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Research Article

Acute Effects of Quick Short - Duration Massage On Vertical Jump; A Crossover Randomised Controlled Trial

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Abstract

Objective

Long - duration preperformance manual massage can have detrimental effects on muscle strength and functional performance. The objective of this study was to examine acute effects of quick short - duration massage on vertical jump performance.

Methods

Fifteen young healthy male individuals (age 21.07 ± 0.25 years, body mass index 22.29 ± 2.39) were recruited. The study design was a crossover randomised controlled trial in which all subjects received both massage interventions and control interventions on separate days. Manual massage was performed for both quadriceps and gastrocnemius muscles for two minutes in total, in a rapid, superficial and stimulatory way. In the control group, subjects were asked to lie down for the same duration as the massage group. Vertical jump height was assessed before and after interventions.

Results

There was no significant difference between the two groups in changes in vertical jump performance. Both groups showed no change after interventions compared to the baselines.

Conclusion

Two - minute quick massage did not improve vertical jump height immediately. Clinicians and athletes should be aware of the current evidence and decision making for the use of preperformance massage should be justified by individual needs and sound clinical reasoning.

Keywords: Preperformance massage; Vertical jump; Warm-up

Introduction

Warm-up is commonly performed by athletes to enhance their physical capabilities [1]. As a form of warm-up, preperformance massage is often performed in various sports settings [2]. Massage can be conducted in either a passive manner by therapists or an active manner by athletes themselves, using specific apparatus, such as a foam roller [3,4]. Main purposes of preperformance massage include preventing injuries, increasing range of motions, decreasing stiffness and soreness and enhancing athletes' strength, endurance and functional performance [5,6]. Proposed rationales for improved strength and functional performance generally involve the following; increasing blood flow to provide more efficient metabolism for muscles [7] and positive psychological effects, such as mood enhancement and increased perceived performance [8].

The research evidence regarding the immediate effects of preperformance massage to improve muscle strength and functional performance is equivocal. In fact, some studies demonstrated that massage might inhibit muscle strength and compromise explosive performance, such as sprinting and vertical jump [2,9,10]. In most studies with negative findings regarding the effects of massage on strength and functional performance, massage tends to be long - duration massage (>10 minutes) [2,9,11]. In reality, however, it is often difficult and impractical for therapists working in teams to perform long-duration massage for every athlete before games.

Since resting effects in lying postures during any types of long - duration massage might facilitate parasympathetic nervous system activity, this potential relaxing effect might have affected the results in the studies with negative results of preperformance massage. It has been anecdotally suggested that quick and stimulatory massage for superficial muscles should be used before competitions to enhance motor output, whilst deep and relaxing massage should be adopted to encourage relaxation and post - exercise recovery [5]. A recent study showed that manual massage with moderate pressure can elicit parasympathetic nervous system response [12]. Considering those factors, it seems to be reasonable to speculate that the effects of massage on athletes' functional performance might depend on the length and the type of the massage. To the best of the authors' knowledge, however, there is no specific data to support the claim that quick short - duration manual massage techniques can improve functional performance.

The objective of this study was to examine acute effects of quick short - duration massage on vertical jump performance. Vertical jump was chosen as a primary outcome measure due to its relevance to many sports, such as basketball, volleyball, gymnastics and so on. A strong correlation between jump and sprint performances in elite football players may imply the importance of this outcome measure to represent overall physical competitiveness of athletes [13].

Methods

Research design and protocol

This study was written in line with the CONSORT statement [14]. This study was a crossover Randomised Controlled Trial (RCT), in which all subjects completed two days of experiments. This research design was chosen in order to guarantee as many samples as possible. One experimental session consisted of massage intervention, and pre - and post - intervention assessments of vertical jump. On another

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day, subjects were told to lie on a bed and the same pre - and post - intervention measurement procedures were conducted to serve as a control group. Due to the nature of the massage intervention, it was not possible to blind participants or therapists. The same physiotherapist performed both massage interventions and measurements of vertical jump. After the recruitment of participants, they performed two experiments in a random order, which guaranteed the allocation concealment.

Participants

An ethical approval was achieved from an ethical committee in Tokyo University of Technology before the commencement of the experiments (registration number: E16HS - 33). Fifteen healthy male collegiate students (age 21.07 ± 0.25 years, body weight 65.20 ± 10.21 kg, height 170.60 ± 5.65 cm, BMI 22.29 ± 2.39) were recruited for this study. Exercise habits of participants were varied, ranging from twice per week to none. Exclusion criteria were as follows; pain during vertical jump, lower - limb injuries in the previous three months or a history of surgical procedures on lower limbs. Before participation, the contents and the purpose of the study and protection of personal information were verbally explained. All subjects read documents regarding the study and signed informed consents. Subjects were instructed to refrain from alcohol intake for 48 hours before testing sessions and not to participate in vigorous exercises for 48 hours before sessions.

