Frontiers in Sport Research
ISSN 2618-1576 Vol. 1, Issue 1: 43-50, DOI: 10.25236/FSST.080107

The techniques of manual massage and its application on exercise-induced fatigue: a literature review

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ABSTRACT. *Massage therapy has been shown to have beneficial effects on various conditions. It is widely used in the field of sports which includes exercise-induced fatigue. There are many techniques among the different kinds of massage. This paper describes the different the techniques of manual massage which include Effleurage (gliding strokes), Petrissage (Kneading Strokes), Friction, Compression, Tapotement (Percussion), Vibration, and Joint mobilizations and stretches. In addition, reviews the techniques of manual massage and exercise-induced fatigue. The result showed that he most popular application techniques of manual massage on exercise-induced fatigue are Effleurage and Petrissage. Therefore, Effleurage and Petrissage can be seen as the useful methods to deal with exercise-induced fatigue for athletes after training sessions or intensive competition.*

Keywords: *Massage; technique of manual massage; Exercise-induced fatigue; Review*

1. Introduction

Manual massage has been used for rehabilitation and relaxation for thousands of years around the world. Manual massage can be defined as ‘‘a mechanical manipulation of body tissues with rhythmical pressure and stroking for the purpose of promoting health and well-being’’[1]. Massage therapy has been shown to have beneficial effects on varying conditions including prenatal depression, preterm infants, full-term infants, autism, skin conditions, pain syndromes including arthritis and fibromyalgia[2][3][4][5][6][7], hypertension, autoimmune conditions including asthma and multiple sclerosis, immune conditions including human immunodeficiency virus (HIV) and breast cancer and aging problems including Parkinson's and dementia[8][9][10][11].

Manual massage also has been widely used in sports. Quick recovery from training and competition is recognized as the most important aspects for athletes, which can reduce the accumulation of exercise-induced fatigue (EIF), avoid overtraining, and prevent the risk of sports-related injuries[12]. To achieve this goal, many methods are used, and therapeutic massage is one of the effective treatments. Evidence-based researches show massage can affect muscle fatigue, which include both the body's overall fatigue[13][14][15][16] and the local fatigue, such as, thumb fatigue[17], quadriceps fatigue[18], lumbar muscle fatigue[19], enhance body recovery [20][21][22], release the delayed onset muscle soreness[23][24], prevent injury, promote athlete performance,[21][25] [20][26]etc. The large proportion of massage application in sports events is due to many coaches and athletes holding the belief, based on observations and experiences, that massage can provide several benefits to the body such as increased blood flow, reduced muscle tension and neurological excitability, and an increased sense of well-being.

There are many types of massage all around the world, such as, Swedish massage, India massage, Japanese massage, Traditional Chinese Massage, Traditional Thai massage, etc., so also have numerous techniques of massage in existence. Different of the techniques of manual massage have different function. The purpose of this paper was to describe and review the current literature on the techniques of manual massage and its application on exercise-induced fatigue.

2. The techniques of manual massage

According to a 2007 survey conducted by the Federation of State Massage Therapy Boards, Swedish massage is the most popular massage method practiced in the United States and sports. This survey is the largest of its kind conducted in history. Therefor the techniques of Swedish massage are introduced in this part[27].

2.1 Effleurage(gliding strokes)

Effleurage is the application of gliding movements that are repeated and fo1low the contours of the body. These movements may be linear or circular. Pressure may be superficial (light) or deep. Variations include one-handed, two- handed, alternate hand, and nerve stroke. The term effleurage (ef-flur-ahzh) originates from the French verb effleurer, meaning “to flow“ and “to glide.“ This is the most versatile massage stroke; you can perform an entire session with effleurage by simply changing depth of pressure, direction of pressure, excursion, speed, and rhythm. Effleurage can be used on virtually every type of body surface. Effleurage is used to apply lubricant and is excellent for assessing, treating, and reassessing tissues. It is also the stroke used to begin and end a massage, as well as the preferred transition stroke to use between other strokes. Effleurage is the most commonly used stroke.

2.2 Petrissage (Kneading Strokes)

Petrissage consists of lifting soft tissues vertically, and then compressing and releasing them. The compression is accomplished by either squeezing or rolling the tissues before releasing, using rhythmic alternating pressures. Several variations of petrissage are one-handed, two-handed, alternate hand, and skin rolling. The term petrissage (peh-tre-sahzh) comes from the French verb petrir, meaning “to mash“ or “to knead.“ Petrissage is the stroke of choice to milk the tissue of metabolic wastes and draw new b1ood and oxygen into the tissues.

