Review Article

Physiological, psychological and performance effects of massage therapy in sport: a review of the literature

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Objectives: Massage is widely used by the athletic population for a variety of purposes such as injury prevention, recovery from fatigue, relaxation, and to increase performance. This paper reviews the scientific literature on the use and effects of massage therapy in sport. Specifically, the review addresses physiological, psychological and performance effects. Method: A literature search was conducted using Medline, Psychlit and Sport Discus databases. In addition, the author's own files were considered. Results: Past studies on blood flow, blood lactate removal and delayed onset of muscle soreness are seen to have produced equivocal results, with blood lactate removal following exercise more efficiently removed through active recovery strategies rather than through massage. Studies on the psychological effects are few in number, however recent research seems to demonstrate massage having positive effects on perceptions of recovery. Few studies exist which assess massage effects on performance, and current findings appear to show little support for the use of massage for performance enhancement. Conclusions: Massage research has been affected by a lack of comparable instrumentation and different research designs that make interpretation and extrapolation of results difficult. It appears the use of massage may largely be based upon anecdotal accounts that convey positive testaments about this form of therapy. The evidence from this review suggests that more scientific research on the effects of massage needs to be undertaken to clarify the precise effects of massage for athletes, however applying scientific principles to the study of massage does pose methodological challenges for the researcher.

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Introduction

Massage has been used in most cultures since early civilization and has had a long tradition of use in sport. Callaghan (1993) and Goats (1994a) have documented the history of massage originating in the early civilizations of Babylon, Assyria, China, India, Ancient Greece and Rome. While the use of massage appears to have reduced in hospital physiotherapy services (Goats 1994b), it has maintained a high profile in sport and is often an important part of an athlete's conditioning (Stamford 1985). Recent use of massage in sport includes Olympic recognition and acceptance. Callaghan (1993) reports extensive use of massage on athletes in the summer and winter Olympics by Great Britain team physiotherapists. Massage appears therefore, to be widely used in the management and prevention of injuries in sport, however the precise benefits of massage may be poorly understood by many practitioners and users (Tiidus 1997). The purpose of this review is to raise awareness of the current empirical evidence with regard to the efficacy of massage, and also to stimulate experimental research activity in the area.

Massage therapy involves manipulation, methodical pressure, friction, rubbing and

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kneading of the body and is argued to have both mechanical and reflectory effects (Calder 1990). Mechanical effects are thought to be pumping circulation, stretching of soft tissue, breaking scar tissue and fibrous adhesions, increasing microcirculation, increasing tissue elasticity and improving tissue permeability. Reflectory effects are considered to be relaxation and opening microcirculation (Calder 1990). These effects have led to the use of massage by athletes for the purpose of physiological, psychological and performance gains. While massage can incorporate a wide range of manipulative techniques, sports massage principally uses Swedish massage methods such as effleurage (stroking), petrissage (kneading), tapotement (percussion), shaking/vibration, and cross-fibre friction (transverse friction) (Cash 1996, Samples 1987, Callaghan 1993, p. 28). Callaghan (1993) argues that 'these techniques are comfortable, palliative and favoured by chartered physiotherapists'. Connective tissue massage, muscle energy techniques, acupressure and other forms of massage that have not been mentioned above, are not included in this review.

Method

A literature search was conducted using Medline, Psychlit and Sport Discus databases. In addition, the author's own files were considered. The searching strategy involved the entry of massage as a single key word, and massage with a combination of other key words (massage and psychology, massage and lactate, massage and blood flow, massage and DOMS, massage and performance). All papers which were available through the British Library Service were reviewed. In some cases, the reference section of papers identified further pertinent research papers, which were also obtained and reviewed.

Physiological effects

Blood flow

Frequent claims are made in the sports literature regarding the benefits of massage which include improved stretching of tendons and connective tissue (Samples 1987), relief of muscle tension and spasm (Ryan 1980, Stamford 1985) and elimination of waste products following training (Birukov 1987, Paikov 1985). Massage is also assumed to enhance muscle recovery from intense exercise, principally due to its supposed ability to speed muscle blood flow. However, studies to date on blood flow are contradictory. Cafarelli and Flint (1993) point out that reports on limb blood flow vary from no effect of massage to as much as a 50% increase. For instance, positive effects were reported by Dubrovsky (1983, 1990) who showed that massage promoted acceleration of muscle and venous blood flow, increased blood volume, and reduced muscle tightness. However, Tiidus and Shoemaker (1995) note that these studies are plagued by methodological problems associated with techniques used to determine blood flow. Specifically, venous occlusion plethysmograph and Xe clearance rates make the accurate monitoring of blood flow during massage problematic (Tiidus & Shoemaker 1995). In contrast, Tiidus and Shoemaker (1995) and Shoemaker et al. (1997) used a more sensitive Doppler ultrasound velocimetry method and showed no effect of massage on blood flow irrespective of the type of massage stroke or the muscle mass being treated. Indeed, Tiidus (1999) suggested that most recent research indicates that blood flow is unaffected by massage.

