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Original Article

The Effect of Lying in Prone Position on Blood Pressure and Heart Rate with and without Massage

Narges Meftahi[1], Soha Bervis[1], Shohreh Taghizadeh[2*], Farahnaz Ghafarinejad[2]

[1]Student Research Committee, Department of Physiotherapy, School of Rehabilitation Sciences, Shiraz University of Medical Sciences, Shiraz, Iran
[2]Department of Physiotherapy, School of Rehabilitation Sciences, Shiraz University of Medical Sciences, Shiraz, Iran

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ABSTRACT

Background: At the present time, massage has become a popular therapy employed in complementary medicine. There is evidence showing that back massage might have many positive psychological effects, possibly due to having many autonomic nervous system afferent inputs. One of the frequent positions during massage is prone position. However, there has been limited research investigating the effect of back massage in the prone position on blood pressure (BP) and heart rate (HR). The present study planned to investigate the changes of blood pressure and heart rate after back massage in prone position.

Methods: Sixty-one healthy women were divided into two groups. Group one lay prone and was given a 15-minute massage while group two just lay prone for 15 minutes. Immediately prior to and after interventions, systolic and diastolic blood pressure and heart rate were measured in both groups. To assess within group differences, paired t-test was used. Independent t-test was also used to assess between group differences.

Results: The results showed that systolic blood pressure decreased significantly after massage and also in the group only lying prone ($P<0.05$), with no significant difference between groups ($P>0.05$). Changes of diastolic blood pressure and heart rate were not significant in either group.

Conclusion: Massage and lying prone both can cause a decrease in systolic blood pressure. Massage was not seen to be more efficient than lying prone.

Introduction

Nowadays, massage has become a popular therapy in complementary medicine and has been shown to have mechanical, physiological and psychological effects. Regulation of the autonomic nervous system as well as the level of cortisol [1,2], epinephrine, and norepinephrine [1] are some of the physiological effects of massage. Furthermore, it results in mental relaxation possibly by modulating neuronal activities in forebrain-amygdala and precuneus network [2] through stimulating the specific c-tactile afferents in the skin [3]. It mechanically stimulates Aβ-fibers and sensory nerve fibers type III and IV [4]. In addition, intermittent pressure during massage can increase blood circulation and lymphatic drainage [5]. As a result, blood pressure (BP) and heart rate (HR) might change following a massage.

Several studies investigated the effect of massage on BP and HR. The parts that were selected for massage in previous studies include face [6], neck [7], chest [4], back [8], shoulder [9], hand [1], foot [10], or a combination of these parts and whole body [3,11]. Aourell et al. reported that back and neck massage might have more effects on BP, possibly due to having many autonomic nervous system afferent inputs [4]. Back massage was applied under different positions in the previous studies [8,12,13].

*Corresponding author: Shohreh Taghizadeh, School of Rehabilitation Sciences, Abiverdi 1 St, Chamran Blvd, Shiraz, Iran, P.O.Box: 71345-1733, Tel: +98 711 6265108, Fax: +98 711 6272495,
E-mail: taghizsh@sums.ac.ir

This leads to an inconsistency among studies regarding the participants' positions during massage. In these studies, the participants have lain in the prone [12,13] or side lying positions [8]. One of the limitations of these studies is that the position of the participants in control group was arbitrary which was not necessarily similar to the massage group [13]. To the best of our knowledge, none of these studies have investigated the effect of a specific position on BP and HR.

Ouchi et al. showed that by providing comfort and mental relaxation during back massage, it can increase the regional cerebral blood flow in the posterior brain region in addition to increasing the parasympathetic tone in the brain when performed in the prone position. They reported that prone posture can itself increase regional cerebral blood flow compared to the supine posture [2]. Based on the results of these studies, it can be proposed that a prone position alone, without accompanying a massage, can change BP and HR. However, there is limited research investigating the effect of back massage while in a prone position on BP and HR. In these studies different positions were used which were not necessarily prone. For example Fraser and Ross Kerr applied back massage in a side lying position [8]. Holland and Pokorny applied back massage in the prone position [12]; It is unclear whether the reported effects were the result of massage alone and/or the prone position since they did not have a control group. Therefore, the purpose of the current study was to evaluate changes in BP and HR in the prone posture with and without massage applied on the back.

