EXPLORING THE BODY THROUGH REFLEXOLOGY: physical behaviors observed during application

Authors

Esmel-Esmel, N; Tomás-Esmel, E; Aparicio, Y; Pérez, I; Montes-Muñoz, MJ; Jiménez-Herrera, M.

Background:

Recent studies on reflexology describe the appearance of different application-associated effects, attributed to a self-regulatory mechanism related to treatment efficacy.

On the other hand, sleep is a physiological process of vital importance for health. Its main value lies in restoring the natural balance between neuronal centers. Among its associated behavioral characteristics are spontaneous movements and eye movements.

The aim of this study is to investigate the effects that occur during application of reflexology and that are not described in the literature.

A total of 111 clients of a therapy center in Tarragona have participated in the study.

The findings have identified four categories of effects, of which there was no previous reference. These effects can be related to any of the stages of sleep. This study shows that reflexology promotes its application for different effects, such as eye movements and spontaneous movements. These data reveal the need to investigate these effects and their impact on health as well as their possible relationship with sleep.

KEY WORDS: reflexology, eye movements, spontaneous movements, body behaviors, sleep stages

INTRODUCTION

Foot reflexology is a complimentary therapy frequently used in various countries of Europe and America[1–4]. It has been shown to be effective in improving the quality of life of cancer patients, decreasing anxiety and stress[5], reducing anxiety associated with menopause symptoms[6], helping to cope with the pain of fibromyalgia[7,8], improving the quality of sleep in women after giving birth[9] and in many other health problems[1,4,10]. It has also been recognized as a therapy that brings other benefits such as an increase in vital energy, body consciousness, relaxation and general well-being[4]. Evidence shows physiological effects such as a better synchronization between heart rate and breathing, as well as vagal activity[5,7], changes in EEG records[11,12] and cortical activity[13]. Different theories explain these changes[14]. Most studies attribute the changes to a modulation of the nervous system[5]. Despite all this, there is little solid scientific evidence to explain the mechanisms of reflexology and the health benefits it can provide[1,2,6,15].

There are different types of reflexology that have evolved from Fitzgerald, founder of the Zone Therapy[16] and known as the father of modern reflexology[17,18]. One of the doctors who most believed in the principles of Fitzgerald was Dr. Riley, who expanded his technique, producing the first diagrams and drawings of the points located in the foot. In 1930, Ingham worked with Dr. Riley, marking her professional development in this field. Ingham assigned major roles to the reflex areas of the feet and spread his method all over the United States, creating one of the most prestigious schools of reflexology[16]. In time, the Ingham method and her books reached Europe, and are still used today by many people interested in the subject of health[19]. Doren E. Bayly introduced the method in Britain in 1966 and Hanne Marquartd in Germany in 1967. In 1984, Marquartd opened a subsidiary in Barcelona, Catalonia (Spain) with the aid of Dr. Montserrat Noguera[20]. Marquartd expanded the foot zone maps, introducing new reflex on the back and on the ground areas and established precisely-located anatomical correspondences.

She also demarcated three new areas with transverse lines, identifying the existing analogy forms between a person in a sitting posture and the shape of the foot. All of this gave rise to a methodology known as reflex zone therapy (RZT)[21,22].

Reflexology is a self-regulatory therapy. It is known that reflexology can promote the appearance of different physical manifestations during the session, referred to hereinafter as body behaviors (BB). These BB can be expressed as yawning, crying, laughing, sweating and intestinal peristalsis or flatus, among others[3,23]. These provide information about the progress of the session and allow the therapist to adapt the treatment to the needs that arise[19,24,25]. In the days following or between sessions, other types of manifestations can appear before improvement, such as the reappearance of old pains, irritation, irritability or exhaustion among others[21,23,26,27]. This suggests that the effectiveness of the treatment is a peripheral vasodilation response, which occurs to eliminate the accumulation of local toxins[14]. Some authors, such as Marquartd, define these manifestations as unpleasant or annoying because of the way they are manifested and for the feeling of discomfort, they cause in the client. These can include increased perspiration or mucous secretions, altered sleep patterns, the appearance of fever, headaches, dizziness, depression, or feelings of mourning[28]. In addition, Gunnarsdottir describes them in his study of fibromyalgia, stating that most women studied had progressively-worsening symptoms, suffering pain, fatigue or flu symptoms before they got better[29]. Other authors have defined them as curative crises as a consequences of a detoxification effect[30,31] or catharsis in which the emotional overflow is part of the healing process[32]. According to Laplantine, (1999) in Bordes[3], through these manifestations, the body is attempting to balance its functions[3,27] using its capacity of self-regulation[27,28] spontaneously re-establishing therapeutic restoration. Some of these physiological or emotional manifestations could be

related to the nervous system[7,25,33–35]. However, little is known about the physical behaviors associated with reflexology or what they express[23].