2.3 Friction

Friction massage is performed by rubbing one surface over another in several directions. Friction can be applied superficially with hands gliding over the skin or deeply while moving skin across underlying tissue layers. Varieties of superficial friction are superficial warming, rolling, and wringing. Deep friction variations include cross-fiber, chucking, and circular.

2.4 Compression

Compression is a non-gliding technique of sustained pressure or a sequence of rhythmic alternating pressures. Variations include one-handed and two-handed compressions. The term compression comes from the Latin compress are, which means “to press together“ or “to squeeze“. This technique commonly uses sustained pressure or a pumping action over muscle and other tissues. Compressed tissue blanches during pressure application, and then becomes hyperemic when pressure is released. This mechanism enhances fluid exchange. Compression can be performed directly on bare skin, as well as over a c1othed or draped client.

2.5 Tapotement (Percussion)

Tapotement involves repetitive staccato striking movements of the hands, moving either simultaneously or alternately. Movements can be rhythmic or arrhythmic. This stroke can be delivered with the ulnar surface of the hand or loosely closed fist, tips or flats of the fingers, open or cupped palm, or the knuckles.

2.6 Vibration

Vibration refers to shaking, quivering, trembling, or rocking movements applied with the fingers, full hand, or an appliance. Variations include fine, Jostling, and rocking. Some vibration involves a back-and-forth or up-and-down motion, whereas other types such as rocking, involve a slower, rhythmic, swinging motion. The speed of vibration varies from rapid to slow.

2.7 Joint mobilizations and stretches

Joints, muscles, and other soft tissues that benefit from massage will also benefit from joint mobilizations and stretching techniques to improve function, restore mobility, and increase range of motion. These techniques provide additional treatment options and can easily be applied before, during, or after the massage, or they may be used as the primary technique. Furthermore, these techniques can be administered passively or actively.

3. The techniques of manual massage and exercise-induced fatigue

Manual massage includes numerous techniques; however, which one is the most popular or appropriate to deal with exercise-related fatigue. There is no answer. Nine compute databases (PubMed, Science direct, SPORT Discus, Springer Link, ProQuest, PubMed, Google scholar, Medline and Europe PMC) were used to this literature, in addition to manual journal searches. The computer databases can provide biomedical and sport-oriented journals, serial publications, books, theses, conference papers and related articles published. The KEYWORDS and phrases for searching include: ‘ muscle fatigue’, ‘sport massage’, ‘exercise fatigue’, ‘massage’, ‘muscle stiffness’, ‘blood lactate’, ‘delayed onset muscle soreness’ and ‘blood flow, etc. Then got the following articles (see table 1), the total number is 36, there are 10 articles have “exercise fatigue“ or “muscle fatigue“ in its title, 13 articles about Delayed Onset Muscle Soreness, 8 articles about Blood Lactate remove, and 5 articles about psychological variables among it. According to the statistics which shows that there are 11 massage techniques appear in these 36 pieces of articles, even there are some techniques are similar, such as, petrissage and stroking, effleurage and kneading, vibration and shaking, which did not be cared about in this analysis. From the table 2 which shows that most of the articles provide the information about the techniques and the duration of massage. Only three articles did not describe which kind of the technique that they used to as intervention method and only two articles did not describe the duration of massage. From the using frequency of massage techniques, the first two places are effleurage and petrissage, the frequency of use is 24 times and 21 times respectively, the percent of use is 66.7% and 58.3% respectively. It shows that effleurage and petrissage are the most popular massage techniques that were used to relieve the muscle fatigue or in sports area. Even there are no evidence-based comparison researches for each massage technique, few details about how the each massage technique to affect muscle fatigue, and why they choose these two massage techniques as their intervention method.

Table 1 application of massage techniques on exercise-related fatigue

No.	study	massage techniques	duration
		Muscle fatigue or exercise fatigue	
1	Balke et al.	NA	15-20
2	Rinder and	Petrissage, effleurage	min
3	Sutherland.	Vibratory mechanical massage,Manual	6 min
4	Balked et al.	massage not specified	3 min