Lactate removal

The exact mechanisms of muscle fatigue are complex, and not fully understood (Tiidus 1999). However, a great deal of evidence exists which suggests that accumulated lactate, and the associated hydrogen ions, are at least partially responsible for slowing recovery from fatigue (Gupta et al. 1996, MacClaren et al. 1989, Maughan et al. 1997). While the majority of lactate accumulated during exercise is removed by direct oxidation and through conversion to glycogen (Gupta et al. 1996), there has been considerable research to discover if oxidation can be enhanced through various methods of recovery. Since it has been proposed that massage could increase blood flow to the muscles being massaged, and blood flow is

suggested to be an important factor in the removal of lactate following exercise through enhanced oxidation and diffusion out of the muscles (Belcastro & Bonen 1975, Dodd et al. 1984, Gaesser & Brooks 1984), studies have sought to determine whether massage has any effect on lactate removal following exercise.

Given that more recent research on blood flow using more sensitive measurement has found no effect of massage, it is perhaps not surprising that research findings have provided very limited support for a positive effect of massage on lactate removal. For instance, although post exercise blood lactate levels were shown to be significantly lower following a massage compared with a passive rest condition, a warm-down intervention was seen to promote the most efficient lactate removal (Bale & James 1991). Additionally, Dolgener and Morien (1993) and Martin et al. (1998) demonstrated superior lactate disappearance in 40% V02 max. cycling recovery compared with massage and passive recovery conditions following short-term intensive exercise. More recently, Gupta et al. (1996) published similar results with superior lactate removal following active recovery. No difference in lactate removal between massage and passive recovery following exercise has also been documented in runners (Zelikovski et al. 1993) and boxers (Hemmings et al. 2000). It is widely acknowledged that lactic acid removal is enhanced during active recovery (Wilmore & Costill 1994) and these findings further suggest that active warm-down strategies may be more efficient than massage at removing lactate in the recovery phase following exercise.

Delayed onset of muscle soreness

Delayed onset of muscle soreness (DOMS) is a painful condition that often occurs after unaccustomed eccentric exercise (Ernst 1998). In a review of the recovery of muscle function following exercise, Tiidus (1997, p. 110) indicates the difficulty in ascertaining the precise features of DOMS and how it relates to similar types of muscle injury/dysfunction and this factor is evident in previous massage research. In a systematic review of research on massage effects on DOMS, Ernst (1998) used strict criteria in which to include studies, and concluded that while most studies also had methodological flaws such as small sample sizes and using multiple therapeutic interventions, there was evidence to suggest massage could alleviate symptoms of DOMS. Indeed, positive effects were cited by Balke et al. (1989) who showed that mechanical and manual massage aid recuperation from exercise fatigue more effectively than rest alone. Smith et al. (1994) also report sports massage was effective in reducing DOMS after exercise, while Bale and James (1991) report a positive effect of massage on muscle soreness after exercise compared to rest and warm down conditions.

Nevertheless, there are numerous studies on DOMS that show no effect of massage. For instance, Isabell et al. (1992) showed that ice massage and ice massage with exercise did not reduce DOMS symptoms in basketball players. Tiidus and Shoemaker (1995) also report that daily massage of the quadriceps muscle group did not reduce subsequent muscle soreness in subjects who had previously completed an intense bout of eccentric quadriceps exercise. Furthermore, Weber et al. (1994) found no significant differences between massage, micro-current electrical stimulation, upper body ergometry, and control groups in force deficits or soreness ratings. Similar non-significant findings of massage compared to stretching and control groups are reported by Lightfoot et al. (1997). Moreover, in an earlier review on the role of massage in the prevention of DOMS, Tiidus (1997) concluded that the effects of massage were likely to be 'variable, small, temporary, and no greater than that which can be brought about by light exercise of the affected muscles'.

Psychological effects

While the psychological benefits of sports massage are frequently reported (e.g. enhanced emotional well being, calmness, improved mood, relaxation, reduced anxiety), until recently these claims have been largely based upon anecdotal evidence. However, scientific evidence supporting the supposed psychological benefits is now greater. A potential pathway for massage enhancing positive affect has been identified by Longworth (1982), who proposed that massage

could promote a feeling of well being through decreased arousal levels.