Over years of clinical practice applying reflexology, we have observed the different effects cited by other authors or sources. One is a state of general relaxation, which usually appears during the first 15 minutes, often accompanied by eye movements with eyes closed and spontaneous movements of different body parts. However, we could not find citations or references in any of the databases consulted. These observations generate a research question: Why do eye and spontaneous movements occur during the application of reflexology? From that, the following hypothesis is proposed: The application of reflexology promotes different behavior. It could be associated with sleep characteristics.

The aim of this study lies in corporeality reading, exploring through reflexology new effects not classified in the literature that may arise during its implementation, describe their characteristics and establish a hypothetical relationship with the sleep process. The interest of the study is to open a debate on possible causes, meanings, effects and / or associated benefits and their impact on health of reflexology.

2. Methods

2.1 *Study Design*

This is a descriptive observational study with a quantitative methodology. Expertise in clinical observation was an important component that allowed us to more deeply understand the process and improve the health care applied. In many investigations, observation has been key to important discoveries. In the present study we use observation as a method for approaching information from reality, for discovering facts and phenomena that we want to investigate and for gaining awareness of the subjectivity that this implies[36], and because, as Lynch[37] suggests, the best theories are those built on actual situations.

It was carried out from March to July 2014. The study was conducted in a complementary therapies center in the area of Tarragona, Catalonia (Spain). Participants were recruited from among the clients who requested reflexology. An information leaflet on the study was prepared and provided to clients upon arrival at the center, to request their voluntary participation.

Initially, clients were evaluated by the health care staff, who established the relevant diagnosis, based on which three groups were created: musculoskeletal, anxiety and stress. A fourth group was later added, consisting of clients who requested this service for prevention, without there being any specific reason or health problem.

They had all received reflexology sessions previously. Clients who had never received reflexology were excluded in order to prevent any discomfort that may arise from observation in their first experience, and also because most of the time on the first visit is devoted to examination. The study group consisted of the first three clients in the morning and the afternoon, provided they met the requirements for inclusion and agreed to participate in the study

2.2 *Intervention*

The intervention consisted of applying reflexology and observing the BB that occurred during the session and that had not been described in the literature. The sessions lasted for one hour, including 15 minutes of rest, and were carried out between 9:00 am and 8:00 pm. Two nurses and two physical therapists, all with academic training and more than five years' expertise in the technique, performed the reflexology sessions. The cartographic map of the reflex areas of the feet, and the treatment technique used in this study were based on the Marquartd methodology[28], and on the professionals' personal experience in the reflex areas of the head and neck. Specifically it consisted of maintaining the application of sustained sedation in the temporomandibular joint, the

oculomotor center, the celiac plexus and the highest point of the diaphragm applied twice as long as the rhythmic movement, which produces a relaxation. The basic movement was carried out with the thumb and was characterized by a rhythmic up-and-down movement, combined with a sustained sedative movement. Average pressure was applied throughout the treatment.

2.3 *Data collection*

The data were collected by observing the patient, then recording the physical manifestations on a grid designed by the research team (based on a previous pilot study) and by video recordings. The professionals who applied the treatment recorded the information. The observations were carried out from the very beginning until the very end of the session and were focused on client observation and on the physical manifestations that occurred. All the information was registered on a records grid. Only seven sessions were filmed, because the quality of the recording was poor, possibly due to deficient equipment. Different movements were observed in all of them. The recordings were kept for six months and then destroyed.

The researchers had the required training and expertise to make proper observations while applying the treatment. They also had the appropriate tools to obtain exact descriptions and sufficient data.

2.4. *Variables*

BB variables appearing during the application of reflexology (RZT) not described in the literature.

Categories and definitions

Eye movements with eyes closed: Ocular eye movement under closed eyelids. It is an easy movement to observe because the cornea and sclera are covered and

under light pressure exerted by the upper eyelid, so that the corneal relief is evident on the lid sur-face and when the eyeball moves, so does this relief [38].

Spontaneous movements: Reflexes manifested as muscle spasms or sequences of spontaneous movements of different body parts[39].

Jaw movements: Movements that occur with close and protrusion of the mandible[40].

Head movements: Biomechanical movements with head displacement[41].

2.4.1. *Movement profile*

Two parameters were established to describe the profile of BB in relation to its peculiarities: latency, to describe the time from the start of the intervention and the onset of BB, and duration, to identify the time that elapsed from the start of the BB until their end.

Speed patterns and characteristics are defined for eye movements.

Eye movements: There are three types of movements: rapid eye movement [REM or saccadic (small fast and precise movements that can be initiated by a visual stimulus or spontaneously)], slow eye movements [slow-moving conjugated movements (SEM)], and vergence movements [simultaneous and opposite movement (MOV)] that characterize the oculo-motor system. The REM are conjugated (simultaneous movement of both eyes in the same direction) and ballistic (fast movement that cannot be changed), and their maxi-mum speed and duration depends on the range of motion[38,42].

