RESEARCH

Effects of Massage as a Combination Therapy with Lumbopelvic Stability Exercises as Compared to Standard Massage Therapy in Low Back Pain: a Randomized Cross-Over Study

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Background: **Little is known about the effects of providing massage as a combination therapy (CT) with lumbopelvic stability training (LPST) in management of chronic nonspecific low back pain (CLBP) among elite female weight lifters. It is unclear whether massage therapy (MT) together with LPST has any additional clinical benefits for individuals with CLBP.**

Purpose: **The current study compares the therapeutic effects of CT against MT as a stand-alone intervention on pain intensity (PI), pain pressure threshold (PPT), tissue blood flow (TBF), and lumbopelvic stability (LPS) among elite weight lifters with CLBP.**

Setting: **The study was conducted at the campus for National Olympic weight lifting training camp.**

Participants: **A total of 16 professional female elite weight lifting athletes who were training for Olympic weight lifting competition participated in the study.**

Research Design: **A within-subject, repeated measures, crossover, single-blinded, randomized allocation study.**

Intervention: **The athletes were randomized into three sessions of CT and MT with a time interval of 24 hrs within sessions and a wash out period of four weeks between the sessions.**

Main Outcome Measures: **The PI, PPT, TBF, and LPS were measured before and after each session repeatedly in both groups of intervention. The changes in the PI, PPT, TBF, and LPS were analyzed using repeated measures analysis of variance (ANOVA).**

Results: **The results showed that the CT significantly demonstrated greater effects in reducing pain perception (45%–51%), improving pain pressure threshold (15% up to 25%), and increasing tissue blood flow (131%–152%) than MT ($p < .001$).**

Conclusion: **The combination therapy of massage therapy and LPST is likely to provide more clinical benefits in terms of PI, PPT, and TBF when compared to massage as a stand-alone therapy among individuals with chronic nonspecific low back pain.**

KEY WORDS: massage; exercise; back pain; rehabilitation; weight lifting; sports

INTRODUCTION

Elite weight lifters are athletes who train to compete in the weight lifting sport at International and Olympic level games.[1,2] During competitive weightlifting, each lift results in a huge bending moment and compressive axial load greater than 17,000 Newton which produces a strong forward shear force from the centre of the vertebral body, contributing to instability of lumbar spine.[3,4] The heavy lifting and loading of weights expose the lumbar region to risk of injuries, particularly to the intervertebral discs, ligaments, and muscles of the lumbar spine.[4,5] Thus, elite weight lifters can encounter an 85% chance of injuries to the low back region and experience a high prevalence of low back pain.[6,7] Therefore, rehabilitation of back pain and back care of athletes involved in weight lifting sports are some of the most pertinent issues to coaches, sports scientists, and clinicians.

The Chartered Society of Physiotherapists recommends massage therapy (MT) for the management of different pain-related conditions related to musculoskeletal disorders.[8] The Ottawa Panel evidence-based clinical practice guidelines suggests MT as an effective intervention for subacute and chronic low back pain symptoms.[9] Some clinical evidences favor the effects of MT to decrease pain and disability among patients with low back pain.[10,11] On the other hand, a recent systematic review cites low level of evidence and questions the therapeutic effects of MT in management of low back pain.[12] Perhaps, this could be argued that past studies evaluated the therapeutic effectiveness of MT as a stand-alone intervention against other forms of physiotherapy and placebo groups.[13] On the contrary, MT is not provided as a sole intervention in clinical practice; instead, it is commonly administered as an adjunct with other interventions. Thus, the clinical effectiveness of MT may need to be studied in combination with other interventions such as active exercises, for example. Therefore, a need arises to evaluate the therapeutic effects of massage as a combination therapy (CT) with other physiotherapy interventions.

Exercise therapy for low back pain has high quality of evidence in clinical practice and is reported as modestly effective in management of low back pain.[13,14,15] Motor control exercise is one of the commonly used exercise interventions for CLBP.[16] Lumbopelvic stability training (LPST) is a motor control intervention that targets activation of deep core muscles and restores motor control and coordination of deep muscles during functional tasks.[16,17] While the majority of the studies investigated the clinical effects of MT against placebo and other interventions, a limited understanding exists on the therapeutic effects of massage as a combination therapy with lumbopelvic stability training. It is not clear whether providing an additional intervention of LPST together with MT may provide any additional benefits for patients with low back pain.

