European Journal of Integrative Medicine 26 (2019) 43–49

Contents lists available at ScienceDirect

European Journal of Integrative Medicine

journal homepage: www.elsevier.com/locate/eujim

How effective is reflexology on physiological parameters and weaning time from mechanical ventilation in patients undergoing cardiovascular surgery?

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ARTICLE INFO

Keywords:
Cardiovascular surgical procedures
Reflexology
Massage
Physiologic monitoring
Mechanical ventilator weaning
Clinical trial

ABSTRACT

Introduction: Cardiovascular disease is one of the leading causes of morbidity and mortality in both developed and developing countries. The present research was designed to determine the effects of reflexology on physiological parameters and mechanical weaning (MV) weaning time.

Methods: In this non-randomized controlled clinical trial, 85 patients who underwent open heart surgery were allocated into either an experimental group (n = 42) or aut control group (n = 43) using convenience sampling. The participants were informed about the study and a written and oral informed consent was obtained from each patient. Along with the study, a twenty-thirty-minute foot reflexology and routine care treatments were applied to the patients in the experimental group and control group, respectively in the post-operative period. In this context, physiological parameters and mechanical ventilation weaning time of the patients were examined at certain intervals.

Results: According to the values obtained before reflexology for experimental and control group, the pulse rate ($p = 0.013$) and diastolic blood pressure ($p = 0.021$) of the patients in the experimental group at 5 min before reflexology were significantly higher. Moreover, oxygen saturation values of the patients in the experimental group at 5 min after extubation were lower ($p = 0.012$). However, reflexology did not exhibit any significant changes in other physiological parameters but the mechanical ventilation weaning time after reflexology was shorter in the experimental group ($p = 0.023$).

Conclusion: Reflexology did not have a significant effect on physiological parameters in patients receiving mechanical ventilation support. Shortening the weaning time from mechanical ventilation suggests that it might be applied effectively in patients receiving mechanical ventilation support in intensive care unit.

1. Introduction

Cardiovascular diseases such as coronary heart disease (CHD), cerebrovascular diseases, peripheral arterial disease, rheumatic heart disease, etc. are considered as the most common reason of the mortality and adversely affect the life. According to the World Health Organization (2017) report, approximately 17.9 million people, representing 31% of all global deaths in 2016, died due to cardiovascular diseases. Open heart surgery (OHS), which is one of the treatment options of cardiovascular diseases, is the most common intervention used to resolve ischemic problems and valve disorders [1–3]. However, patients often experience many physiological and psychological problems after OHS [4].

Weaning from mechanical ventilation (MV) after cardiovascular surgery is still one of the most complicated tasks in the routine work of the intensive care unit (ICU). The patients undergoing OHS are usually exposed to extubation within 1–6 hours since they can usually continue spontaneous ventilation immediately after recovery from anesthesia. Unfortunately, long-term sedation and analgesia for approximately 2.6%–22.7% causes prolongation of the weaning time from MV [5]. Sedation is constantly performed after cardiovascular surgery to increase MV tolerance, decrease metabolic requirements during respiratory and hemodynamic instability and reduce pain and anxiety. However, these drugs have serious adverse effects such as bradycardia, hypotension, dysmotility, inactivity, weakness, delirium and prolongation of weaning from mechanical ventilation [5–7]. Prolonged weaning time after OHS causes a rise in the risk of morbidity and mortality, a delayed hospitalization in ICU and increase in hospital

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[1] All research done by the authors.

https://doi.org/10.1016/j.eujim.2019.01.008
Received 28 September 2018; Received in revised form 17 January 2019; Accepted 17 January 2019

costs [5,6,8–10].

Recently, there has been an interest towards complementary and alternative therapy (CAT) for patients undergoing cardiovascular surgery [11]. Of the CAT methods, reflexology helps stimulate nerves by applying pressure on reflex points on ears, hands and mostly feet, which correspond to all parts of the body. This method activates self-healing process of the body, improves the blood and energy circulation, gives sense of relaxation, and maintains the homeostasis [3,12,13].

As far as we know, the effects of reflexology on pain [14,15], anxiety [11,16], physiological parameters [17,18], and fatigue [14] have been examined but there has been no report apart from our earlier report [4] on the plausible effects of reflexology on MV weaning time in patients undergoing cardiovascular surgery. The aim of the study was to determine the effects of reflexology on physiological parameters and MV weaning time.