Center management approved the study. Participants were briefed on all aspects of the study and asked to sign a consent form to participate.

2.5. Statistical analysis

A descriptive and bivariate analysis was performed. Qualitative variables are presented as absolute (n) and relative frequencies (%) and quantitative variables as mean and standard deviation or median and percentiles as appropriate. Minimum and maximum values are presented when relevant. A bivariate analysis has been conducted through chi-square test or ANOVA as appropriate.

All analyses were carried out using the SPSS v. 15.0. statistical package and differences were considered statistically significant when p value was <0.05.

3. Results

One hundred and eleven people participated in the study: 77 women and 34 men from 13 to 86 years of age. Results showed new findings in BB observed while applying reflexology and describe them here for the first time. They were established in four categories: eye movements with closed eyes, spontaneous movements, jaw movements and head movements. (Table 1)

Table 1. Demographic characteristics of the clients evaluated according to the underlying cause of the reflexology.

(n =77)	Skeletal muscular	Maintenance	Stress	Anxiety
Women [n(%)]	31 (86)	24 (69)	12 (57)	10 (53)
Age [mean(SD)]	53 (17)	47 (15)	39 (9)	40 (15)

Clients showed signs of drowsiness. In some cases, they appeared to be sleeping and in others, they snored. Most clients' eyes were closed and their features relaxed as the intervention progressed.

Different BB appeared in all groups to a greater or lesser extent. As for the comparison between groups, differences were observed depending on the cause for consultation although they were not statistically significant. (Table 2)

Table 2 Presence of movements according to groups. n (%)

	Global	Skeletal muscular	Maintenance	Stress	Anxiety	P
Frequency [n (%)]	111(100)	36 (32.4)	35 (31.5)	21 (18.9)	19 (17.1)	-----
Eye movements	42(37.8)	11 (30.5)	11 (31.4)	12 (57.0)	8 (42.1)	0.173
Spontaneous movements	52(46.8)	22 (61.1)	15 (42.8)	7 (33.3)	8 (42.1)	0.181
Jaw movements	14 (12.6)	4 (11.1)	4 (11.4)	4 (19.0)	2 (10.5)	1.000
Head movements	27(24.3)	10 (27.7)	6 (17.1)	6 (28.6)	5 (26.3)	0.297

Eye movements and spontaneous movements had the highest prevalence. There were gender differences in relation to the reason for consultation. (Table 2). As for sex, none of the variables showed statistically significant differences.

Eye movements category

Eye movements were observed in a total of 42 clients (37.5%) with the stress groups (n=21) as the most significant, obtaining a larger number of observations (n=12) than non-observations (n=9). They occurred between 10 and 20 minutes after the start of the session. These movements had different speeds. Two types of speeds were observed: 35 clients had slow, gentle, conjugated movements lasting between 15 seconds and a max-imum of five minutes. Rapid and ballistic movements were observed in seven of our clients, with a duration of eight seconds to one minute. In some patients, repetition

phases were observed after a brief rest of several seconds. No vergence movements were observed.

Spontaneous movements category

A total of 52 clients (46.4%) had spontaneous movements. The musculoskeletal group had the most significant incidence of spontaneous movements, with the number of observations [n = 22 (61%)] exceeding non-observations. Spontaneous movements also appeared between 10 and 20 minutes after the session had started, being movements of different parts of the body (hands, arms, legs, and fingers). Sequences of facial movements such as eyebrows, chin and labial movements were also observed. Spontaneous movements were short-lived.

The subjects in the musculoskeletal group showed more spontaneous movements than those in the stress group, according to Fisher's exact test. The musculoskeletal group showed spontaneous movements more frequently than the stress group ($p=0.044$) and the stress group showed eye movements more frequently than the musculoskeletal group ($p=0.04$).

Jaw and head movements category

There was little impact on jaw and head movements, with the musculoskeletal, maintenance and stress groups presenting equivalent records of observations (Table 2). Head and jaw movements appeared 15 minutes after the session started and were brief.

No adverse effects were reported during the study.

DISCUSSION

The purpose of this study was the observation of different BB which had not been de-scribed in the previous literature and that may arise during the application of reflexology. The analysis of the relationship between the observed BB and reflexology had not been carried out before. Only other types of BB have been described[3,19,23,25,27,32]. That is why there are no studies with which to establish a direct discussion. The results showed four different types of BB: eye, spontaneous, jaw and head movements.

Three main objectives have been pursued in this work: identify new indicators, describe their characteristics and establish a hypothetical relationship with the sleep process. From a clinical perspective, this research opens a debate on these responses, their meanings and the impact they may have on health.