Methods

Subjects: This randomized controlled clinical trial was performed in Shiraz Rehabilitation School clinic. The sample size was calculated by G*Power Software [14] considering a minimal statistical power of 80% (P=0.05). Based on independent sample t-test used for analyzing data in this study, the minimum number of subjects per group was 23. Inclusion criteria were: having no pain or motion limitation in the back area and no history of trauma in these regions. The participants also had to have a blood pressure of less than 140/90 mmHg. Participants were excluded from the study if had any of the following: heart disease, Raynaud's disease, Berger's disease, neuropathy, diabetes mellitus, hypertension, rheumatoid arthritis and neurological deficits. Since getting massage from a female therapist is not ethical for male clients and vice versa in our country, all participants were women in the present study. After assessing the women's eligibility for participating in the study, sixty one healthy women aged between 35-55 years old participated in this study. For group assignment, two blurred envelopes containing a paper with the name of groups were prepared. They were randomly assigned into two groups: the massage group (n=32, age: 48±6.5) and the control group (n=29, age: 49±2.5). All participants signed an informed consent form. This study was approved by the Ethics Committee at the Shiraz University of Medical Sciences.

Experimental protocol: The participants were asked to avoid strenuous physical activity on the day of test and to avoid eating within 2 hours before the study. After being in a relaxed position for several minutes, SBP, DBP and HR of participants were measured. BP was measured by aneroid sphygmomanometer (KaWeMastermed A1, Germany). A physical therapist measured the radial artery pulse rate in the distal part of the forearm for one minute for recording HR.

Massage was performed by a trained physical therapist while the participants were lying on a comfortable bed at Shiraz School of Rehabilitation Science physiotherapy clinic. The neck and back of participants were exposed during massage. The upper and lower extremities were covered by blankets. A small pillow was placed under the abdomen to maintain the lumbar curve in the neutral position. For smooth movements of the therapists' hands, talcum powder was used. A 15-min period massage included 5 minutes effleurage, 5 minutes kneading and 5 minutes wringing massage. The order of these three types of massage was randomly selected for each participant. During effleurage, the therapist's hands moved in a single direction from distal to proximal. For kneading, the therapist manipulated the skin and subcutaneous tissues in a circular manner; the right-hand pressure was applied in a clockwise direction in an angle between 8 and 11 on a clock. The left hand circles were in counter-clockwise direction in an angle between 4 to 1 on a clock. (Figure 1).

During wringing massage, the therapist used fingers and thumbs of both hands to compress and pick up the tissues and the underlying structures. Fingers of one hand pulled tissues in one direction while the thumb of the other hand pushed them in opposite direction; concomitantly, the hand moved along the lifted tissues during massage [15].

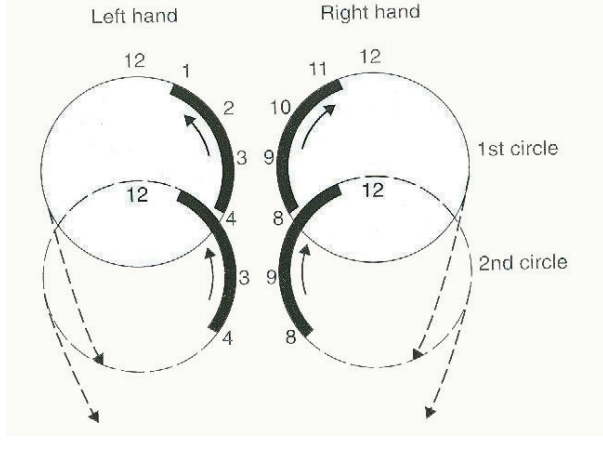

Figure 1: Hand Pressure method and direction for exerting kneading massage [14]

First, the neck was given a massage. The neck area was divided into three parts (medial, middle, lateral) depending on the size of the neck. A massage was performed from lateral line to the medial and from upper to the lower part of the neck. The lateral and middle parts were bordered the supra clavicular fossa and the medial part bordered the axillary space (Figure 2) [15]. After the neck, the massage was continued in a line from upper part

of the buttock to the scapula and a line from upper part of the buttock to the medial part of the superior angle of scapula (Figure 2) [15].

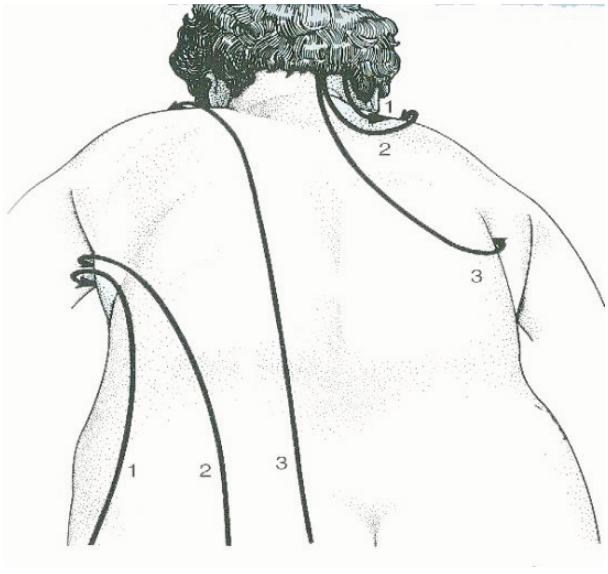

Figure 2: Lines for applying massage [14]

The control group was only instructed to lie down in prone position in the same environment as the massage group for 15 minutes. After 15 minutes massage or 15 minutes lying prone without massage, BP and HR measurements were repeated.