Experimental procedures

In first experimental sessions, anthropometric measurements were taken and Body Mass Index (BMI) was calculated accordingly. In both intervention and control sessions, subjects performed vertical jump twice with maximal efforts to familiarise themselves with the task at first. The data of these preliminary jump practices were utilised to determine the reliability of this outcome measure. Vertical jump height was assessed using a digital jump meter (JUMP - MD, Takei Scientific Instruments, Japan) (Figure 1). In measurements, they were instructed to jump upwardly as high as they could. A specific jumping strategy was not set. Following the familiarization, subjects sat on a chair with back rest for one minute. After subjects performed two vertical jumps at maximal efforts as baselines subsequently, they received either massage intervention or no intervention. A massage intervention consisted of 10 - second effleurage and 10 - second tapotement for quadriceps and gastrocnemius muscles on both sides (Figure 2). Tapotement was applied with hypothenar eminence of both hands in a percussive way. Effleurage was performed as rapidly repeated strokes using the palmar side of one hand. Both massage techniques were administered in a quick, superficial and stimulatory manner without any oils or creams for two minutes in total, including the time for the therapist to move around the bed and for subjects to change lying positions (Figure 2). Massage was performed by the same physiotherapists who had taken Masters degree in musculoskeletal and sports physiotherapy. Massage was consistently performed in the following order; effleurage for left quadriceps, tapotement for left quadriceps, effleurage for right quadriceps, tapotement for right quadriceps, effleurage for left gastrocnemius, tapotement for left gastrocnemius, effleurage for right gastrocnemius and tapotement for right gastrocnemius. In the control group, subjects were asked to lie down on bed in supine or prone for one minute respectively. Immediately after massage or comparator intervention, vertical jump was measured in the same procedure as the baseline measurements.

Figure 1: Assessment of vertical jump height using the jump meter.

Figure 2: Examples of massage interventions; effleurage (left) and tapotement (right).

Two testing sessions were separated by 72 hours at least, in order to minimise the effects of delayed onset muscle soreness. Each session was held at the same time of day. All testing sessions were conducted in the same room at the same room temperature of 22 degrees Celsius. Participants had been instructed to wear a short sleeve T - shirt and shorts in the experiments. The first author organised all the sessions, performed massage interventions and assessments for all the subjects. Care was taken to ensure that all participants received the same verbal instructions and visual cues to minimise potential effects on arousal levels. This trial was registered in University Hospital Medical Information Clinical Trials Registry (registration number: UMIN000025962) in advance.

Statistical analysis

The results are presented as mean ± Standard Deviation (SD) values. The data of preliminary jump practices was utilised to calculate Intraclass Correlation (ICC) and determine the reliability of the outcome measure. An independent t - test was used to assess differences between two conditions and the paired t - test for differences between pretest and posttest within each condition. All statistical analyses were conducted with SPSS (IBM, USA). ICC was evaluated accordingly; <0.20 as slight, 0.21 - 0.40 as fair, 0.41 - 0.60 as moderate, 0.61 - 0.80 as substantial and 0.80< as almost perfect [15,16]. The differences were considered statistically significant at $p < 0.05$. Additionally, Hedges' g and 95% Confidence Intervals (CI) were calculated to determine between - group effect sizes [17,18]. Effect size was categorised as large (>2.00), moderate (>1.25 - 1.90), small (0.50 - 1.25) or trivial (<0.50) [19]. A post hoc power analysis was performed using G*Power 3.1.9.2 [20].

Results

All subjects (n = 15) participated in both sessions and there was no drop - out. ICC of the vertical jump measurement was 0.97. Thus, the vertical jump measurement was proven to have an almost perfect reliability [15,16]. In vertical jump assessments, 14 out of 15 subjects adopted countermovement strategy using dynamic arm swings, whilst only one subject used squat strategy, starting from a static position [21]. Table 1 indicates the results regarding vertical jump height in the experiments. There was no significant difference between two baseline data (p = 0.59), which guaranteed the baseline comparability. A paired t - test found no significant change in the massage group (p = 0.35) or the control group (p = 0.55) by each intervention. An independent t-test demonstrated no significant difference in changes in vertical jump height between the two groups (p = 0.24) (refer to Figure 3). The between - group effect size for massage intervention was 0.41 (95% CI - 0.39 to 1.21), which is classified as a trivial effect [19]. Since 95% CI included the value of zero, the acute effects of massage were regarded as not being significant [18]. As a result of post hoc analysis, the value of statistical power was 0.20.