Regarding eye movements, sight is the sense that provides us with information and control over the world around us, and its neurophysiology is anatomically very complex[38,43]. Nervous impulses control the contraction of the eye muscles through the cranial nerves. Neurophysiologically, there are three main types of eye movements[44,45]. Among them are the saccadic movements, used to move the gaze from one interest point to another outside the field of vision. These movements provide us with information on the processes of perception and attention. According to this, one might consider that the movements observed in the study are related to the saccadic movements that occur in-voluntarily,

which are also reported to occur when the eyes are closed in response to non-visual stimuli[38,44,46–48].

Spontaneous movements could be related to be physiological responses of the muscle tissue in which the viscoelastic properties of the tendons and connecting tissues determine their mechanic characteristics[39]. These movements occur almost exclusively at early ages[49,50] and without external stimuli, despite the fact that certain stimuli can induce them or modify them either increasing, decreasing or inhibiting them[50]. Moreover, they can be observed during sleep as brief sudden muscle jerks[51], which were investigated by neurophysiologist Bremer in relation to the regulation of muscle tone[52.] In this study, spontaneous movements sometimes involved the entire muscle group, but sometimes they only involved a small area, categorizing them as muscle fasciculations. Fasciculation are caused by minor muscle contractures. They often affect the eyelids, calves or thumbs and are generally caused by stress or anxiety[53], which could explain the movements observed in this study. According to the results obtained, it could be stated that the spontaneous movements observed during the session triggered variations in muscle tone[14] to release physical tensions contained in the tissues.

In the context of this study, the characteristics of BB observed and the degree of relaxation and sleepiness that clients presented, suggest that there might be parallels with the neurobiology of sleep. This finding is difficult to explain, because although many stud-ies speak of an important state of relaxation mediated by reflexology[4,54,55] or its influence on sleep problems and sleep quality[56,57], we found no studies that had a direct relationship with the neurobiology of sleep.

Sleep is a physiological process of vital importance to health. It is regulated by complex neural mechanisms[58], and has behavioral characteristics associated with it. In normal human sleep, we can distinguish between the waking state

and two sleep states; REM (Rapid Eye Movements) and NREM sleep, also called slow-wave sleep (SWA). Some features of the N1 and N2 of the NREM phase are drowsiness, brief sudden muscle twitches, physical changes, temperature decrease, disconnection of the environmental perception accompanying sleep onset and slow eye movements[59]. Recent research on eye movements in sleep and wakefulness propose new and diverse theories on the connections that can be established between eye movements and memory processes, reading comprehension and learning[60–62] as well as connections with the processing of emotional memories[62].

According to the findings, though only speculatively, it can be thought that a process similar to slow-wave sleep (or a short nap from which we can obtain some benefits such as memory consolidation, the learning process or work to combat problematic situations) is established during reflexology application. This could explain some of the changes in behavior and improvements in concentration reported by some reflexology users[4]. The neuronal bases of these correlations seem to suggest that eye movements control our view of the world and could therefore be a doorway to our minds[63].

The analysis of the data for the musculoskeletal and stress groups showed a greater presence of spontaneous movements in the musculoskeletal group than in the stress group. In parallel, the stress group showed a higher incidence of eye movements, and the presence of these movements was greater than their absence. These facts could be related to age, as the musculoskeletal group had an average well above the stress group. It could be said that, generally, older people present more musculoskeletal conditions, in comparison to younger people who can live with a higher level of stress. In our review, spontaneous and jaw movements would be more related to physical content, freeing tensions contained in the musculoskeletal system as a response to obtain postural equilib-rium and which is expressed in changes in muscle tone.

As for the study of jaw movements, Le Huquet, did some research in healthy patients during sleep, developing a method for recording the jaw position in three dimensions. The results of his studies show that the position of the jaw was significantly influenced by the different phases of sleep. Significant movements, closing and protruding of the jaw were recorded in the transition from wakefulness to phase 1 sleep ($p<0.05$)[40]. This, according to the author, suggests a simultaneous modulation of the muscle tone in the upper airway.

On the other hand, various extremely important physiological processes are closely related, or even determined by sleep[64]. Examples include the establishment or conservation of energy, elimination of free radicals accumulated during the day, the regulation or restoration of cortical electrical activity, thermal regulation, metabolic or endocrine regulation, synaptic homeostasis, immunological activation or memory consolidation among others[59].

Although the design of the present study did not make it possible to determine the degree of sleepiness that accompanied the observed manifestations, the existence of some similarities between these behaviors and certain conduct characteristics associated with the different phases of sleep, is presented as a hypothesis. According to this, the generated behavior observed during the application of reflexology and its direct relationship to its neurobiology could be considered. This would also explain the relaxation response experienced by many subjects receiving this therapy[54,55,65]. These effects can be related to NREM sleep.

In reference to BB, Tiran and Chumun state that many of these responses do not happen simply by touch, suggesting that reflexology is more significant and deeper than a simple massage effect[66]. However, given the complexity of these events or changes, and the fact that they sometimes occur synergistically[67], more research is needed as they may have a key role in the mechanisms of

action. As Tiran states, safety cannot be overlooked as an important aspect of practice. A thorough understanding of reflexology, and knowledge of both the adverse effects and benefits, are required [68]..

