Effect of Limb Massage and Exercises on Phantom Limb Pain among Amputee Patients

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Abstract

Phantom limb pain is experienced when the brain sends pain signals to limbs that are not there. Ongoing military conflicts, motor vehicle crashes and machinery accidents can cause traumatic injuries requiring amputation. Regardless of the cause of the injury, traumatic amputations result in a complex pain management issues. In addition, the post-amputation pain can influence patients' mobility, sleep, and overall quality of life, despite the abundance of literature on phantom limb pain; there remains no clear consensus on the mechanisms of the disorder and best method of management. ***Objective:*** *Determine the effect of limb massage and range of motion exercises on phantom limb pain among amputee patients.* ***Setting:*** *The study was carried out in Tishreen University Hospital, Lattakia, Syria.* ***Subjects:*** *The study comprised 30 adult male patients with amputee limb (upper or lower) aged 20-60 years.* ***Tools:*** *Socio-demographic and Clinical Data Structured Interview Schedule and Leeds Assessment of Neuropathic Symptoms and Signs Pain Scale (S-LANSS).* ***Results:*** *Results of the present study revealed that the implemented range of motion exercises and limb massage improved significantly the patients' phantom limb pain, whereby the mean score percent changes after exercises and massage was 26±2.35 percentage, and the LANSS mean score decreased from 14±2.569 to 10±3.288. A statistical significant relation was noted between LANSS mean score and injury site and injury duration (P=0.056, P=0.049 respectively).* ***Conclusion:*** *Range of motion exercises and limb massage improved pain level among amputee patients.* ***Recommendations:*** *Based on the results the researcher recommended incorporating non-pharmacological methods like limb range of motion exercises and residual limb massage to relieve phantom limb pain.*

Keywords: Phantom limb pain, Exercises, Massage.

Introduction

Phantom limb pain is defined as sensation of pain originating from an area of body tissue that is not physically present, it is a common phenomenon, which affects around 60-80% of limb amputees. The onset of phantom limb pain ranges from hours to decades, and the frequency of episodes vary from every few days to several times each day. The length of episodes can range from less than 1 minute to continuous. Often amputees also describe an awareness of nonpainful phantom sensations such as shooting, squeezing, tingling, throbbing, stabbing, burning, cramping and itching or pins and needles originating from the absent limb[1-3].

Phantom sensations and pain reported following amputation of different body parts including the eyes, tongue, nose, breast, bowel, and bladder but the most common occurrence is following limb amputation. Patients with phantom pain report of two peak periods of onset, the first within a month and the second a year after amputation[2,4].

The heterogeneity of phantom limb pain is widely acknowledged, and it recognized that the disorder likely arises from multiple mechanisms. Some authors have argued for mechanism-based management of pain, although others have attempted to classify amputation pain according to severity and etiology.

However, phantom limb pain remains a blanket term for pain in absent tissue, regardless of the qualities and theorized mechanisms of this pain. Nurses should obtain information about pain from the patient as part of their care plan and use the tools available in their clinical area[5-7].

The complex etiology of phantom limb pain leads to a variety of problems, including the potential for underreporting of pain in suffering patients. In a survey of 2694 military veterans, only 54% reporting phantom limb pain sought treatment from their health care provider, and only 19% of those patients were offered any treatment. A similar study conducted in England reported that only 72 of 526 phantom limb pain sufferers requested any treatment from their health care provider. In both surveys, individual patients reported being told that there was nothing their health care provider could do for their pain or that the pain should resolve on its own. Several patients stated that their health care providers avoided answering the questions or told them that the pain was only ‘‘in their head’’ These reports are not surprising, considering the lack of evidence from controlled, long-term studies with large sample sizes and adequate follow-up that show effective treatments for phantom limb pain[8-11].

Phantom limb pain related to traumatic amputations will continue to be a problem for the military health care system and international medical community as well as negatively influencing amputees’ quality of life. The disparity between what is known about the causes and treatments and current practice must be addressed to improve outcomes for patients who suffer from post-amputation pain. Health care providers must place a priority on continuing to assess pain issues throughout the continuum of care. Providers at every level of care should be informed about the multitude of treatment options that exist, and about emerging research, to ensure that patients receive the individualized pain management that they deserve[12-15].

Despite the abundance of literature on phantom limb pain, there remains no clear consensus on the mechanisms of the disorder; phantom limb pain may be attributed to genetic make-up, memories, neuroma, spinal plasticity, and cortical re-mapping. A standard treatment for the disorder remains equally elusive. Treatments range from acupuncture to deep brain stimulation and include mirror/virtual reality therapies, mental imagery, transcutaneous nerve stimulation, deep brain, motor cortex, and spinal cord stimulation, and the pharmaceutical agents such as morphine, gabapentin, amitriptyline, calcitonin, ketamine. The divergence in theories on phantom limb pain stems in part from the heterogeneity of the disorder itself[5,16,17].

