

Phantom Fighters: Coping Mechanisms of Amputee Patients with Phantom Limb Pain: A Longitudinal Study

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ABSTRACT

Phantom Limb Pain (PLP) is a phenomenon commonly observed in orthopedic rehabilitation units that can have detrimental effects on patients' functioning. Psychological aspects of PLP have been widely investigated showing that some coping mechanisms are advantageous at certain points but not at others. However, the mechanisms related to positive adjustment to PLP during the course of rehabilitation have not been adequately examined. The aim of the study was to investigate the relationship between PLP and coping mechanism at two points during the rehabilitation process. Thirty one orthopedic inpatients, who had undergone lower-limb amputation following diabetic complications, rated their pain levels and mental coping strategies. The Ways of Coping Checklist, Life Orientation Test, and the McGill Pain Questionnaire, 1 - 15 days post-surgery and six months post-surgery were used for evaluation. Denial was found to be negatively correlated with PLP shortly after amputation. In contrast, optimism was found to be negatively correlated with PLP six months after the surgery. Emotion-focused coping mechanisms were found to be positively correlated with PLP. It is concluded that denial during the early stages of recuperation and optimism at later stages of rehabilitation is associated with reduced PLP. Awareness of these mental processes by both medical staff and family members may enable acceptance of these processes and thus facilitate patients' rehabilitation.

Keywords: Phantom Limb Pain; Mental Coping Mechanisms; Denial; Optimism

1. Introduction

Phantom Limb Pain (PLP) refers to painful sensations in an amputated or denervated part of the body [1]. These painful sensations are reported by 50% - 85% of limb amputees beginning a short period after the procedure, with the reported episodes ranging from a minimum of several weeks per year to daily occurrences [2-4].

PLP is a challenge to caregivers and researchers in multi-disciplinary fields, and is sometimes detrimental to the sufferers. The occurrence of PLP can substantially disrupt the rehabilitation process, and can have serious consequences for the health and functioning of the patient [5]. These consequences might be physical, emotional or functional [5-12].

The perception of the etiology of PLP has changed substantially over time. Initially, PLP was perceived as

primarily psychological, however later, physiological explanations were proposed to explain the source of the phenomenon [12,13]. Current views maintain that an integrative bio-psycho-social approach is mandatory in order to better understand PLP [4].

Research on psychological factors related to PLP adjustment revealed positive correlations between pain and various psychiatric disorders, such as: depression, anxiety, stress, post-traumatic stress disorder, which may increase pain sensation. Cognitions have also been studied and catastrophizing was associated with pain. However, perceived control was found to be negatively correlated with pain sensations [4,11,15-21].

Various coping mechanisms help amputee patients deal with pain [22]. Moreover, coping styles were found to be important predictors of psychosocial adjustment. For example, the psychosocial functioning of adults with acquired limb amputations was shown to be significantly

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related to the use of coping strategies [23]. Folkman and Lazarus [24] identified two main coping mechanisms: emotion-focused coping and problem-focused coping. According to this model, coping refers to the cognitive, emotional, and behavioral efforts aimed at keeping a balance between the person and the environment. Coping has two main functions: to regulate distress (emotion-focused coping) and to take actions to change and improve the situation (problem-focused coping). Problem-focused coping is related to a special form of emotion-focused coping, namely, “emphasizing the positive” which facilitates problem-focused coping [24]. Studies have shown emotion-focused coping to be associated with poor psychosocial outcomes [25-27].

Optimism (defined as a generalized expectation that future outcomes will be positive) was also found to be correlated with coping in patients with amputation [28,29]. Dunn [30] showed that having an optimistic disposition was associated with lower levels of depression and higher levels of self-esteem during the rehabilitation process after lower-limb amputation. Horgan and MacLachlan [31] demonstrated that respondents with high levels of optimism were more likely to search for positive meanings for their amputations. Furthermore, additional research showed a correlation between optimism and good rehabilitation outcomes [32,33].

A broadly acknowledged coping mechanism specifically found to be a common defense mechanism in the etiology of PLP is denial, that is, the refusal to believe that the stressor exists or the attempt to act as though the stressor is not real [34]. People who experience the loss of a limb have been shown to go through the five stages of grief also experienced by people who are dying: denial, anger, bargaining, depression, and acceptance [8,35]. Research shows that denial of the implications of an amputation (as a type of emotion-focused coping) is a positive short-term coping style following amputation [36]. However, in the long term, denial is associated with higher levels of depression and hostility and poor adjustment [37,38,19].

While coping mechanisms and psychosocial adjustment in amputees have been studied, little is known about the psychological processes associated with PLP reduction during rehabilitation of lower-limb loss. Elaborating on the psychological aspects of this phenomenon may add an additional perspective to caregivers’ understanding of coping with PLP.