2. Methods

2.1. Design and setting

This non-randomized controlled clinical trial was conducted at the cardiovascular surgical ICU of a teaching hospital in Istanbul, Turkey between December 2015 and November 2016.

2.2. Sample

The study groups involved the participants who underwent OHS and then G power (v3.1.9) was used for power analysis in order to decide the sample size. The power of the study as 1-β (β = type 2 error probability) and is required to have a power of 80%. Based on the assumption that the assessments to be made between two independent groups would have a large effect size (d = 0.8), the minimum example size was specified to be 26 patients for each group. However, considering possible patient loss all through the study period, 85 participants, the experimental group (n = 42) and control group (n = 43) were included in the study. Patients who met the following criteria were allocated into the groups using convenience sampling, a non-random sampling methods.

The selected participants who met the following criteria were aged between 18–75 years, experienced elective/planned OHS, had not experienced a foot-related medical issue (surgery, open sore, past scars, callus, contagious skin infection or a known neuropathy, and so forth), had no deep vein thrombosis, varicose veins or femur fracture, had no intra-aortic balloon pump or cardiac pacing, had a pulse rate of > 60/min and systolic blood pressure of > 90 mmHg, had a partial thromboplastin time of 60 s and, consented to participate in the research and these patients were included into the study.

2.3. Measurement and intervention

A day before surgical procedure, data including age, gender, body mass index (BMI), duration of surgery, aortic clamp time and medical history such as diabetes mellitus, hypertension, etc., smoking habits and pre-operative physiological parameter values were collected.

2.3.1. Experimental group (G_1)

A reflexology massage was applied to respiratory, circulatory, urinary and lymphatic system zones on the two feet of the patients for 20–30 min one hour later after admission to the ICU, post-operatively.

Reflexology was performed by a trained researcher. The researcher participated in a reflexology course with a theoretical and practical content for reflexology practice and successfully completed the certificated course. The accuracy of reflexology points, touch techniques and reflexology protocol prepared in the light of the literature [4,11,19] were confirmed by an experienced specialist reflexologist.

2.3.2. Reflexology protocol

All patients were placed in a supine position. The practitioner washed her hands and rubbed them with some olive oil to bring them to body temperature. Heating movements on the feet were applied for five minutes. Foot heating movements applied were the slip, push-pull, scrubbing, rotation, Achilles tendon stretching methods applied to all plantar and dorsal regions of both feet using all fingers and palms. A slight pressure was applied to the solar plexus of both feet for one minute. The reflexology application started with the right foot in order not to affect the heart directly. Reflexology was applied to the points of respiratory, circulatory, urinary and lymphatic systems of the right foot first and then the left foot for at least two minutes in each zone. The reflexology points of these systems were determined by considering the recommendations of the Association of Reflexologists (AoR) [20]. The application was completed by applying gentle pressure to the solar plexus of both feet for one minute. Reflexology applied for each patient lasted twenty-thirty minutes on average.

Physiological parameters (pulse rate-PR, respiratory rate-RR, systolic blood pressure-SBP, diastolic blood pressure-DBP, mean arterial pressure-MAP and oxygen saturation-SO_2) were monitored six times on the patient monitor (Infinity® Kappa-Dräger, Germany). Six measurement times were as follows: (T_1) 5 min after admission to the ICU, (T_2) 5 min before reflexology, (T_3) 20 min during reflexology, (T_4) 10 min after reflexology, (T_5) 5 min after extubation, (T_6) 60 min after extubation (Fig. 1).

2.3.3. Control group (G_2)

Regular treatment and care without any massage were applied to the patients. Data related to the evaluation of the time from the transfer of the patient after OHS to the ICU to extubation were collected from the patient files.

2.4. Data analyses

The results were analyzed using Number Cruncher Statistical System (NCSS) 2007 (Kaysville, Utah, USA). For the analysis, the Student *t*-test for the two-group comparison of the normally distributed data and Mann Whitney U for the two-group comparison of non-normally distributed data were used. The inter-group comparison of normally distributed variables was performed using the Paired Sample *t*-test. The Repeated Measure test was utilized for the evaluation of normally distributed variables. The comparison of qualitative data was performed utilizing the Fisher-Freeman Halton test, Fisher's exact test and Yates Continuity Correction test. Statistical significance was established at $p < 0.01$ and $p < 0.05$. The results were represented as mean ± standard deviation.