The refractory nature of phantom limb pain to traditional medical and interventional therapies underscores the importance of developing complementary and alternative therapies includes psychological (guided imagery, hypnosis, biofeedback therapy), cognitive, and behavioral methods in addition to other complementary methods like acupressure acupuncture, chiropractic, massage[14].

Nurses have an important role in managing pain control because they have more contact with patients who are experiencing pain than any other healthcare professional. Using pain assessment tools improves communication and makes it easier to select the appropriate treatment. Assessment should include an evidence-based tool that is appropriate to the individual's needs and health problem and should consider the physical, psychological, social and spiritual aspects of the pain experience; they should be aware about phantom limb pain and how it can differ from other types of pain to ensure all patients receive holistic care[15,16,18]. In this study we will try to explore non-pharmacological methods effectiveness on phantom limb pain.

Aim of the Study

The aim of this study is to determine the effect of limb massage and range of motion exercises on phantom limb pain among amputee patients.

Research Hypothesis:

Patients with phantom limb pain after amputation who are exposed to limb massage and range of motion exercises will exhibit relief of phantom limb pain.

Materials and Method

Materials

Design: Quasi-experimental (pre-post test).

Setting: *The study was carried out in Tishreen University Hospital, Lattakia, Syria*.

Subjects: *A convenient sample of 30 adult male patients with amputee limb (upper or lower) their* age 20-60 years, able to move without assistance, mentally capable of understanding and performing instructions, and agree to participate in the study.

Tools:

Tool I: Socio-demographic and Clinical Data Structured Interview Schedule

It was designed by the researcher after thorough review of literature and included Socio-demographic characteristics of the patients such as age, social status, level of education, occupation. Health history: including cause, site, and intensity of injury, operation type and time, presence of other chronic diseases and physical limitation.

Tool II: Leeds Assessment of Neuropathic Symptoms and Signs Pain Scale (S-LANSS)

The LANSS is a simple and valid 7-item tool for identifying patients whose pain dominated by neuropathic mechanisms; it has been tested in a number of settings. Each item is a binary response (yes or no) to the presence of symptoms (5 items), clinical signs (2 items) with total score 25 points. It was developed by Bennett G. (2001) and its reliability and validity tested by Bennett M, and Smith B (2005)[19]. The S-LANSS has Cronbach α of 0.76 when completed unaided, rising to 0.81 when completed at interview, demonstrating a good level of internal consistency.

Method

- The official approvals from the competent authority.
- All studied patients were surveyed to identify those fulfilling the study criteria, then the researcher selected 30 patients randomly by ballot to participate in the study.
- Each patient included in the study groups interviewed individually to assess his phantom limb pain using S-LANSS tool to obtain basic data.
- The intervention: (range of motion exercise and massage sessions were executed five times daily for every patient for two weeks duration).
- Evaluation of phantom limb pain was implemented using S-LANSS tool.
- Data collection started from the 15 of March 2015 to the end of October 2015.

Ethical considerations:

Informed consent of the patients was obtained after explanation of the purpose of the study. Confidentiality and patients' privacy were assured.

Statistical Analysis

Statistical analysis performed using Stata (version 13). P value less than 0.05 considered statistically significant. A chi-square test used to study the relationship between two categorical variables. An

independent sample t-test used to compare the means of a normally distributed variable.

The Wilcoxon-Mann-Whitney test was used when the dependent variable was not normally distributed.

Results

Table (1) shows the socio-demographic characteristics of the studied patients; their age ranged from 20 to 60 years, patients aged 20-35 years constituted 53.34% of them, and the rest 33.33% and 13.33% were either 36-50 years or more than 50 years respectively.

In relation to educational level the largest percent of the study subjects 46.67% have secondary education. Patients with primary education constituted 30% and those with higher education amounted 23.33%.

Concerning the patients' occupation the table shows that soldiers constituted 63.33% of the sample and worker patients amounted 26.67%, the other types of occupation constituted 10% of studied sample.

Table (2) shows the injury characteristics of the studied patients; regarding the injury reason 60% of patients have injury because of military conflict, 26.67% of them in vehicle crashes and the machinery accidents constituted 13.33% of injury reasons.

In relation to injury site, the largest percentage of the study subjects 63.33% have lower limb injury, versus 36.67% have upper limb injury.