It could be considered that the application of sustained sedation in the temporomandibular joint, the oculomotor center, celiac plexus and the highest point of the diaphragm might have some relationship with our results. Although this relationship has not been investigated in this study, clinical experience shows that there are points with great therapeutic content.

All of this leads to the possibility of a new line of research on a possible mechanism of action of reflexology. There may have been neurophysiological action influenced by reflexology in which vision or the oculomotor center play an important role. We cannot provide answers to questions but we can replicate the study and measure BB. Given this, there are certain parameters that identify these movements such as amplitude, speed and latency among others which can be measured. The findings can serve as a guide for future research. The evaluation of these observations requires specified measurement tools such as an electroencephalogram or polysomnography, with the aim of measuring these movements, as well as indicators of sleep variables: eye movements, muscle tone, heart rate and breathing.

It may be that these BB have been observed by other practitioners who have not written about them. They may have gone unnoticed because when reflexology is applied the attention is mainly focused on the feet. Other reasons may be that the stretcher is not at an appropriate height, or there might be low light, making observation difficult. LIMITATIONS

Some limitations should be considered in the study.

As this is a descriptive study based on observation, we cannot categorize the various movements observed objectively.

Another limitation of this study is that the professionals who applied the reflexology were also the researchers. Therefore, some bias could exist. However, the data were recorded by four different trained people and some sessions were filmed, which made the observations objective to a certain degree.

In this study, the Marquartd methodology and a basic protocol with some additional contributions stemming from personal experience were applied and could have contributed to the appearance of the observed movements. However, it may be possible to obtain the same effects with standard reflexology. In addition, the conditions of the therapeutic center where the therapy was applied (private center, relaxed environment, appropriate temperature) may also have had some relationship with the movements.

Recommendations

We have several suggestions for future physical behavior studies. First, all studies should feature comparison groups. Second, it is necessary to carry out further research in the field aiming to measure these movements as well as the sleep variable indicators: electroencephalogram (EEG), eye movements, muscle tone, heart rate and breathing.

As a strong point, and to the extent of our knowledge, no other study similar to this one exists.

CONCLUSIONS

The results allow us to conclude that the application of reflexology leads to a wide range of clear secondary manifestations expressed through different physiological behaviors. In this study, four categories of body movements are described for the first time and their possible relationship with both the reason for the consultation and gender of the patient is suggested.

However, little research has been conducted on physical behaviors that can appear dur-ing the application of reflexology. This study is a first step towards researching these movements in order to better understand the effects associated with this therapy and shed light on its mechanisms of action. Reflexology therapy is not simple and providing more evidence and research on its responses and mechanisms of action is necessary to provide safe, high-quality service.

No adverse effects were observed.

ACKNOWLEDGEMENTS

The authors wish to thank all the participants who collaborated in this study, and the CRAI at Rovira i Virgili University of Tarragona. Last, we wish to thank the Faculty of Nursing at URV Tarragona for their support in promoting reflexology.

Author Disclosure Statement

There are no conflicts of interest.

References

1. McCullough JEM, Liddle SD, Sinclair M, Close C, Hughes CM. The physiological and biochemical outcomes associated with a reflexology treatment: A systematic review. *Evidence-based Complement Altern Med*. 2014;2014. doi:10.1155/2014/502123.

2. Muñoz Sellés E. Teràpies complementaries i alternatives en l'atenció al part: implantació i ús en els hospitals acreditats per a l'atenció natural al part normal i formació de les llevadores que hi donen assistència. May 2014. http://diposit.ub.edu/dspace/handle/2445/54696. Accessed July 21, 2014.

3. Bordes M. “Esto no es una mancia”. Un análisis de las formas de diagnóstico y tratamiento en las medicinas alternativas. *Ciencias Soc y Reli Sociais e Reli*. 2013;15(19):49-71.

4. Launsø L, Brendstrup E, Arnberg S. *An Exploratory Study of Reflexological Treatment for Headache*. Vol 5. 1999.

5. Hughes CM, Krirsnakriengkrai S, Kumar S, McDonough SM. The effect of reflexology on the autonomic nervous system in healthy adults: a feasibility study. *Altern Ther Health Med*. 2011;17:32-37. http://www.ncbi.nlm.nih.gov/pubmed/22164810.

6. Williamson J, White A, Hart A, Ernst E. Randomised controlled trial of reflexology for menopausal symptoms. *BJOG An Int J Obstet Gynaecol*. 2002;109:1050-1055. doi:10.1016/S1470-0328(02)01504-5.

7. Lu W-A, Chen G-Y, Kuo C-D. Foot reflexology can increase vagal modulation, decrease sympathetic modulation, and lower blood pressure in healthy subjects and patients with coronary artery disease. *Altern Ther Health Med*. 2011;17(4):8-14. http://www.ncbi.nlm.nih.gov/pubmed/22314629.