Statistical Analysis: Parameters normality was approved by Kolmogorov–Smirnov test. Independent t-tests were used to compare data between the two groups. The level of significance was set at P<0.05 for all statistical tests. Paired t-test was used to assess the differences prior and after interventions within the group lying prone without massage. For all data analyses, SPSS version 17 (SPSS, Chicago, IL) was used.

Results

The results showed that mean age (P=0.2), SBP (P=0.07), DBP (P=0.08) and HR (P=0.07) before were not significantly different between two groups interventions. The current study showed that SBP decreased significantly after lying prone with massage (P=0.001) and without massage (P=0.03). However, DBP (with massage; P=0.73 and without massage; P=0.96) and HR (with massage; P=0.23 and without massage; P=0.08) showed no significant decrease in either group (Table 1). In addition, the differences between the two groups were not significant with regards to SBP (P=0.92), DBP (P=0.86) and HR (P=0.78) (Table 2).

Discussion

The purpose of this study was to assess the changes in BP and HR in the prone position with and without massage. The results of this study revealed a significant reduction in SBP immediately after massage. The pressure exerted during massage may promote vagal activity [5] which caused a decrease in stress hormones [3,16] following a parasympathetic response of the autonomic nervous system [5,17]. In other words, changes within neuronal circuits, caused by repetitive sensory stimulation of pressure receptors, reduce sympathetic activity that leads to a decrease in blood pressure [6,18]. Moreover, an increase in skin temperature due to the massage can cause a greater parasympathetic activity [6].

In addition, in the present study, SBP was significantly reduced after lying prone for 15 minutes without massage. Ouchi showed that lying prone can enhance neural activities in the forebrain amygdala and posterior brain region, specifically the precuneus networks. These responses may result in improving the parasympathetic tone in the brain and as a result, provide relaxation and a decrease in BP. Buttagat et al. explained that the prone position may assist parasympathetic activity while receiving massage therapy [18].

Our results showed no immediate decrease in DBP either after the massage or lying prone. Aourell explained that DBP did not decrease after a single massage session and needed repeated following

Table 1: Immediate effects of interventions, within groups

Group	Variables	Before (mean±SD)	After (mean±SD)	P value
Lying prone with massage	SBP (mmHg)	116.4±14.5	111.3±13.4	0.001*
	DBP (mmHg)	78.2±9.3	77.6±10.4	0.73
	HR	74.2±12.9	72.7±12.9	0.23
Lying prone without massage	SBP (mmHg)	105.4±27.8	100.1±21.1	0.03*
	DBP (mmHg)	73.3±11.7	73.2±10.1	0.96
	HR	69.5±6.4	68.3±6.7	0.08

*P<0.05, SD: standard deviation, SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate

Table 2: Comparison of SBP, DBP and HR between groups

Difference between before and after	Groups	Mean±SD	P value
SBP (mmHg)	Lying prone with massage	5±7.8	0.92
	Lying prone without massage	5.3±1.3	
DBP (mmHg)	Lying prone with massage	0.5±9.3	0.86
	Lying prone without massage	0.1±11.8	
HR	Lying prone with massage	1.4±6.6	0.78
	Lying prone without massage	1 ±3.1	

*P<0.05, SD: standard deviation, SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate

massage sessions over time [4].

The present study also found no difference in HR between pre and post- massage and lying prone without massage. Moraska et al. explained in a literature review that quite a large percentage (44%) of studies did not identify a change in HR after massage [19]. They also asserted that although these studies reported significant reduction in HR, the changes were too low; approximately 3–6 beats per minute. In addition, HR reduction did not persist after the massage session in those studies [19].

The results of the current study revealed no significant difference between the two groups in BP and HR. This means that both massage and lying prone without massage can decrease SBP. In other words, it seems that massage was not more efficient than solely lying prone in decreasing systolic blood pressure, leading to an assumption that both had the same effects.

Our study was limited by the duration of follow-up. We only assessed the immediate effect of prone position and applying massage on the BP and HR. The second limitation was that we only assessed the women. This was of course as the result of the ethical rules in our country. Therefore, the study results may not be extended to men.

Conclusion

In summary, according to this study, both massage and solely lying prone can effectively reduce SBP. However, with regard to changes in BP and HR, there was no significant difference between solely lying prone or lying prone with massage. Consequently, massage can be a safe, simple technique in reducing BP in healthy people. Additional studies may be needed to investigate the effects of lying prone as an effective suggestion.

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Conflict of Interest: None declared.

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