Finally, the results were coupled with principal component and clustering analysis in order to discriminate and clarify the experimental groups concerned with measurements at certain intervals.

2.5. Ethical considerations

This study was approved by the institutional ethical committee review board [Approval no. 10840098-604.01.01-E.3780] and conducted in accordance with the principles of the Declaration of Helsinki (2008). The necessary institutional permission from the hospital the study was conducted at and the ethical institutional permission from the clinical research ethics committee of a university were obtained. Patients who met the study criteria were informed about the study and a written and oral informed consent was obtained from each patient.

3. Results

3.1. Individual characteristics

The data with respect to the demographic information were given in

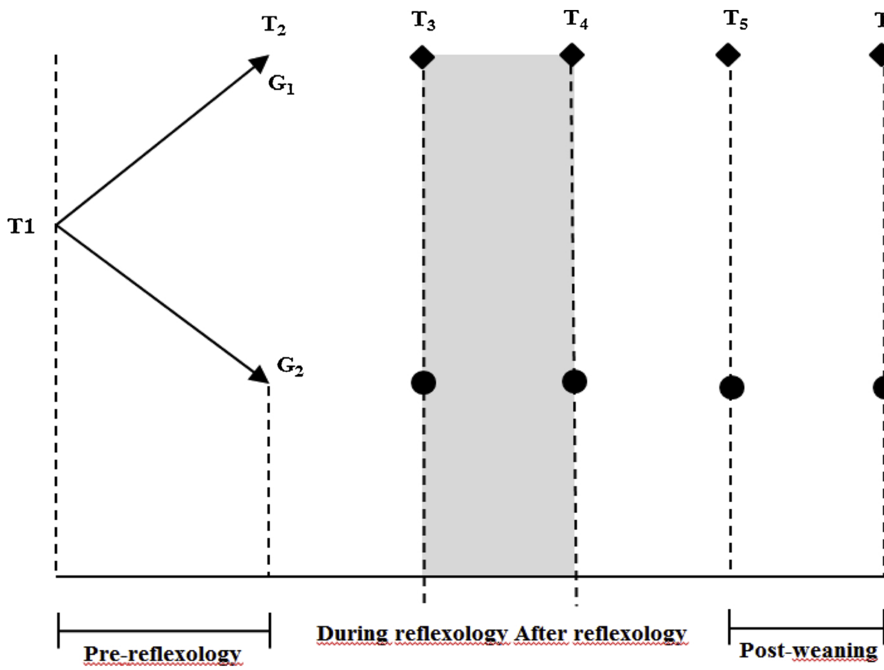

Fig. 1. Measurement times of physiological variables.

Table 1
Patients' Characteristics (N = 85).

	All Subjects (N = 85)	Experimental (n = 42)	Control (n = 43)	*p*
Age (years)				[a]0.557
M ± SD	61.26 ± 8.12	61.79 ± 7.10	60.74 ± 9.05	
Gender, n(%)				[b]0.186
Female	27(31.8)	10(23.8)	17(39.5)	
Male	58(68.2)	32(76.2)	26(60.5)	
Education status, n(%)				[c]0.405
Illiterate	17(20)	7(16.7)	10(23.3)	
Primary school	58(68.2)	31(73.8)	27(62.8)	
Middle school	5(5.9)	3(7.1)	2(4.6)	
High school and over	5(5.9)	1(2.4)	4(9.3)	
Body mass index (kg/m^2)				[a]0.123
M ± SD	29.57 ± 4.73	28.77 ± 3.70	30.35 ± 5.49	
Smoker, n(%)				[c]0.010*
Yes	9(10.6)	4(9.5)	5(11.6)	
No	52(61.2)	20(47.6)	32(74.4)	
Type of surgery, n(%)				[c]0.264
CABG	66(77.6)	35(83.3)	31(72.1)	
Valve surgery	9(10.6)	2(4.8)	7(16.3)	
CABG + Valve surgery	10(11.8)	5(11.9)	5(11.6)	
Aortic clamp time (min)				[e]0.809
M ± SD	50.73 ± 26.325	49.71 ± 25.11	51.72 ± 27.72	
Diabetes mellitus, n(%)				[b]0.452
Yes	38(44.7)	21(50.0)	17(39.5)	
No	47(55.3)	21(50.0)	26(60.5)	
Hypertension, n(%)				[b]0.899
Yes	49(57.6)	25(59.5)	24(55.8)	
No	36(42.4)	17(40.5)	19(44.2)	
Lung disease, n(%)				[d]0.738
Yes	9(10.6)	5(11.9)	4(9.3)	
No	76(89.4)	37(88.1)	39(90.7)	