8. Gunnarsdottir TJ, Peden-McAlpine C. Effects of reflexology on fibromyalgia symptoms: A multiple case study. *Complement Ther Clin Pract*. 2010;16(3):167-172. doi:10.1016/j.ctcp.2010.01.006.

9. Li C-Y, Chen S-C, Li C-Y, Gau M-L, Huang C-M. Randomised controlled trial of the effectiveness of using foot reflexology to improve quality of sleep amongst Taiwanese postpartum women. *Midwifery*. 2011;27(2):181-186. doi:10.1016/j.midw.2009.04.005.

10. Mc Vicar AJ, Greenwood CR, Fewell F, D’Arcy V, Chandrasekharan S, Alldridge LC. Evaluation of anxiety, salivary cortisol and melatonin

secretion following reflexology treatment: A pilot study in healthy individuals. *Complement Ther Clin Pract*. 2007;13(3):137-145. doi:10.1016/j.ctcp.2006.11.001.

11. Natarajan K, Acharya U R, Alias F, Tiboleng T, Puthusserypady SK. Nonlinear analysis of EEG signals at different mental states. *Biomed Eng Online*. 2004;3:7. doi:10.1186/1475-925X-3-7.

12. Zhen LP, Nur Fatimah S, U RA, Dennis Tam K-W, Paul Joseph K. Study of heart rate variability due to reflexological stimulation. *Clin Acupunct Orient Med*. 2003;4:173-178. doi:10.1016/S1461-1449(03)00072-0.

13. Miura N, Akitsuki Y, Sekiguchi A, Kawashima R. Activity in the primary somatosensory cortex induced by reflexological stimulation is unaffected by pseudo-information: a functional magnetic resonance imaging study. *BMC Complement Altern Med*. 2013;13:114. doi:10.1186/1472-6882-13-114.

14. Tiran D, Chummun H. The physiological basis of reflexology and its use as a potential diagnostic tool. *Complement Ther Clin Pract*. 2005;11(1):58-64. doi:10.1016/j.ctnm.2004.07.007.

15. Ernst E. Is reflexology an effective intervention? A systematic review of randomised controlled trials. *Med J Aust*. 2009;191(5):263-266. http://www.ncbi.nlm.nih.gov/pubmed/19740047. Accessed March 2, 2014.

16. Ingham ED, Byers DC. *The Original Works of Eunice D. Igham: Stories the Feet Can Tell*. Saint Petersburg, Fla., U.S.A. : Ingham Pub.; 1984. http://cataleg.urv.cat/record=b1075134~S13*cat. Accessed July 28, 2015.

17. Samuel CA, Ebenezer IS. Exploratory study on the efficacy of reflexology for pain threshold and tolerance using an ice-pain experiment and sham TENS control. *Complement Ther Clin Pract*. 2013;19(2):57-62.

doi:10.1016/j.ctcp.2013.02.005.

18. Issel C. *Reflexology : Art, Science*. Sacramento, CA: New Frontier Publishing; 1996. http://cataleg.urv.cat/record=b1466178~S13*cat. Accessed June 16, 2014.

19. Marquardt H. *Manual Práctico de La Terapia de Las Zonas Reflejas de Los Pies*. Barcelona [etc.] : Urano; 2003. http://cataleg.urv.cat/record=b1197263~S13*cat. Accessed April 23, 2014.

20. Noguera Fusellas M, Solanas Noguera P, Barcena CH. *La Fuente de La Salud : Una Aproximación a La Medicina Integrativa*. Barcelona [etc.] : Paidós; 2015. http://cataleg.urv.cat/record=b1492840~S13*cat. Accessed November 7, 2015.

21. Lett A. The future of reflexology. *Complement Ther Nurs Midwifery*. 2002;8:84-90. doi:S1353-6117(01)90581-5 [pii]\r10.1054/ctnm.2001.0581.

22. Noguera M. La terapia de las zonas reflejas de l os pies en los pacientes terminales de cáncer. *Nat Medicat*. 2000;56:26-33.

23. Gunnarsdottir TJ, Jonsdottir H. Healing crisis in reflexology: Becoming worse before becoming better. *Complement Ther Clin Pract*. 2010;16:239-243. doi:10.1016/j.ctcp.2010.01.005.

24. Dougans I. *The New Reflexology: A Unique Blend of Traditional Chinese Medicine and Western Reflexology Practice for Better Health and Healing*. New York: Marlowe & Co.; 2006. http://cataleg.urv.cat/record=b1460477~S13*cat. Accessed April 24, 2014.

25. Leet A. *Reflex Zone Therapy for Health Professionals*. London: Churchill Livingstone; 2000.

26. Tiran D. Revising the rules of reflexology. In: *Clinical Reflexology: A Guide*

for Health Professionals. …. Vol Second edi. CHURCHILL LIVINSGTONE ELSEVIER; 2011:81-95.

