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

Brian J. Hemmings

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...
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 microriculation, 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 spasms (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% VO2 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, Tidius (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. Tidius 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, Tidius (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 (Tyrin 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.

References

Cafarelli E, Flint F 1993 The role of massage in preparation for and recovery from exercise. Physiotherapy in Sport 16: 17–20

© 2001 Harcourt Publishers Ltd
Hemmings B 2000b Psychological and immunological effects of massage after sport. British Journal of Therapy and Rehabilitation 7: 516–519
Ryan A 1980 The neglected art of massage. Physician and Sports Medicine 8: 25
Samples P 1987 Does sports massage have a role in sports medicine? Physician and Sports Medicine 15: 177–183