CABG: coronary artery bypass grefting; M ± SD: mean ± standard deviation.
$p > 0.05$, $*p < 0.05$; $**p < 0.01$.
[a] Student *t*-test.
[b] Yates' Continuity Correction test.
[c] Fisher Freeman Halton test.
[d] Fisher's Exact test.
[e] Mann Whitney *U* test.

Table 2
Comparison of the Experimental (G_1) and Control (G_2) Groups on Physiologic Parameters (N = 85).

Measurement	T_1 M ± SD	T_2 M ± SD	T_3 M ± SD	T_4 M ± SD	T_5 M ± SD	T_6 M ± SD
PR						
G_1	78.26 ± 16.93	81.69 ± 15.34	81.88 ± 15.57	82.17 ± 14.99	92.62 ± 14.58	93.60 ± 13.92
G_2	74.33 ± 10.92	73.95 ± 12.57	76.14 ± 13.43	78.26 ± 14.54	89.95 ± 12.85	92.91 ± 11.65
t	1.277	2.546	1.821	1.221	0.895	0.247
[a]*p*	0.205	0.013*	0.072	0.225	0.373	0.805
RR						
G_1	12.26 ± 0.91	13.19 ± 2.44	13.69 ± 2.73	14.07 ± 3.04	19.98 ± 4.21	20.31 ± 4.02
G_2	12.70 ± 1.64	13.23 ± 2.31	13.40 ± 2.53	14.07 ± 2.80	20.70 ± 4.87	21.70 ± 4.42
t	1.508	0.082	0.518	0.003	0.731	1.514
[a]*p*	0.134	0.935	0.606	0.998	0.467	0.134
SBP						
G_1	116.12 ± 18.87	128.26 ± 20.18	122.79 ± 19.03	120.95 ± 19.38	132.38 ± 16.45	130.00 ± 17.74
G_2	116.42 ± 17.44	124.47 ± 18.73	126.49 ± 18.83	124.98 ± 20.09	130.16 ± 15.94	128.00 ± 14.62
t	0.076	0.899	0.902	0.940	0.631	0.568
[a]*p*	0.940	0.371	0.370	0.350	0.530	0.572
DBP						
G_1	59.50 ± 10.47	66.86 ± 12.52	64.43 ± 12.13	64.21 ± 11.22	63.81 ± 8.36	63.31 ± 8.49
G_2	57.56 ± 8.68	61.00 ± 10.44	62.86 ± 12.44	63.58 ± 10.92	63.77 ± 8.80	64.02 ± 9.57
t	0.932	2.344	0.588	0.264	0.023	0.363
[a]*p*	0.354	0.021*	0.558	0.793	0.982	0.717
MAP						
G_1	78.40 ± 13.46	86.62 ± 14.52	82.79 ± 14.17	82.38 ± 13.49	86.67 ± 9.56	85.54 ± 10.61
G_2	77.77 ± 12.35	82.26 ± 12.31	83.51 ± 15.18	83.49 ± 14.99	85.90 ± 10.32	85.35 ± 10.37
t	0.228	1.495	0.228	0.358	0.355	0.084
[a]*p*	0.821	0.139	0.820	0.721	0.723	0.933
SPO_2						
G_1	98.71 ± 2.30	99.14 ± 1.60	99.19 ± 1.33	99.14 ± 1.46	97.48 ± 3.05	97.45 ± 3.04
G_2	98.67 ± 2.02	99.49 ± 1.33	99.47 ± 1.14	99.35 ± 1.36	98.81 ± 1.52	98.30 ± 2.09
t	0.085	1.082	1.023	0.674	2.572	1.506
[a]*p*	0.932	0.282	0.309	0.502	0.012*	0.136

