have an individual code so that names can be removed and anonymity can be guaranteed. This information may be presented together, however there will be nothing that would allow identification of participants.

The report will be presented in the form of a dissertation to Cardiff School of Sport, at Cardiff Metropolitan University.

Are there any benefits from taking part?

Yes, you will learn about massage and how it can be used within sport, as well as the implication associated with it.

What happens next?

Following this information sheet, there is one form to complete. This form is for you to consent to taking part in the project, if you are willing to take part these forms should be completed upon arrival to your first testing session.

How we protect your privacy:

As is made clear, everybody involved in the study will respect your privacy. Very careful measures have been taken to make sure that any of the information you have provided us with will not give away anything that may be identifiable and traced back to you.

All the information you will be giving us will be stored securely away from consent and assessment form. At the end of the research project any sensitive information will be deleted, consent and assessment forms will be the only remaining information relevant to you, these will be kept for ten years as required by the University.

Further information

If you have any questions about the research or how I intend to conduct the study, please contact me.

Thomas Sanders

07713214658

T_sanders001@yahoo.co.uk

APPENDIX C

PARTICIPANT CONSENT FORM

CONSENT FORM

Title of Project: The Effects of Pre-Competition Anterior and Posterior Lower Limb Massage on 30 Meter Sprint Performance in Male Rugby Union Players

Name of Researcher: Thomas Sanders

Participant to complete this section: Please tick each box.

1.	I confirm that I have read and understand the information sheet for this evaluation study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	☐
2.	I understand that my participation is voluntary and that it is possible to stop taking part at any time, without giving a reason.	☐
3.	I also understand that if this happens, my relationship with Cardiff Metropolitan University, or our legal rights, will not be affected.	☐
4.	I understand that information from the study may be used for reporting purposes, but confidentiality will be maintained, and I will not be identified at any time.	☐
5.	I agree to take part in this study.	☐

_____ _____

Signature of Participant Date

_____ _____

Name of person taking consent Date

_____

Signature of person taking consent

APPENDIX D

PARTICIPANT SCREENING GUIDELINES

Contraindications to Massage

-How would you describe your general health?

(Cough/ Cold etc.)

-Blood Pressure?

(When/ Who/ Results)

-Any Medication?

(Name/ Dosage/ What for)

-Any Surgery?

(Procedure/ Date/ Signed off by Dr.)

-Subject to any Medical Condition/s.

-Any Allergies?

-Anything else that may be of relevance?

-Have you been injured in the four weeks prior to commencement of the study?

APPENDIX E

MASSAGE TECHNIQUE DESCRIPTORS

Effleurage - (16)
Technical Description
The skin is stroked with pressure towards the heart, the technique is applied with one or two hands, or the forearm. Pressure is kept constant, contact area is mainly broad. These techniques are conducted in either a lunge or a squat position.

Techniques
-**Half Moon** (Side stance, one hand inward full circles, second hand sweep above first in the same movement in half circles around other hand) Warm up.
-**Flat hand** (Lunge Stance, straight hands laying on top of another, apply pressure in straight lines with the palm of the hand) Warm up - progression/ Shallow/ Mid.
-**'V'** (Both palms in contact with the skin, interlocking using thumbs at the base of the leading hand, hands remain linked using movements similar to flat hand) Warm up/ Shallow.
-**Rotary** (Same shape as 'V' but hands apart chasing each other, softening and turning in fingers at the top of the movement) Warm up/ Shallow.
-**Cam and Spindle** (Grip thumb with a closed fist, guiding hand in flat hand position, working in direction of muscle fibres) Deep.
-**Forearm Glide** (Apply pressure through the forearm, gripping the wrist of the working arm with the other hand) Mid/ Deep.
-**Butterfly** (Apply pressure through overlapping the thumbs, with fingers spread out in a cage, move mall distances when using this technique) Very Deep.

Petrissage
Technical Description
Two hands move inwardly moving circles which intersect. The points of intersection are pinched together during the movement between finger and thumb. A wringing or torque is placed upon the soft tissue.

Techniques
Fingers pinch muscle and alternate hands overlapping in the middle, stand in side lunge, working on the opposite side of the body to where stood. Can be applied to Latissimus Dorsai, Deltoids, Trapezius, and Biceps, Hamstrings (on smaller individuals), calves or any muscle that can be picked up.

APPENDIX F

SPSS OUTPUTS

10m Sprint performance

Pairwise Comparisons

Measure: MEASURE_1

(I) massage	(J) massage	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.032	.018	.104	-.071	.007
2	1	.032	.018	.104	-.007	.071

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

30m sprint performance

Pairwise Comparisons

Measure: MEASURE_1

(I) massage	(J) massage	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.011	.023	.623	-.060	.038
2	1	.011	.023	.623	-.038	.060

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

APPENDIX G

RAW DATA

Warm Up Only	Warm Up Only		Warm up & Massage	
Participant	10m Split Time - WU Only	30m Time - WU Only	10m Split Time - WU & Massage	30m Time - WU & Massage
CH1	1.945	4.742	1.963	4.767
GR1	1.924	4.792	1.931	4.893
JF1	1.662	4.257	1.761	4.193
TM1	1.852	4.333	1.9	4.239
RD1	1.816	4.345	1.812	4.356
PS1	1.686	4.144	1.838	4.231
JB1	2.116	5.121	2.001	4.921
JM1	1.892	4.674	1.882	4.712
DT1	1.828	4.521	1.866	4.536
MS1	1.828	4.6	1.834	4.691
SD1	1.822	4.334	1.959	4.358
JB1	1.92	4.538	1.896	4.531
WG1	1.773	4.219	1.803	4.237
JW1	1.956	4.801	2.021	4.916
Standard deviation	0.115	0.276	0.078	0.275
Average	1.859	4.530	1.891	4.542