Early research into the effect of massage on psychological parameters in the sport setting was limited by methodological and statistical limitations such as small sample sizes, and the use of research designs which failed to control for the sensitization effects which arise when attempting to monitor changes in psychological state as a result of an intervention such as massage (Tyurin 1986). Indeed, Cafarelli and Flint (1993) argue that considerable weight has been given to anecdotal accounts inappropriately and practical experiences in the field which confirm the positive effect of massage on psychological well-being. However recent empirical studies now seem to provide preliminary support for the psychological benefits of massage. For instance, Weinberg et al. (1988) found a positive relationship between massage and mood state in physical education students. Likewise, Leivadi et al. (1999) found dance students experienced less anxiety and more positive mood following massage therapy.

A series of recent studies also support the use of massage for psychological regeneration following exercise. For example, Hemmings (2000a) showed how massage improved mood state in a group of amateur boxers undergoing intensive training when compared with passive rest and touching control conditions. The latter condition enabled elimination of the sensitization effects that can confound massage study results. A similar design showed how massage could improve perceived recovery following intense training (Hemmings 2000b). Finally, perceived recovery has also been found to increase with the use of massage following athletic performance as well as following training sessions (Hemmings et al. 2000).

Performance effects

There are also frequent anecdotal claims in the sports literature that massage can enhance athletic performance (Samples 1987). While performance in some instances may be difficult to define and may involve qualitative and quantitative components, massage studies in this area have typically used variables such as performance times and muscle force parameters. However, Cafarelli and Flint (1993) state that the scientific literature does not reveal many controlled investigations that address this question. However, three studies which have shown positive effects of massage demonstrated small increases in muscle endurance and power output (Ask et al. 1987, Balke et al. 1989, Rinder & Sutherland, 1995).

Studies showing no effect of massage on performance parameters include effects on maximal muscle voluntary contraction (Cafarelli et al. 1990, Wiktorsson-Moller et al. 1983) and stride frequency during sprinting (Harmer 1991). Furthermore, Boone et al. (1991) showed no effect of a pre-performance massage on sub-maximal running performance and various physiological markers when compared with a no massage condition.

During many athletic events the ability to recover quickly from the effects of exercise and fatigue is vital and massage is often recommended as a way to reduce recovery time and play a crucial role where repeated performance is required (Balke et al. 1989). However, while Callaghan (1993) has acknowledged the widespread use of massage to supposedly increase the rate of recovery and enhance the potential of athletes to perform to capacity in the next event, scientific support for the role of massage in exercise recovery and subsequent performance is sparse.

Two studies have addressed the role of massage where repeated performance was required and found no effect of massage on physiological markers or on overall performance. Drews et al. (1990) investigated the scientific effects of massage on repeated performance in elite cyclists. Participation in a 4-day stage race completed with daily post stage massage showed no differences in subsequent daily stage performance times or muscle enzyme levels in pre/post stage and post-treatment conditions when compared with a no massage condition completed 18 days later. Additionally, eight amateur boxers demonstrated no increase in punching force on a boxing ergometer in a post massage condition compared to a no massage control condition (Hemmings et al. 2000). Suitably, these findings question whether massage can demonstrate a positive effect on repeated sporting performance.

However, in contrast, Zelikovski et al. (1993) found 45% improvements in subsequent exercise performances following a twenty-minute massage recovery period when compared with a passive recovery condition. In this study, eleven men exercised at a constant workload until exhaustion. During the recovery, the subjects' legs were massaged using a pneumatic device, immediately after which a second constant load exercise bout was completed. The further finding that cardiorespiratory and blood parameters showed no differences between conditions prompted the authors to suggest a psychological pathway through which massage could positively influence recovery and subsequent performance.

Summary

In summary, the scientific literature on the effects of massage on physiological variables has produced results that are at best equivocal. Recent studies on blood flow appear to show no effect, and the literature on massage effects on blood lactate removal following exercise show greater support for active warm down strategies. Few studies exist on the effects of massage on DOMS, and at present no clear trend emerges on the effectiveness of massage therapy. Nevertheless, the literature appears to be showing increased evidence of positive effects of massage on psychological states in athletes, particularly for improving perceptions of recovery following exercise. Finally, the effects of massage on performance has not received a great deal of attention, but investigations to this point only offer marginal support for a positive effect.

While much anecdotal evidence exists which conveys positive testaments to massage, there is a clear need to apply scientific research principles to further investigate the effects of massage on recovery from exercise, and its effects on performance. It is evident from past research that replications of massage studies are virtually impossible with the type of massage, timing and duration, parts of the body massaged and pressure applied all seemingly down to the individual researchers' preference (Callaghan 1993). Suitably, while experimental protocols have varied considerably between studies, there is some doubt whether massage may be an effective modality to relieve physical fatigue and hence enable more efficient physiological restoration for athletes.

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