Concerning injury duration, the table shows that most of studied sample (46.67%) have injury from 1-3 year and 33.33 % of them have injury from less than one year, 20% for more than 3 years.

Table (3) shows the effect of exercises and massage on phantom limb pain. It appears from the table that the pain mean score of studied patients was 14±2.569 before exercise and massage implementation decreased to 10±3.288 after implementation with mean change percentage about 26±2.35%; the difference was statistically significant (P=0.024).

Table (4) shows the relation between socio-demographic characteristics and changes in pain mean score after intervention. It appears from the table that the implementation of the exercise and massage, the age of the patients was not related to their phantom limb pain after the implementation. No statistical significant relation found (P=0.264); the same thing appear that the phantom limb pain score not affected by educational level of patients (P=0.366), while the implementation of the exercise and massage, the occupation of the patients was related to their phantom limb pain. A statistical significant relation was found (P=0.054).

Table (5) shows the relation between injury characteristics and changes in pain mean score after intervention. It appears from the table that the implementation of the exercise and massage; that the injury reason not related to the phantom limb pain after the implementation no statistical significant relation found (P=0.271); while the phantom limb pain was related to the injury site and injury duration, a statistical significant relation found (P=0.056), (P=0.049) respectively.

Discussion

It is generally recognized that in amputee rehabilitation, a multidisciplinary health team approach is required in order to address the individual's diverse needs. In today's medical and rehabilitation practice, that team usually consists of a medical doctor, nurse, physical therapist, occupational therapist and psychological support[20,21].

Recently we have learned much about the pathophysiology and management of phantom limb pain since it first described about five centuries ago. However, there is still no one unifying theory relative to the

mechanism of it. Specific mechanism-based treatments are still evolving, and most treatments are based on recommendations for neuropathic pain. The evolution of the mechanistic hypothesis from body schema and neuropathic theories to the recently proposed role of mirror neurons in the mechanism of pain have added to our understanding of it[22-24].

Results of the present study revealed that the implemented range of motion exercises and massage improved significantly the patients' phantom limb pain. This improvement may attributed to the fixed schedule of the exercise program which motivated patients and changed upper, lower neurological signals sent to the pain center in patients' brain or pain threshold elevated with repetition of stimulation. Whereby the mean score percent after exercises, massage enhanced and the LANSS mean score decreased. This results supported by Ulger O (2009) and Tseng C (2007). They said in their studies; that after the exercises, the subjects felt less phantom limb pain due to the relaxation of the phantom limb. This indicates that exercises that alter muscle tension and position in the residual limb can influence the intensity of phantom pain[25,26].

Often, amputees will experience pain symptoms in areas that are not directly associated with the amputation. These structures, referred to as compensatory structures, are the muscles and joints; that are required to perform new and/or additional functions due to the limitation or inability to perform them with the amputated limb. Such factors will further limit the amputees' functional abilities and should addressed early in order to prevent or relieve them; development of contractures in joints above the site of the amputations is a frequent occurrence[6,7,27].

As contractures result in lost range of motion of the affected joint, reduction and prevention of contractures is very important in order to avoid complications such as poor prosthetic fit, gait deviations, inability to ambulate with a prosthetic all together, and development of pain in the effected muscles and joints. Thus, range of motion exercises can play an important role to improve patient capabilities and decrease phantom limb pain. In addition to its restrictive characteristics, scar tissue can have negative effect on the neighbouring tissues, resulting in stiffness, pain and limited range of motion. Furthermore, itching and sensitivity of scar tissue is very common, which besides being unpleasant, can reduce the amount of time a prosthetic tolerated (if it fits over the scar area) or reduced the range of motion of affected joints. Positive out-comes of scar tissue massage result in reduced tightness, stiffness, pain, itching, an increase in the range of motion of affected and surrounding joints and an overall improvement in movement quality[25-27].

According to Munk N (2015) and Carrelli B (2015) who emphasized in their studies that the massage therapy recognized for its effect of increasing circulation, systemically and locally[28,29]. Good blood flow and appropriate tissue profusion is very important since it is the source of nutrients and waste elimination to and from all tissues. Many amputees report poor circulation of the affected limb, which results in a cold, and often time's painful residual limb. Winter can be a particularly difficult time as the cold weather reduces peripheral blood flow. Many amputees report it takes a number of hours, if at all, for the residual limb to return to a "normal" temperature and the burning pain to subside. Massage therapy and range of motion exercises can have a short-term or long-term effect in providing relief from the above symptoms. It is important to stress that relief for even a short period can have a very positive effect psychologically[29,30].