Thus, the main aims of the study were 1) to investigate the acute effects of combined therapy (MT and LPST) on PI, PPT, lumbopelvic stability, and TBF among elite female weight lifters with CLBP, and 2) to compare the effects of the combined therapy (LPST & MT) against the stand-alone MT on the PI, PPT, and TBF among elite female weight lifters with nonspecific chronic low back pain. The study hypothesized that massage as a combination therapy with LPST may has significant therapeutic effects when compared to massage as stand-alone therapy for management of CLBP among the elite weight lifters. The findings of the study may help to generate evidence for the effects of combination therapy (MT & LPST), and it may assist clinicians to choose an effective management program for CLBP among elite weight lifters.

METHODS

Participants

A total of 16 elite female weight lifters with CLBP from a national weight lifting training camp participated in the study. The participants were included in the study if they experienced mild-to-moderate back pain between 12th rib to gluteal folds over the past three months, with a visual analogue pain score between 2/10–7/10 cm. The participants were excluded from the study if they reported any referred pain below gluteal fold with neurological involvement in lower limbs, history of past surgery, history of smoking, and history of any back injury in the last three months. Additionally, participants with diagnosis of spinal stenosis, menstrual history during the study period, and who had any skin diseases over the trunk region were not included in the study. None of the participants took alcohol, any sort of medications, weight lifting training protocols, stimulant (e.g., caffeine) 12 hrs prior to the study measurements. Informed written consent was obtained from the study participants, and a university ethical committee approved the human ethics for the study.

Study Design

A within-subject, repeated measures, crossover, single-blinded, randomized allocation study design was conducted to examine the effects of a combination therapy (LPST and MT) against the MT. The participants were randomly allocated to either of the two intervention groups through a simple randomized concealed allocation method. Every participant received a total of 3 sessions of intervention, with 24 hrs interval between each session. The participants were crossed-over to the other intervention group after four weeks of wash-out period. A list of outcome variables related to pain, physiological change in the lumbar soft tissue, and motor function of the lumbopelvic region were measured pre- and post-intervention applications on Day 1, Day 2, and Day 3.

Outcome Measurements

A range of outcome measures, such as PI, PPT, LPS, and TBF, were measured repeatedly before and after each intervention by a qualified physiotherapist who was blinded to the study. All the outcome measurements and interventions were conducted in a controlled environmental room with a temperature of 24.5°C ± 0.5°C and a relative humidity of 60% ± 5%. An intrarater reliability was examined for all outcome measurements, and the measurement method was established to be reliable prior to data collection.[18] A total of three measures were taken for all measurements, and the mean score was used for further analysis.

The outcome measures related to pain, such as PI and PPT, were measured according to a previously established protocol.[19,20,21] The participants scored the PI on the visual analogue score (VAS) with a 10-cm indicator scale. The severity of the pain intensity over the lumbosacral area was marked with 'no pain' on the left end of the scale and 'maximum pain' on the right end of the scale. The PPT was measured in units of kilo Paskal (kPa) by a pressure algometer (Algometer type II, Somedic SenseLab AB, Sweden) with a probe size of 1.0 cm^2. The skin was marked at the most tender spot on a fixed point at two different body regions, namely upper trapezius and the lumbar region. The pressure pain was collected by applying pressure with an incremental increase at a rate of 40 kPa/sec until the applied stimulus was perceived to be painful by the participants.

The TBF was measured as an indicator of physiological change over the tissue at the lumbar region using a Laser Doppler blood flow meter (DRT4, Moor Instruments Inc., UK) with the participants in prone position.[19] The most tender spot on the posterior aspect of lumbosacral region between the first and fifth lumbar spine was marked. The TBF was measured on the same tender spot, every minute for a period of 5 min, through the Laser Doppler blood flow meter placed over the marked site. The mean value of the TBF was used for analysis.

The lumbopelvic stability was measured as an indicator of lumbopelvic motor function. The measurement were carried out on participants in supine crook lying position with hip flexed to 70° to maintain the lumbar spine in the mid neutral position. A pressure biofeedback device inflated to 40 mmHg was placed between the second lumbar spine and the first sacral spine. Per established protocol, the participants performed a unilateral leg lift in the sagittal plane, followed by progressive levels of seven lumbopelvic stability tests.[18,19] An ability to maintain the registered pressure at 40 mmHg during the testing movement was marked as a successful performance. When the participants were not able to hold 40 ± 2 mmHg in the biofeedback device, the progression of the lumbopelvic stability test was stopped.

Exercise Interventions

Massage therapy

The MT was administered to the participants on the dorsal region of the trunk extending from occiput to auxillary lines and until posterior iliac crest. Table 1 shows the different MT techniques, description of each MT technique, and position of participant and frequency of application. The MT intervention was administered for a total of three days with an interval of 24 hrs rest between each session, and each individual MT session was performed for 20 min with moderate pressure on the tissues.