M ± SD: mean ± standard deviation.
PR: pulse rate; RR: respiratory rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure; SPO_2: arterial oxygen saturation.
T_1: 5 min after admission to the ICU; T_2: 5 min before reflexology; T_3: 20 min of reflexology; T_4: 10 min after reflexology; T_5: 5 min after extubation; T_6: 60 min after extubation.
$p > 0.05$, $^*p < 0.05$; $^{**}p < 0.01$.
[a] Student t-test.

Table 1. In the experimental group, patients were aged 61.79 ± 7.10 (years), 76.2% were male, 47.6% were non-smokers, and 59.5% had hypertension. Of the patients, 83.3% experienced CABG and the aortic clamp time was 49.71 ± 25.11 (min).

In the control group, patients were aged 60.74 ± 9.05 (years), 60.5% were male, 74.4% were non-smokers and 55.8% had hypertension. Of the patients, 72.1% experienced CABG and the aortic clamp time was 52.72 ± 27.72 (min). Demographic properties of the groups except the number of non-smokers did not differ significantly ($p > 0.05$). The number of non-smokers was higher in the experimental group ($p = 0.010$).

3.2. Physiological parameters

The results concerning with intergroup and intragroup comparisons of patients' PR, RR, SBP, DBP, MAP and SO_2 at certain intervals were represented in Table 2. On the PR values obtained at 5 min before reflexology (T_2), PR of the patients in the experimental group was 81.69 ± 15.34 though that of the controls was 73.95 ± 12.57. DBP of the patients in the experimental group at 5 min before reflexology (T_2) was 66.86 ± 12.52 though that of the controls was 61.00 ± 10.44. PR and DBP of 5 min before reflexology was significantly higher in the experimental group than that in the control group ($t = 2.546$, $p = 0.013$; $t = 2.344$, $p = 0.021$). SO_2 of the patients in the experimental group at 5 min after extubation (T_5) was 97.48 ± 3.05 whereas that of the controls was 98.81 ± 1.52. SO_2 of 5 min after extubation was significantly lower in the reflexology group than that in the control group ($t = 0.012$, $p = 0.012$). No significant differences were observed for other physiological values obtained at different certain intervals (T_1, T_3, T_4, T_6) ($p > 0.05$).

3.2.1. Principal component analysis (PCA) and agglomerative hierarchical clustering (AHC)

For the Group 1 (experimental group), the discrimination can be evaluated from the principal component analysis scores plot between different treated groups including T_1, T_2, T_3, T_4, T_5 and T_6 time intervals using physiological parameters examined along with the study as shown in Fig. 2. The different times in each group represent similar effects on the investigated parameters. This illustrates that there are significant differences between different timing groups. Herewith, a better discrimination was revealed where the two principal components accounted for 98.54% of the total variance. As shown in Fig. 2, the first axis and second axis explained 71.00% and 27.54% of total variance. Results obtained from the principal component analysis showed the presence of the well-discriminated and defined groups. The first (T_1), the second (T_2, T_3, T_4) and third one (T_5, T_6) were clearly represented and discriminated. The similar discrimination was also supported by the agglomerative hierarchical clustering (AHC).

The similar discrimination was also obtained for Group 2 (control group) coupled with PCA and AHC (Fig. 3). Those discriminations clarify that in both groups, the SO_2 values are low in T_5-T_6 time intervals, which are compatible with the weaning time of patients from MV and spontaneous respiration.