Therefore, the aim of this study was to examine the correlation between coping mechanisms adopted by patients and PLP at two different points in time, following lower-limb amputation: a few days after the procedure, and six months later: a point in time when stump pain should have been resolved and when PLP would be deemed to be chronic [2], indicating a different stage in

coping with pain.

We hypothesize that the coping mechanisms for pain management that are more prevalent a few days after surgery (such as denial and other emotion-focused strategies) would be negatively correlated with pain sensations [37]. However, these same coping mechanisms would be positively correlated with PLP six months later.

2. Methods

2.1. Ethics Statement

All participants received written and oral instructions of the research aims and procedures and gave informed written consent. This study was approved by the local ethic committee of Sheba Medical Center and Bar-Ilan University and performed in accordance with the Declaration of Helsinki.

2.2. Participants

The study sample consisted of 31 lower-limb amputee patients suffering from diabetes (28 men and 3 women) who were hospitalized in the orthopedic department of the Sheba Medical Center. All patients with reported PLP (as opposed to those reported as having stump pain or phantom sensations), as detailed in their medical records were enrolled in the study. No patients approached were subsequently excluded from the study. Of the participants, 21 were below-knee amputees, 4 were above-the-knee amputees, and 6 were foot amputees. The selection criteria for the group were as follows: 1. Patients who suffered from diabetes and had above- or below-knee amputation surgery; 2. Patients who experienced phantom limb pain; 3. Patients for whom a maximum of fifteen days had elapsed since the operation; and 4. Patients with no chronic pain complaints other than those associated with the amputation.

The use of drugs, including painkillers, major and minor tranquilizers, and muscle relaxants was prevalent, with 71% of the patients reporting drug use. **Table 1** provides a demographic breakdown of the sample.

Table 1. Demographic and clinical data of the patients (n = 31).

	Maximum	Minimum	Mean (SD)
Age (years)	55 (7.12)	75	45
Education (years)	11.34 (3.12)	17	5
Time since amputation (days)	9.29 (3.23)	15	4
Present Pain Intensity indices			
At present	1.64 (0.52)	5	1
Minimum level	1.29 (0.52)	3	1
Maximum level	4.03 (1.01)	5	2

2.3. Instruments

The Ways of Coping Checklist (WOCC) is a measure that operationalizes and quantifies coping capabilities [24]. This checklist was administered in its translated and validated Hebrew version [39,40]. The instrument is a 42-item measure, utilizing a 5-point scale format, with responses ranging from 0 (not appropriate) to 4 (regularly used). The scores of the WOCC are produced by calculating the means of the responses.

The questionnaire consists of four subscales: a problem-focused coping strategy (PF; e.g., "I planned a course of action and followed it"), an emotion-focused coping strategy (EF; e.g., "I wish I had the ability to change the way I feel"), a seeking-social-support coping strategy (SSS; e.g., "I accept sympathy and understanding from others"), and denial (e.g., "I tried to forget the whole thing") [40]. A high score on a specific subscale indicates greater use of the coping strategy measured by the subscale. The internal reliability of the WOCC was tested using Cronbach's alpha coefficient; the coefficient confirmed satisfactory internal reliability of the subscales (PF = 0.88, EF = 0.82, SSS = 0.86, denial = 0.74).

The Life Orientation Test (LOT) measures generalized optimism [28]; that is, it tests individuals' sense of the probability that hopeful expectations will indeed materialize. The Hebrew version of the questionnaire was administered to the patients [41]. The LOT scale is comprised of twelve items: four positive items (e.g., "I am always optimistic about the future"), four negative items (e.g., "Things never work out the way I want them to"), and four distracters (e.g., "I find it important to keep busy"). The LOT is rated on a 4-point scale ranging from 1 (I agree very much) to 4 (I disagree very much). A high score on this scale indicates a high level of optimism.

The McGill Pain Questionnaire (MPQ), compiled by Melzack [42], was used in its validated Hebrew translation form [43-45]. The MPQ assesses qualitative components of pain and differentiates among different aspects of pain. Although the scale is made up of four parts, we made use of the Present Pain Intensity (PPI) scale, which consists of six items, rated from 1 (mild) to 5 (excruciating). When presented with this questionnaire, respondents were asked to rate how well a statement matches their PLP sensation at present, at its minimum level, at its maximum level, and when experiencing other types of pain (toothache, headache, and stomachache). We used the values of the three initial items.

2.4. Procedure

Personal data on the patients were obtained from their medical records. Patients who met inclusion criteria were approached in their room a few days after the amputation procedure. The researcher introduced himself and explained the research and its goals while emphasizing the

two-stage procedure. If the patient agreed to proceed, he or she was given the informed consent form and, after signing, was asked to complete the questionnaire. Six months later, the patients were contacted via telephone and the questionnaires were re-administered.