Lumbopelvic stability training

The LPST was performed per established protocol using a Pilates power gym reformer device (Thane Fitness, UK) for a total of three days with an interval of 24 hrs rest between each session.[19,20,21] All the LPST exercises were performed in supine crook lying position and with contraction of core stabilization muscles in hip flexion and knee flexion at 70° and 90°, respectively, with a pressure biofeedback placed beneath the lumbar spine between the levels of the second lumbar spine and the first sacral spine. The participants were instructed to stop the advance level of exercises if there was any increase of back pain during the training or if the registered air pressure of 40 ± 10 mmHg in the pressure biofeedback unit was lost. The exercises were performed in the following order: core with alternate hip abduction, core with alternate knee raise, core with both arms adduction, core with both arms extension, core with alternate arm lift, core with alternate leg lift, and finally core with alternate leg and arm lift. The whole duration of the LPST intervention was for 20 min, with every exercise performed 8 times for 2 sets with 15 seconds of rest interval between repetitions.

In combination therapy group, the order of therapy for either LPST or MT was randomized to each individual participant. All interventions were performed by an independent qualified manual therapist. All the participants were instructed to inform the therapists if the given interventions increased the pain and the therapy was stopped immediately.

Statistical Analysis

The sample size was calculated from a pilot study using a G*Power statistical program with a significant alpha level of 0.05 and power analysis of 0.80 with an estimated effect size of 1.039 for the primary study variable (pain) which warranted a total of 16 participants for the study.[22] The Statistical software package for social sciences [SPSS] for Windows, version 20.0, was used to analyze the data. As normality

Table 1. Description of the Massage Therapy Technique Applied to Study Participants

Massage Techniques	Effleurage: Cycles of pressured long gliding stokes with drainage towards the auxillary lymph nodes	Compression & Static Contact: Moderate compressive pressure applied through the palm and heel of the hand in a slow sustained pumping method	Petrissage: Pick up and squeeze techniques with mild to moderate pressure	Kneading: Moderate pressured deep circular movements performed through fingers, palm and heel of the hand	Friction: Quicker deeper movements performed on the tissue perpendicular to the direction of the muscle fibres
Position of the Participant	All the participants were positioned in prone position on a manual therapy bed with pillows supported underneath the lower legs				
Duration of Application	6 min, 3 min duration x 2 cycles at the beginning and end of the session	3 min per cycle of intervention	5 min per cycle of intervention	5 min per cycle of intervention	1 min per cycle of intervention

analysis using Shapiro-Wilk test determined a normal distribution of measured variables, repeated measure analysis of variance (ANOVA) was used to analyze the changes in measured values of PI, PPT, LPST, and TBF within each group and between the groups. *P* value of less than .05 was set as level of significance for all study measures. The clinical effect of the intervention was determined by estimating percentage change in the measured values of outcome variables calculating the difference between pre-and post-changes divided by one hundred.

RESULTS

The study participants have a mean age of 20.44 ± 3.14 years and they are involved in weight lifting sports for a mean duration of 6.38 ± 2.31 years approximately. The results showed that CT demonstrated significantly greater effects in reducing pain perception (45% to 51%), improving pain pressure threshold (15% to 25%), and increasing tissue blood flow (131% to 152%) than MT ($p < .001$). In addition, the result showed that the MT significantly improved PPT ($p < .01$) (lumbar region and upper trapezius), VAS ($p < .01$), LPST ($p < .01$), and TBF ($p < .01$). The additional therapeutic benefits provided by CT were significantly greater when compared to MT as a stand-alone therapy ($p < .001$). Lumbopelvic stability levels seemed to change minimally after CT; however, the observed changes are not statistically significant, except for Day 2. The values of PI, PPT, TBF, and LPST, along with the percentage change for Day 1, Day 2, and Day 3 from both the CT and MT groups, are shown in Table 2 and Table 3, along with the effect size and confidence intervals.

DISCUSSION

The current study compared the effects of MT as a combination therapy with LPST among elite weight lifters with CLBP. While both the groups improved in the measured clinical variables, a significant improvement in the PI, PPT, and TBF was observed as effects of combination therapy in comparison to the massage as a stand-alone therapy. Thus the findings supported the study hypothesis on the enhanced therapeutic effects for massage when provided as a combination therapy with LPST.