27. Cartwright T, Torr R. Making sense of illness: the experiences of users of complementary medicine. *J Health Psychol*. 2005;10(4):559-572. doi:10.1177/1359105305053425.

28. Marquardt H. *Manual Práctico de La Terapia de Las Zonas Reflejas de Los Pies*. Barcelona : Urano; 2015. http://cataleg.urv.cat/record=b1490689~S13*cat. Accessed May 10, 2016.

29. Gunnarsdottir TJ, Peden-McAlpine C. Effects of reflexology on fibromyalgia symptoms: A multiple case study. *Complement Ther Clin Pract*. 2010;16(3):167-172. doi:10.1016/j.ctcp.2010.01.006.

30. Bagheri-Nesami M, Shorofi SA, Zargar N, Sohrabi M, Gholipour-Baradari A, Khalilian A. The effects of foot reflexology massage on anxiety in patients following coronary artery bypass graft surgery: a randomized controlled trial. *Complement Ther Clin Pract*. 2014;20(1):42-47. doi:10.1016/j.ctcp.2013.10.006.

31. Sahai IC. Reflexology--its place in modern healthcare. *Prof Nurse*. 1993;8:722-725.

32. Mackereth PA. An introduction to catharsis and the healing crisis in reflexology. *Complement Ther Nurs Midwifery*. 1999;5(3):67-74. doi:10.1016/S1353-6117(99)80017-1.

33. Jones J, Thomson P, Lauder W, Howie K, Leslie SJ. Reflexology has an acute (immediate) haemodynamic effect in healthy volunteers: a double-blind randomised controlled trial. *Complement Ther Clin Pract*. 2012;18(4):204-211. doi:10.1016/j.ctcp.2012.03.006.

34. Gunnarsdottir TJ, Jonsdottir H. Does the experimental design capture the

effects of complementary therapy? A study using reflexology for patients undergoing coronary artery bypass graft surgery. *J Clin Nurs*. 2007;16:777-785. doi:10.1111/j.1365-2702.2006.01634.x.

35. BT M. Massage therapy and reflexology awareness. *Nurs Clin North Am*. 2001;36(1):159-170.

36. Zamberlán C, Calvetti A, Reinstein de Figueiredo T, Dei Svaldi J, Heckler de Siqueira HC. Técnicas de observación y la temática calidad de vida: una revisión integrativa. *Enfermería Glob*. 2011;10(24). doi:10.4321/S1695-61412011000400021.

37. Lynch K. Good city form. *City*. 1984:524. http://www.amazon.co.uk/Good-City-Form-K-Lynch/dp/0262620464.

38. Urtúbia Vicario C. *Neurobiología de La Visión*. Barcelona : Edicions UPC; 1999. http://cataleg.urv.cat/record=b1201629~S13*cat. Accessed June 4, 2014.

39. Garcia Garcia JA. *Metodología de La Investigación Bioestadística Y Bioinformática En Ciencias Médicas Y de La Salud*. Vol Edición, 2. (Hill M, ed.). MEXICO; 2014.

40. Le Huquet A. Jaw Movement During Sleep. 2008. http://hdl.handle.net/1974/1403.

41. Vergara Núñez C, Lee M X, Mena Marusich K, et al. Efecto del aumento de la dimensión vertical oclusal en la posición natural de cabeza en pacientes portadores de prótesis removible. *Rev Clínica Periodoncia, Implantol y Rehabil Oral*. 2015;8(1):67-72. doi:10.1016/j.piro.2015.02.004.

42. Gila L, Villanueva A, Cabeza R. Fisiopatología y técnicas de registro de los movimientos oculares. *An Sist Sanit Navar*. 32:9-26. http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1137-

66272009000600002&lng=es&nrm=iso&tlng=es. Accessed May 5, 2016.

43. Paul Carrillo-Moraa, Jimena Ramírez-Perisb KM-V. Neurología del Sueño y su importancia: antología para el estudiante universitario. *Article*. 2013;56(4):11.

44. L. Gila, A. Villanueva RC. Fisiopatología y técnicas de registro de los movimientos oculares. *An Sis San Navarra*. 2009;32(3):9-26. http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1137-66272009000600002&lng=es&nrm=iso.

45. Sharpe JA, Wong AMF, Fouladvand M. Ocular motor nerve palsies: implications for diagnosis and mechanisms of repair. *Prog Brain Res*. 2008;171:59-66. doi:10.1016/S0079-6123(08)00609-2.

46. Fontes de Gracia AI. Aspectos del agrupamiento perceptual: Estímulos de Wertheimer en el modelo de la sístesis geométrica. 2003.

47. Micic D, Ehrlichman H, Chen R. Why do we move our eyes while trying to remember? The relationship between non-visual gaze patterns and memory. *Brain Cogn*. 2010;74:210-224. doi:10.1016/j.bandc.2010.07.014.