3.3. Mechanical ventilation weaning time

The evaluation of the comparison of MV weaning time between the groups revealed that the mean MV weaning time of the patients in the

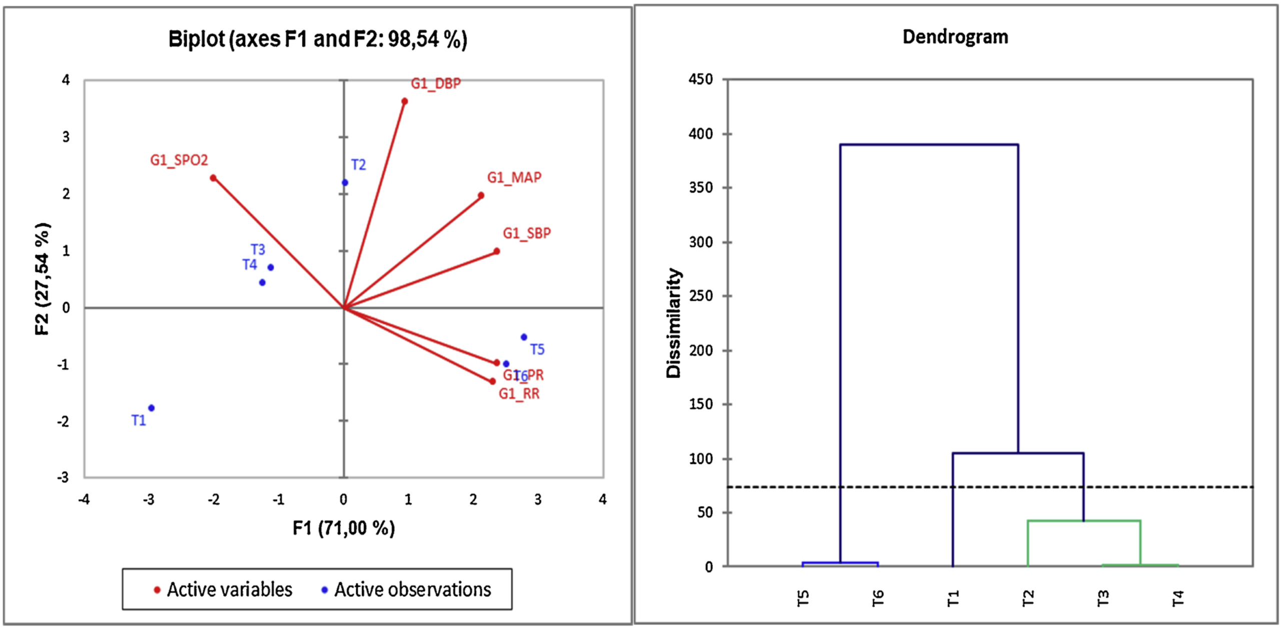

Fig. 2. Principal component analysis scores for experimental group.

reflexology group was 486.74 ± 144.91 (min) whereas that of the controls was 586.05 ± 239.18 (min). The mean MV weaning time was significantly shorter in the experimental group than that in the control group ($p = 0.023$) (Table 3).

Table 3
Comparison of the Experimental (G_1) and Control (G_2) Groups on Weaning Time (N = 85).

	Experimental (n = 42) M ± SD	Control (n = 43) M ± SD	[a]p
Weaning time (min)	486.74 ± 144.91	586.05 ± 239.18	0.023*

M ± SD: mean ± standard deviation.
$p > 0.05$, *$p < 0.05$; **$p < 0.01$.
[a] Student *t*-test.

4. Discussion

Even though the physiological effects of reflexology are not completely understood, a few theories have been proposed. Of those theories, “hemodynamic theory” is more widely accepted, proposing that reflexology-mediated stimulation increase and regulates blood flow to the concerned organ or body part. Moreover, “nerve impulse theory” which is well-known for its role on regulation of autonomic nervous system proposes that the stimulation of certain reflex points on foot enhances nerve connections corresponding to the body components. The autonomic nervous system is also responsible for controlling physiological variables such as breathing, heart rate and blood pressure [21].

Research by Jones et al. [19] investigating the reflexology effects on acute hemodynamic variables in healthy individuals suggested that reflexology applied to the left foot of healthy individuals resulted in a