In the subsequent paragraphs, the possible scientific explanation behind the improvements observed

Table 2. Comparison of Pain Pressure Threshold (PPT) and Percentage Change (%Ch) Values are Showed as Mean ± Standard Deviation (SD) Between the Combination Therapy and Massage Therapy Groups

Groups	*Day*	*PPT-Lumbar Region*			*PPT-Upper Trapezius*		
		Pre-	*Post-*	*%Ch [95% CI]*[a]	*Pre-*	*Post-*	*%Ch [95% CI]*[a]
CT	Day 1	472.28±98.64	560.09±90.10	19.95[b,c] [15.32 - 24.57] (0.93)	377.85±60.58	470.98±69.61	25.66[b,c] [20.74 - 30.57] (1.43)
	Day 2	565.34±100.50	658.88±110.75	16.92[c] [13.54–20.29] (0.88)	474.91±74.16	558.42±31.03	18.11[c] [14.32–21.89] (1.58)
	Day 3	661.38±124.79	762.08±129.20	15.68[b,c] [13.10–18.25] (0.79)	534.61±79.69	631.65±98.61	18.64[b,c] [14.34–22.93] (1.08)
MT	Day 1	440.64±215.47	512.65±227.23	19.42[c] [13.69–25.14] (0.32)	371.31±112.07	423.15±133.41	14.15[c] [7.64–20.65] (0.42)
	Day 2	528.76±214.35	587.85±235.06	12.25[c,d] [5.10–19.39] (0.26)	415.86±126.96	456.69±130.87	10.91[c,d] [6.46–15.35] (0.31)
	Day 3	598.69±242.74	665.73±255.85	12.88[c,e] [8.47–17.28] (0.25)	467.41±147.32	519.31±167.10	11.51[c,e] [7.18–15.83] (0.33)

[a]Cohen's d effect size*; unit:* PPT (kPa)
[b]CT vs. MT; $p<.001$
[c]Significant differences between pre–post ($p<.01$)
[d]Significant differences between pre-and post-values between Day 1 and Day 2; $p<.05$
[e]Significant differences between pre-and post-values between Day 1 and Day 3; $p<.05$

Table 3. Comparison of Visual Analogue Score (VAS), Tissue Blood Flow (TBF), and Lumbopelvic Stability (LPS) Outcomes and Percentage Change (%Ch) Values are Showed as Mean ± Standard Deviation (SD) Between the Combination Therapy and Massage Therapy Groups

Groups	Day	*VAS*			*LPST*			*Tissue Blood Flow*		
		Pre-	*Post-*	*%Ch [95% CI]*[a]	*Pre-*	*Post-*	*%Ch [95% CI]*[a]	*Pre-*	*Post-*	*%Ch [95% CI]*[a]
CT	Day 1	5.12±2.47	2.87±1.85	44.92[b,c] [34.04-55.81] (1.04)	3.12±0.50	3.25±0.68	3.64 [-1.29-8.57] (0.22)	13.78±3.04	30.48±4.91	131.7[b,c] [102.51-160.88] (4.20)
	Day 2	4.37±2.06	2.18±1.27	49.24[b,c] [39.55-58.92] (1.31)	3.25±0.57	3.68±0.70	14.58[c,d] [5.82-23.33] (0.67)	13.54±2.71	32.22±5.30	145.22[b,c] [118.44-171.99] (4.66)
	Day 3	3.62±1.74	1.75±1.12	51.04[b,c] [43.69-58.38] (1.30)	3.67±0.60	3.87±0.80	4.89 [-0.40-10.18] (0.29)	12.98±2.39	32.20±4.94	152.21[b,c] [131.70-172.73] (5.24)
MT	Day 1	4.00 ±1.09	3.06±1.43	26.04[c] [16.78-35.29] (0.74)	2.93±0.68	3.06±0.68	5.20 [-1.92-12.32] (0.19)	11.03±2.09	24.92±12.44	122.94[b,c] [81.54-164.33] (1.81)
	Day 2	4.06±1.09	2.93±1.52	26.94[c] [17.00-36.87] (0.86)	2.93±0.68	3.25±0.57	13.54[c] [3.11-23.96] (0.51)	10.96±2.23	23.37±6.95	114.00[b,c] [90.31-137.69] (2.70)
	Day 3	3.93±1.34	2.62±1.31	35.10[c,e] [25.66-44.53] (0.99)	3.31±0.60	3.62±0.95	8.54[e] [1.96-15.11] (0.40)	11.49±1.59	24.60±7.99	112.36[b,c] [83.64-141.07] (2.73)

[a]Cohen's d effect size*; unit:* VAS (cm), TBF (flux/min), LPS (mmHg)
[b]CT vs. MT; $p<.001$
[c]Significant differences between pre-post ($p<.01$)
[d]Significant differences between pre-and post-values between Day 1 and Day 2; $p<.05$
[e]Significant differences between pre-and post-values between Day 1 and Day 3; $p<.05$

in the combination therapy is discussed in terms of clinical effects. The current study findings are compared and discussed against the very few available scientific evidences. The clinical characteristics of the combination therapy in terms of dosage, frequency of application, and depth of application are discussed in order to transfer the knowledge from the study to clinical practice.