48. Ehrlichman H, Micic D, Sousa A, Zhu J. Looking for answers: Eye movements in non-visual cognitive tasks. *Brain Cogn*. 2007;64:7-20. doi:10.1016/j.bandc.2006.10.001.

49. Cabanyes Truffino J. El comportamiento fetal: una ventana al neurodesarrollo y al diagnóstico temprano. *Pediatría Atención Primaria*. 2014;16(63):e101-e110. doi:10.4321/S1139-76322014000400012.

50. Ajuriaguerra J. De los movimientos espontáneos al diálogo tónico postural y a las actividades expresivas. *Anu Psicol*. 1983;28:199-203.

51. Carrillo-Mora P. Sleep Neurobiology and its importance: Anthology for

the university student. *Rev Fac Med*. 2013;56:5-15. http://www.scielo.org.mx/scielo.php?pid=S0026-17422013000400002&script=sci_arttext.

52. Kerkhofs M, Lavie P. Frédéric Bremer 1892-1982: a pioneer in sleep research. *Sleep Med Rev*. 2000;4(5):505-514. doi:10.1053/smrv.2000.0112.

53. Joseph V. Campellone MD. Medlineplus. *Fascilulaciones musculares*. 2016. https://www.nlm.nih.gov/medlineplus/spanish/ency/article/003296.htm.

54. D.M. S, M.B. W, A. C, et al. A randomised, controlled trial of the psychological effects of reflexology in early breast cancer. *Eur J Cancer*. 2010;46(2):312-322. http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=2009656436.

55. Wright S, Courtney U, Donnelly C, Kenny T, Lavin C. Clients' perceptions of the benefits of reflexology on their quality of life. *Complement Ther Nurs Midwifery*. 2002;8(2):69-76. doi:10.1054/ctnm.2001.0593.

56. Valizadeh L, A S, Zamanazadeh, V; L KN. Comparing the effects of reflexology and footbath on sleep quality in the elderly: A controled clinical trial. *Iran Red Crescent Med J*. 2015;17(11):1-8. doi:10.5812/ircmj.20111.

57. Hughes CM, Smyth S, Lowe-Strong a S. Reflexology for the treatment of pain in people with multiple sclerosis: a double-blind randomised sham-controlled clinical trial. *Mult Scler*. 2009;15(11):1329-1338. doi:10.1177/1352458509345916.

58. Mistlberger RE. Circadian regulation of sleep in mammals: role of the suprachiasmatic nucleus. *Brain Res Brain Res Rev*. 2005;49(3):429-454. doi:10.1016/j.brainresrev.2005.01.005.

59. De Andrés I, Garzón M R-SF. Functional Anatomy of Non-REM Sleep. *Front Neurol*. 2011;2(70). doi:10.3389/fneur.2011.00070.

60. Landmann N, Kuhn M, Piosczyk H, et al. The reorganisation of memory during sleep. *Sleep Med Rev*. 2014;18(6):531-541. doi:10.1016/j.smrv.2014.03.005.

61. Diekelmann S, Wilhelm I, Born J. The whats and whens of sleep-dependent memory consolidation. *Sleep Med Rev*. 2009;13(5):309-321. doi:10.1016/j.smrv.2008.08.002.

62. Schabus M, Gruber G, Parapatics S, et al. *Sleep Spindles and Their Significance for Declarative Memory Consolidation.* Vol 27. 2004.

63. Schütz AC, Braun DI, Gegenfurtner KR. Eye movements and perception: A selective review. *J Vis*. 2011;11. doi:10.1167/11.5.9.

64. Velayos JL. *Medicina Del Sueño : Enfoque Multidisciplinario*. Madrid [etc.] : Médica Panamericana; 2009. http://cataleg.urv.cat/record=b1478985~S13*cat. Accessed May 10, 2016.

65. Kim JI, Lee MS, Kang JW, Choi DY, Ernst E. Reflexology for the symptomatic treatment of breast cancer: A systematic review. *Integr Cancer Ther*. 2010;9(4):326-330. doi:10.1177/1534735410387423.

66. Tiran D. Reflexology in pregnancy and childbirth. 2010. http://books.google.es/books?hl=ca&lr=&id=4lLlPvFkcvgC&oi=fnd&pg=PT4&dq=reflexology+and+pregnancy&ots=hGgb6rEIG0&sig=4mgKMOsrBfzh3Zn39DUAS89UGTc. Accessed February 12, 2014.

67. Mackereth P. The psychological basis for therapeutic outcomes of reflexology. In: *Clinical Reflexology: A Guide for Health Professionals. ….* Vol Second edi. CHURCHILL LIVINSGTONE ELSEVIER; 2011:15-28.

68. Tiran D. The physiological basis of reflexology. In: *Clinical Reflexology: A Guide for Health Professionals. ….* Vol second edi. Churchill Livingston; 2011:3-13.