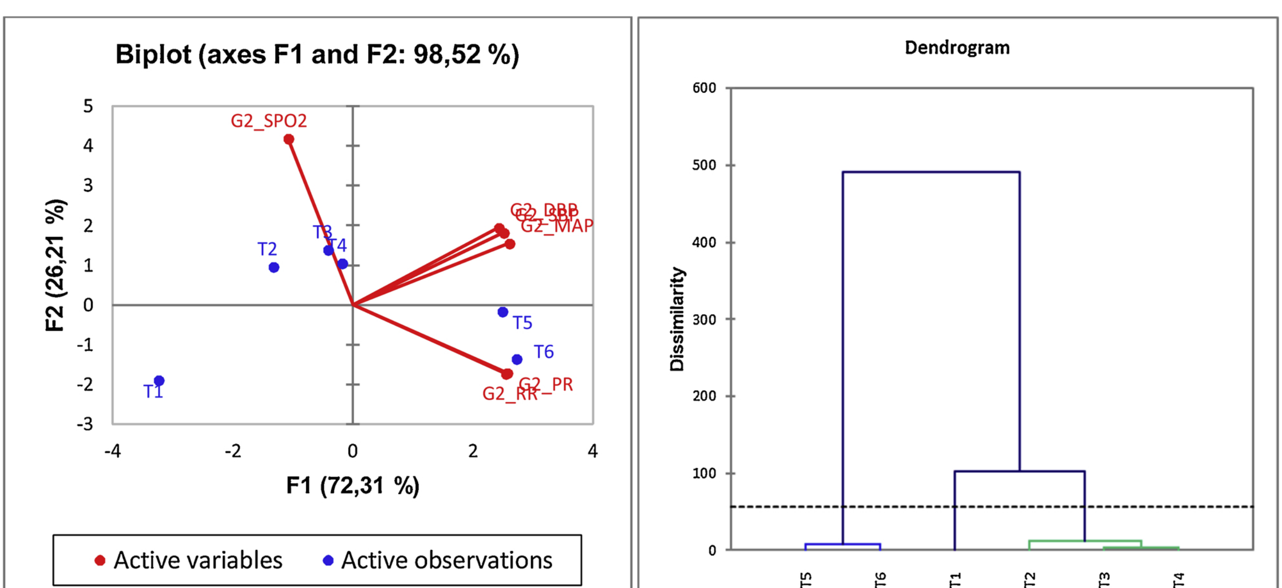

Fig. 3. Principal component analysis scores for control group.

significant decrease in cardiac index; but did not effect significant changes on the HR, SBP and DBP. Similar results have also been reported in other studies. A study investigating the effects of foot reflexology on pain and physiological variables after cesarean section by Khoshtarash et al. [17] and another study investigating acute haemodynamic effects of reflexology in patients with chronic heart failure by Jones et al. [18] showed that there were no statistically significant differences on physiological variables between the two groups; that reflexology had no statistically significant effect on physiological parameters. Similarly, a study on the effects of reflexology on physiological variables and MV weaning time in patients who underwent OHS reported that the experimental groups did not differ significantly regarding physiological parameters (PR, RR, SBP, DBP, MAP and SO_2) [4]. Furthermore, a study investigating the acute effects of reflexology on hemodynamic variables in healthy individuals by Rollinson et al. [22] proposed that reflexology applied healthy individuals had no significant effects on PR and blood pressure values.

However, a study investigating the effects of foot massage and reflexology applied to ICU patients on physiological variables by Kaur, Kaur and Bhardwaj [23] showed that SBP and PR of patients in the experimental group were significantly decreased after reflexology (within the normal range). There were significant increases in DBP and SO_2 values. In a study examining the effects of reflexology on physiological signs of anxiety in patients receiving MV support by Akin Korhan, Khorshid and Uyar [7] reported that patients' PR, SBP, DBP and RR were noteworthy lower in the experimental group on all 5 days of reflexology. In a research study by Eguchi et al. [24], SBP and DBP decreased significantly after the aroma foot massage compared to those before the intervention. However, no significant changes were found in PR.

Along with the present study, the assessment of the intergroup comparison of PR, DBP, and SO_2 showed that PR and DBP of the patients in the experimental group at 5 min before reflexology were higher than that in the control group. SO_2 of the patients in the experimental group at 5 min after extubation was lower in the experimental group than that in the control group. Other physiological values obtained at different certain intervals were not observed significant differences. The present results showed that reflexology had no significant effects on physiological parameters (PR, RR, SBP, DBP, MAP and SO_2) which were supported by the previous studies on the physiological and hemodynamic variables in patients who experienced cesarean section, healthy individuals, those who experienced heart surgery and who had chronic heart failure [4,17–19,22]. The lack of homogeneity of physiological parameters between the groups before reflexology is one of the limitations of our study.