An understanding on the underlying mechanisms of action for massage in the form of CT with LPST may help coaches, sports scientists, and athletes learn about the benefits of the therapy for athletes with low back pain. The possible explanation for the CT group to experience significant improvements in the pain variables (PI and PPT) might be related with principles of pain gate control theory and biochemical serotonin effects from higher centre such as cerebral cortex.[23,24] According to the pain gate control theory, MT stimulates larger mechanoreceptor impulses that travel in the larger mechanoreceptor afferent pathways and acutely blocks the pain signals at the motor cortex.[25] Since the changes in pain variables were measured immediately before and after the interventions, the improvements in the PI and PPT could be well related as immediate pain gate control effects among the participants where the mechanoreceptors of the participants were likely to be stimulated by MT. The current study did not measure levels of biochemical such as levels of serotonin, dopamine, and cortisol. Nevertheless, available evidence suggests that MT may reduce cortisol level and increase antinociceptive substances, such as serotonin and dopamine levels, which may possibly explain pain reduction among the participants.[25] In addition, LPST was reported to cause a significant release of plasma endorphin that resulted in pain reduction among participants with CLBP.[26] Therefore, it is possible that a combination therapy of massage with LPST may produce pain modulation as a therapeutic benefit through pain gate theory and endogenous opioids-induced analgesic effects in low back pain.

Tissue blood flow is a measure of physiological effects of therapeutic treatments and an indicator of tissue health and healing after injury.[19,27] Reduced TBF may cause accumulation of acidity in the muscle and eventually produces pain.[19] Furthermore, similar effects related to TBF deprivation and pain generation are proposed by vicious cycle theory among patients with low back pain.[27] Alternatively, a raise in TBF is suggested to improve tissue proprioception, tissue healing, dorsal horn inhibition, and descending pain control inhibition.[28] As massage involves rubbing, squeezing, and mechanical pressure on soft tissues, the mechanical stimulation may also cause increase in TBF.[29] In addition, LPST is suggested to improve TBF and core muscle thickness, enhance spinal stability, reduce abnormal movements at lumbar spine, and eventually reduce pain perception.[19,20,21] Thus, several evidences suggests that CT of massage and LPST improves TBF and healing of the tissue.[19,29,30] Therefore, it is possible that all the above mechanisms potentially contributed to improvement in the PI, PPT, and TBF among the participants in the current study. On the other hand, the CT had no significant improvement in the lumbopelvic stability. Perhaps an increased number of interventions may be necessary to have any impact on the lumbopelvic stability; this needs to be ascertained through further studies.

The minimal clinically important difference (MCID) scores determine response of the patients to treatment and guides clinical decision-making on the usefulness of a therapy.[31] To our knowledge, the current study was the first study that reported MCID values for MT in combination with LPST. In the current study, the results of MCID scores showed a clinically significant increase for PI (44% up to 51%), PPT (16% up to 25%), and TBF (131% up to 152%) in the CT group, when compared to the pre-therapy levels and with the MT group. As there were no past studies available which had published MCID for combination therapy, the MCID scores of current study could not be compared. However, the effects of providing massage as a combination therapy with LPST was supported by a recent study that showed effectiveness of MT was enhanced by addition of lumbopelvic stability exercises in low back pain patients.[32] Thus, the findings of the current study demonstrates favorable results in support of a combination therapy of massage and LPST for managing CLBP among elite weight lifters.

The current study has a few limitations. All the study participants were females and highly trained elite professional weight lifting athletes. Thus, the study findings might have limited external validity to apply for members of the general population with low back pain. Nevertheless, the findings of the study highlight the usefulness of massage as a combination therapy with LPST for management of low back pain. Only the immediate effects were measured in this study and, hence, the findings did not cover the long-term effects of the CT in low back pain. The strength of the study is that it followed a clinically recommended protocol for MT and LPST and, therefore, it might provide a clear practice protocol in clinical practice.[20,21,33]

CONCLUSION

The combination therapy of MT and LPST is likely to provide more clinical benefits in terms of PI, PPT, and TBF when compared to massage as a stand-alone therapy among individuals with chronic nonspecific low back pain.

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CONFLICT OF INTEREST NOTIFICATION

The authors declare there are no conflicts of interest.

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