	Pre - intervention	Post - intervention
Massage (n = 15)	54.43 ± 6.06 cm	55.00 ± 6.38 cm
Control (n = 15)	55.63 ± 5.59 cm	55.27 ± 6.46 cm

Table 1: Mean and SD of vertical jump height.

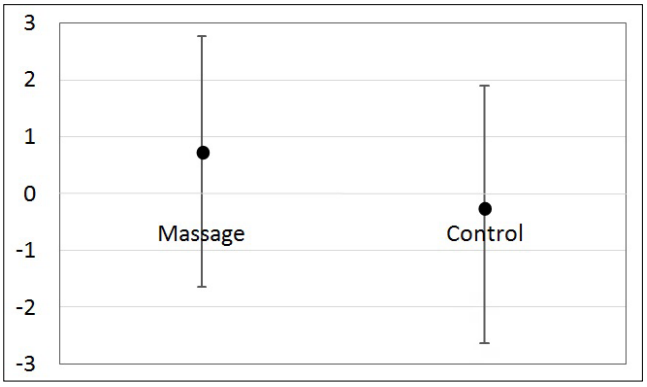

Figure 3: A comparison of changes in vertical jump height; 0.57 ± 2.21 cm (massage group) and -0.37 ± 2.25 cm (control group).

Discussion

The results of this study suggest that two - minute quick preperformance massage for lower - limb muscles has no immediate positive effect on vertical jump height compared to no intervention. Although we suspected that this type of preperformance might have positive effects on functional performance, unlike longer - duration massage with moderate pressure, we found that preperformance massage might have no immediate benefit for vertical jump performance irrespective of the duration.

To date, to the best of the author's knowledge, this study is the only investigation examining the acute effects of quick short - duration manual massage on vertical jump height as opposed to no intervention. Many studies investigated the effects of longer-duration preperformance massage on muscle strength and explosive performance, such as sprinting and vertical jump and found that they were not effective or even detrimental [2,4,9-11]. Our findings were in line with those studies, implying that any types of massage might not be effective to enhance athletes' vertical jump performance acutely.

Although these findings suggest that any types of preperformance massage are not efficacious to improve athletes' explosive performance acutely, it does not negate its clinical utility in all circumstances. Some studies demonstrated that massage can modulate pain and increase range of motion [22,23]. It might be appropriate to conduct preperformance massage for athletes with pain or athletes who require greater range of motion to achieve better performance. Other studies showed that massage can alleviate perceived fatigue and improve muscles strength after exhaustive exercises [24-26]. It might be appropriate to perform massage between sets of games to achieve better endurance and performance afterwards. Manual massage was found to be effective to reduce stress [27,28]. Preperformance massage might be appropriate when athletes' excessive nervousness can compromise their physical capabilities. Additionally, the findings in this study suggest that rapid preperformance massage might not negatively affect vertical jump performance in the short term. One crossover RCT also suggested that the acute effects of massage were not detrimental on tennis players' grip strength [29]. Thus, potential mental benefits might justify its use in some cases. Overall, preperformance massage should be carefully used based on the combination of research evidence, athletes' individual needs and clinicians' clinical reasoning.

Several methodological limitations should be acknowledged in this study. A first problem lies in the sampling method. As we recruited subjects with varied exercise habits, this heterogeneity might have biased the findings. The study might have been underpowered (power = 0.20) due to the small sample size (n = 15) [30]. An inclusion of non-athletes was another limitation, as athletic population was more relevant. Since the therapist who performed the massage also conducted the vertical jump measurements, the assessor was not blinded. It is theoretically possible that the absence of blinding might have biased the measurement results. Also, this study did not consider other contributing factors to athletes overall performance, such as endurance, flexibility and psychological states. Lastly, it is not realistic to perform preperformance massage alone as a warm-up. It is often combined with other warm-up strategies, such as aerobic exercises, stretching and motor imagery. Thus, this study failed to capture the real effects of preperformance massage in the contexts of other warm-up interventions. Further studies with more methodological rigour are required to contribute to stronger evidence on this topic.

Conclusion

Based on our findings, it appears that the quick short - duration stimulatory massage for lower - limb muscles has no acute effect on vertical jump performance. Any types of preperformance massage for the purpose of improving athletes' explosive performance immediately can be a waste of time or even undermine their performance. The author would not argue against the use of preperformance massage in all circumstances because its effects on endurance, flexibility and athletes' psychological states should be also considered to maximise athletes' specific aspects of performance. Clinicians and athletes should be aware of the current evidence and they are encouraged to use a traditional active warm-up, and the use of preperformance massage should be justified by individual needs and sound clinical reasoning.

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