5	Carafilli et al.	Vibratory mechanical massage	4 min
6	Tanakat.	Effleurage, kneading, and compression	5 min
7	Rinder AN.	Petrissage, effleurage	3 min
8	Young R.	Slow, rhythmic effleurage and deep stroking	5 min
9	Brooks C.	effleurage and circular friction	5 min
10	Rinder et al.	Petrissage, effleurage	22 min
1	Carafalli et al.	Percussive, vibratory	5 min
2	Farr T.	**Delayed onset muscle soreness**	30 min
3	Hart J.	Petrissage, effleurage	5 min
4	Jonhagen S.	Repeating the cycles of Petrissage and	10 min
5	Tiidus PM.	effleurage	10 min
6	Smith LL.	Petrissage, effleurage	30 min
7	Mancinelli C.	Superficial and deep effleurage stroke	17min
8	Weber MD.	Petrissage, shaking, wringing, cross-fiber	8 min
9	Farr et al.	massage, effleurage	30 min
10	Hasson et al.	Petrissage, effleurage and vibration	NA
11	Hilbert et al.	Petrissage, effleurage	20 min
12	Lightfoot et al.	Petrissage, effleurage	10 min
13	Rodenburg et	Retrograde	15 min
1	al.	12 min of Petrissage, 7 min of effleurage, 1	5 min
2	Smith et al.	min of tapotement	17 min
3	Bale and	Petrissage	20 min
4	James.	effleurage, tapotement, and Petrissage	10 min
5	Dolgener and	effleurage, shaking, petrissage, cross-fibre	20 min
6	Morien.	**Blood lactate**	15 min
7	Gupta et al.	NA	10 min
8	Hemmings et	Petrissage, effleurage	20 min
1	al.	kneading and stroking	15 min
2	Monedero and	Petrissage, effleurage	30 min
3	Donne.	Stroking, effleurage and tapotement	60 min
4	Gupta S.	Kneading and stroking	NA
5	Poertson A.	Effleurage	20 min
	Monedero J.	Effleurage, stroking, And taponement	20 min
	Leivadi et al.	**Psychological variables**	
	Zeitlin et al	Petrissage, effleurage, and friction	
	Weinberg et al	Petrissage, effleurage, and friction	
	Hemmings	NA	
	Hemmings et	Petrissage, effleurage	
	al.	Petrissage, effleurage	

Table 2 statistics of using frequency about massage techniques

Massage techniques	Frequency(times)	Percent (%)	Rank
Effleurage	24	66.7	1
Petrissage	21	58.3	2

Stroking	5	13.9	3
Vibration	4	11.1	4
Kneading	3	8	5
Friction	3	8	6
Tapotement	3	8	7
Shaking	2	6	8
Cross-fiber	2	6	9
Compression	1	3	10
Wringing	1	3	11

4. Conclusion

Manual massage is a useful method for rehabilitation and relaxation. It is research hotspot in the field of sports and medicine. Plenty of previous studies proved that manual massage can affect exercise-induced fatigue, and enhance the recovery of exercise-induced fatigue. Swedish massage is the most popular massage as the previous studies showed that it is the most widely used and researched in sports. Our results showed that the most popular application techniques of manual massage on exercise-induced fatigue are effleurage and petrissage. Therefore, effleurage and petrissage can be seen as the useful methods to deal with exercise-induced fatigue for athletes after training sessions or intensive competition.

References

[1] T. M. Best, R. Hunter, A. Wilcox, and F. Haq(2008). Effectiveness of sports massage for recovery of skeletal muscle from strenuous exercise., *Clinical journal of sport medicine : official journal of the Canadian Academy of Sport Medicine*, vol. 18, no. 5, pp. 446–60.

[2] J. K. Daniel C. Cherkin, Karen J. Sherman(2011). A Comparison of the Effects of 2 Types of Massage and Usual Care on Chronic Low Back Pain, no. 6, pp. 121-126.

[3] C. Arroyo-Morales, Manuel; Fernández-Lao, Carolina; Ariza-García, Angelica; Toro-Velasco, Cristina; Winters, Marinus; Díaz-Rodríguez, Lourdes; Cantarero-Villanueva, Irene; Huijbregts, Peter; Fernández-De-las-Peñas and P. Medicine(2011). Psychophysiological Effects of Preperformance Massage Before Isokinetic Exercise, vol. 25, no. 2, pp. 481–488.

[4] D. J. Engen, D. L. Wahner-Roedler, A. Vincent, T. Y. Chon, S. S. Cha, and C. A. Luedtke(2012). Feasibility and effect of chair massage offered to nurses during work hours on stress-related symptoms: A pilot study, *Complementary Therapies in Clinical Practice*, vol. 18, no. 4, pp. 212–215.

[5] M. K. Brennan and R. D. DeBate(2006). The effect of chair massage on stress perception of hospital bedside nurses, *Journal of Bodywork and Movement Therapies*, vol. 10, no. 4, pp. 335–342.