In this study, vital sign values obtained after reflexology remained within normal limits. This result is consistent with the knowledge that reflexology gives benefits to certain groups and usually does not cause any harmful effects as long as certain precautions are taken in patients with certain medical conditions [13]. Additionally, O'Mathuna [12] proposed that a few reflexology sessions at a certain interval should be applied, highlighting that one reflexology session applied to patients had no clinical significance in acute physiological and hemodynamic variables of the patients. Clinical difference can be reached by the application of 6–8 sessions at certain intervals, a finding which can direct future studies [12,19].

The present results are partially inconsistent with the results of a few studies in the literature [7,23,24]. The responses of reflexology treatment may vary from person to person, because each individual's body systems are different [13]. However, this inconsistency can be attributed to the type, application zone, and depth of reflexology, the number of sessions, comorbid diseases and differences between MV modes. Usually, the effects of different massage techniques on the autonomic nervous system are different. For example, deep pressure simulates sympathetic response while mild touch stimulates parasympathetic response [4]. In addition, different results arise due to other factors such as the beliefs and treatment expectations [25].

The mechanism of reflexology action in shortening MV weaning time has not yet been completely clarified but it is widely considered that reflexology is successful on MV weaning variables by reducing or eliminating pain and anxiety of the patients [4,16]. Related studies in the literature showed that foot reflexology and massage therapy significantly decreased pain [15,17,26] and anxiety [7,14,27,28]. It was reported that the disease conditions and pain decreased in the patients undergoing reflexology and there was a significant reduction in the amount of drug needed [13]. Also, the implementation of reflexology emphasizes the significance of the developing therapeutic relationship between the individuals [4,7,12].

The use of long-term sedation and analgesia causes prolongation of the weaning time from MV. The current trend in patients receiving MV support is towards lighter sedation [5,10,29]. Kress et al. [30] and Schweickert et al. [31] reported that in patients receiving MV support, daily sedation interruption decreases the weaning time from MV and the duration of intensive care unit stay. Akin Korhan et al. [7] also showed that reflexology increased patient-ventilator asynchrony and reduced stress level and sedation requirement in patients with MV.

In this study, the mean MV weaning time was significantly shorter in the experimental group. The results were supported by the findings by Ebadi, Kavei, Moradian and Saeid [4]. There is no other study conducted on a similar with our research that examines the effect of reflexology on MV weaning time. However, the role of reflexology in shortening weaning time from MV may be attributed to reduction in pain, anxiety and sedation requirement.

Additionally, there are limitations in this study. Firstly, randomization was not used to allocate the patients to the groups because the study was conducted at different times so that the experimental and control groups were prevented from being affected by each other in a single intensive care unit. Secondly, the homogeneity of physiological parameters could not be obtained before the intervention and reflexology was performed as a single session. However, the pain and anxiety levels of patients receiving MV support were not evaluated and the effect of confounding factors such as comorbidity, APACHE, EuroSCORE, bleeding volume, etc. were not measured. Further research should examine and compare the effects of reflexology on pain and anxiety and the above-mentioned confounding factors with the weaning time from MV in CABG patients. Moreover, more than one reflexology session should be applied to the patients in order determine its effects on physiological parameters.

5. Conclusion

In this study, the effects of reflexology were not significant at either 20 min during reflexology (T_3) or 10 min after reflexology (T_4) in terms of physiological parameters. However, there were significant differences between 5 min before reflexology (T_2), 5 min after extubation (T_5) and 60 min after extubation (T_6), which may indicate that more than one session of the reflexology is required. It is worthy to note that reflexology might be considered as a safe nursing intervention considering physiological parameters stayed within the normal ranges. Shortening the weaning time from MV shows that it might be applied effectively in patients receiving MV support in ICU. Consequently, reflexology is suggested to be implemented by nurses as a basic, non-pharmacological and non-invasive process in the care of patients with MV in ICU.

Financial support

The authors declared no financial support.

Conflict of interest

The authors declare that they have no potential conflict of interest.

Acknowledgements

This study has been extracted from a research project of dissertation of a PhD student in surgical nursing. We would like to express our sincere thanks to all of the patients and their family who voluntarily participated in this study.

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