Werner R (2014) in his study reported that the massage is effective at many levels of pain tissue level, cognitive level, and nerve level (pain gate)[30]. It is frequently sighted in rehabilitation textbooks for amputees that non-invasive techniques such

as massage therapy increases sensory input from periphery (the limb) that may over-ride the brains perception of pain, which may provide temporary or partial relief of the phantom pain. Massage treatment may consistent of applying massage directly to the amputated end (the stump), to the muscle and soft tissues above the amputated area (the residual limb) or to soft tissues at the proximal end of the effected limb. A more general massage approach may be appropriate as well, with the goal being to reduce stress and anxiety that are recognized as increasing the intensity or frequency of pain[30].

In addition, present study results revealed that a statistical significant relation between patients' occupation and pain mean score after massage and exercises was found. whereby the soldiers' mean score was better than other occupations after exercises and massage, this improvement may be due to the solider desire to heal quickly and most of soldiers were young or may they are more able to tolerate pain; while no significant relation with age and level of education was found.

Moreover, a statistical significant relation was noted between injury site and injury duration; this result may be related to that the lower limb pain mean score was more than upper before implementation, while the intensity of injury was more dangerous in lower limb. Duration of injury may affect the patient adaptation with pain this may lead to existence of more difference between patients who have the amputation recently and have phantom limb pain.

Conclusion

It can be concluded from the study that the limb massage and range of motion exercises improved significantly patients' phantom limb pain intensity.

Recommendations

- Incorporating range of motion exercise and limb massage into a pain management program is highly recommended due to the direct benefit in treatment of soft tissue dysfunction and circulatory problems.
- Also, it is highly recommended that an amputee receive limb massage in conjunction with the beginning prosthetic training and ongoing prosthetic use in order to prevent muscle strain, tightness and related pain symptoms that may develop due to the alterations in posture and biomechanics.

Table (1): Distribution of the patients according to their socio-demographic characteristics

Socio-demographic Characteristics	No (n=30)	%
Age (in years)		
▪ 20 -	16	53.34
▪ 36 -	10	33.33
▪ 51 > 60	4	13.33
Level of education		
▪ Up to primary	9	30
▪ Secondary	14	46.67
▪ Higher education	7	23.33
Occupation		
▪ Soldier	19	63.33
▪ Worker	8	26.67
▪ Other	3	10

Table (2): Distribution of the studied patients according to their injury characteristics

Injury Characteristics	No (n=30)	%
Injury reason		
▪ Military conflict	18	60
▪ Vehicle crashes	8	26.67
▪ Machinery accidents	4	13.33
Injury site		
▪ Lower limb	19	63.33
▪ Upper limb	11	36.67
Injury duration		
▪ Less than 1 year	10	33.33
▪ 1-3 years	14	46.67
▪ More than 3 years	6	20

Table (3): Effect of (ROM exercises, Massage) on phantom pain (LANSS) mean score

	Pain/LANSS Mean score (Before)	Pain/LANSS Mean score (After)	Mean percent change	*Significance*
T. mean score 25	14±2.569	10±3.288	26±2.35%	*P=0.024**

*Significant value at P≤0.05

Table (4): Relation between socio-demographic characteristics and changes in pain mean score after intervention

Socio-demographic Characteristics	Pain/LANSS Mean score (Before)	Pain/LANSS Mean score (After)	*Significance*
Age (in years)			
▪ 20-	14±2.574	9±1.988	
▪ 36-	15±3.223	9±1.559	*P= 0.264*
▪ 51-	13±3.215	10±3.236	
Level of education			
▪ Preparatory	14±2.569	11±1.265	
▪ Secondary	16±3.265	12±2.445	*P=0.366*
▪ Higher education	14±3.216	10±3.336	
Occupation			
▪ Soldier	17±2.523	10±3.228	
▪ Worker	13±3.465	10±2.549	*P=0.054**
▪ Other	15±3.618	11±1.586	

*Significant value at P≤ 0.05

Table (5): Relation between injury characteristics and changes in pain mean score after intervention

Injury Characteristics	Pain/LANSS Mean score (Before)	Pain/LANSS Mean score (After)	*Significance*
Injury reason			
▪ Military conflict	18±2.569	11±1.244	
▪ Vehicle crashes	15±3.265	10±2.511	*P=0.271*
▪ Machinery accidents	14±3.216	10±3.266	
Injury site			
▪ Lower limb	19±2.569	10±3.271	*P=0.056**
▪ Upper limb	14±3.265	11±2.559	
Injury duration			
▪ Less than 1 year	15±2.569	9±2.188	
▪ 1-3 years	13±3.265	10±3.229	*P=0.049**
▪ More than 3 year	12±3.216	11±3.236	

*Significant value at P≤ 0.05

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