[6] J. Guo *et al.* (2017). Massage alleviates delayed onset muscle soreness after strenuous exercise: A systematic review and meta-analysis, *Frontiers in Physiology*,

vol. 8, no. SEP, pp. 1–12.
[7] F. Kamalia, F. Panahib, S. Ebrahimic, and L. Abbasic(2008). Comparison between massage and routine physical therapy in women with sub acute and chronic nonspecific low back pain, no.12, 99. 123-132.
[8] T. Field(2016). Massage therapy research review, *Complementary Therapies in Clinical Practice*, vol. 24, pp. 19–31.
[9] D. J. Engen, D. L. Wahner-Roedler, A. M. Nadolny, C. M. Persinger, and B. a Bauer(2010). The effect of chair massage on muscular discomfort in cardiac sonographers: a pilot study., *BMC complementary and alternative medicine*, no. 10, p.50.
[10] L. L. Smith *et al.* (1994). The Effects of Athletic Massage on Delayed Onset Muscle Soreness, Creatine Kinase, and Neutrophil Count: A Preliminary Report, *Journal of Orthopaedic & Sports Physical Therapy*, vol. 19, no. 2, pp. 93–99.
[11] V. S. Cowen *et al.* (2006). A comparative study of Thai massage and Swedish massage relative to physiological and psychological measures, *Journal of Bodywork and Movement Therapies*, vol. 10, no. 4, pp. 266–275.
[12] N. Neagu(2017). Importance of recovery in sports performance, vol. IX, no. 1, pp. 53–59.
[13] A. Moraska(2005), Sports massage: A comprehensive review, *Journal of Sports Medicine and Physical Fitness*, vol. 45, no. 3, pp. 370–380.
[14] M. S. Hidetoshi Mori(2007). Effect of massage on blood flow and muscle fatigue ollowing isometric lumbar exercise, no. 22016, pp. 71–76.
[15] J. L. Durkin, A. Harvey, R. L. Hughson, and J. P. Callaghan(2006). The effects of lumbar massage on muscle fatigue, muscle oxygenation, low back discomfort, and driver performance during prolonged driving, *Ergonomics*, vol. 49, no. 1, pp. 28–44.
[16] S. K. Crawford *et al.*(2014). Effects of immediate vs. delayed massage-like loading on skeletal muscle viscoelastic properties following eccentric exercise, *Clinical Biomechanics*, vol. 29, no. 6, pp. 671–678.
[17] R. Young, B. Gutnik, R. W. Moran, and R. W. Thomson(2005). The effect of effleurage massage in recovery from fatigue in the adductor muscles of the thumb, *Journal of Manipulative and Physiological Therapeutics*, vol. 28, no. 9, pp. 696–701.
[18] A. N. Rinder and C. J. Sutherland(1995). An investigation of the effects of massage on quadriceps performance after exercise fatigue, *Complementary Therapies in Nursing and Midwifery*, vol. 1, no. 4, pp. 99–102.
[19] T. H. Tanaka, G. Leisman, H. Mori, and K. Nishijo(2002). The effect of massage on localized lumbar muscle fatigue.," *BMC complementary and alternative medicine*, no. 2, p. 9.
[20] P. Weerapong, P. A. Hume, and G. S. Kolt(2005). The Mechanisms of Massage and Effect on Performance, Muscle Recovery and Injury Prevention, *Sports Medicine*, vol. 35, no. 3, pp. 235–256.
[21] B. Hemmings, M. Smith, J. Graydon, and R. Dyson(2000). Effects of massage on physiological restoration, perceived recovery, and repeated sports performance., *British journal of sports medicine*, vol. 34, no. 2, pp. 109–114.
[22] A. Paoli *et al.* (2013). Sports massage with ozonised oil or non-ozonised oil:

Comparative effects onrecovery parameters after maximal effort in cyclists,“ *Physical Therapy in Sport*, vol. 14, no. 4, pp. 240–245.
[23] C. A. Mancinelli, D. S. Davis, L. Aboulhosn, M. Brady, J. Eisenhofer, and S. Foutty(2006).The effects of massage on delayed onset muscle soreness and physical performance in female collegiate athletes, *Physical Therapy in Sport*, vol. 7, no. 1, pp. 5–13.
[24] Z. Zainuddin, M. Newton, P. Sacco, and K. Nosaka(2005). The effects of massage on delayed onset muscle soreness, *Journal of Athletic Training*, vol. 40, no. 3, pp. 174–180.
[25] R. Ogai, M. Yamane, T. Matsumoto, and M. Kosaka(2008). Effects of petrissage massage on fatigue and exercise performance following intensive cycle pedalling, *British journal of sports medicine*, vol. 42, no. 10, pp. 834–8.
[26] K. A. Dawson, L. Dawson, A. Thomas, and P. M. Tiidus(2011). Effectiveness of regular proactive massage therapy for novice recreational runners, *Physical Therapy in Sport*, vol. 12, no. 4, pp. 182–187.
[27] E. C. Elizabeth Holey(2002). Evidence-Based Therapeutic Massage A practical guide for therapists the third edition.