2.5. Analytic Strategy

All analyses were conducted using SPSS (SPSS-15 Inc., Chicago, Illinois). One-way analysis of variance (ANOVA) was used to compare WOCC indices of patients in the hospitalization stage, followed by Tukey post-hoc test. In order to test the correlation between the mental variables and Present Pain Intensity in both time periods, Pearson correlation coefficient was employed. Significance was set at $\alpha < 0.05$.

3. Results

Comparison of WOCC indices in the hospitalization phase, revealed a significant difference between the different indices shortly after the amputation procedure ($F(3,28) = 91.69, p < 0.001$). Tukey post hoc test revealed that denial of life-long implications of the surgery was the most commonly employed coping mechanism, whereas seeking social support was the least common (see **Table 2** for the data).

Table 3 presents correlation coefficients between optimism and coping abilities, and Present Pain Intensity at the first administration and at the second phase of the study. That is, the scores on the same questionnaires re-

Table 2. Means (standard deviations) and ranges of the WOCC (n = 31).

Variable	Mean (SD)	Minimum	Maximum
Problem-focused	2.59 (0.57)	1.5	3.7
Emotion-focused	2.57 (0.55)	1.4	3.5
Seeking social support	2.52 (0.64)	1.3	3.7
Denial	2.65 (0.79)	1.2	4

Table 3. Pearson correlations between scores on the WOCC, LOT, and PPI indices of recently amputated respondents (n=31).

	At present	In hospitalization Minimum Level	Maximum Level	Six months At present
Optimism	-0.02	-0.06	-0.19	-0.44*
Problem-focused	0	-0.05	0	0.01
Emotion-focused	0.01	-0.02	0.23	0.45*
Seeking social support	0.22	0.09	0.2	0.03
Denial	-0.31*	-0.25	0.17	0.33

* $p < 0.05$.

administered six months after amputation.

4. Discussion

The current study examined the mental coping mechanisms that are associated with PLP at two points in time. In the first stage, a few days post-amputation, the most employed defense mechanism reported by PLP patients, was denial, whereas seeking social support was the least employed. In addition, we found denial to be negatively correlated with PLP a few days after the operation, while six months after surgery, optimism was found to be negatively correlated with PLP. Finally, a positive correlation was found between emotion-focused mechanisms and PLP at six months post surgery, showing that this mechanism is associated with PLP a considerable period of time following the surgical intervention.

Our results complement findings by Pucher *et al.* [1] who concluded that patients' coping strategies affect their experience of pain, denial, in particular, was found to be associated with less reported pain in the initial phase of trauma following surgery [36,37]. By disregarding the implications of the disability, denial may enable other mental resources to surface in order to cope with the physical aspects of the amputation. Hence, denial aids in focusing on regaining bodily capabilities [46]. The correlation between denial and lower pain levels demonstrates the tendencies of patients post lower limb amputation to "favor" this self focused coping mechanism over the interpersonal coping mechanism "seeking social support".

Furthermore, studies have shown that consistent use of emotion-focused coping mechanisms is associated with depression in lower limb amputation patients, while for example, denial, long after the surgery might also eventually result in high levels of depression and hostility [47,36]. Our results add to this, by showing that use of emotion-focused coping mechanisms in general, six months after surgery is correlated with higher phantom limb pain sensation, indicating that this strategy is negatively associated with some aspects of rehabilitation.

On the other hand, it appears that adopting an optimistic view six months post amputation is associated with low levels of PLP. Optimism may instill meaning in the amputation, providing one with a greater sense of control over the event, as well as over the resulting disability [30,31].

This study has several limitations. Although there are numerous coping mechanisms and emotional constructs that most likely influence coping with PLP, we chose to explore a number of specific ones. Had we included additional constructs, we may have obtained a broader and clearer picture of the factors associated with this phenomenon. In addition, our sample included patients with lower-limb amputations at various sites, constituting a

diverse population. More homogenous samples in terms of the physical location of the amputation may aid in further clarifying interactions between coping mechanisms and PLP.

Furthermore, future studies should examine other aspects associated with lower-limb PLP to expand our grasp of this phenomenon, and should focus on patients who have undergone upper-limb amputation as well. The work presented here focuses on the psychological domain in relation to pain prediction. However, in light of the need for a comprehensive perspective, future researchers should study the interaction of physical, social, and psychological variables together on long-term post-amputation PLP.

In conclusion, from a psychological standpoint, those who deny the consequences of the amputation shortly after it has occurred may suffer less from PLP. Moreover, optimism is also associated with lower PLP six months after surgery, whereas emotion-focused coping mechanisms are associated with higher levels of PLP. In consequence, it seems that the relation between PLP and coping mechanisms indicates the six months post-amputation as a relevant time frame for rehabilitation which patients and caregivers of which caregivers should be aware.

The implications of this study lie in the importance of understanding the underlying mental processes experienced by patients shortly and six months after surgery. Caregivers such as physicians, rehabilitative therapists, and family members can be educated regarding these mental processes and the emotional manifestations they should expect to see in patients following amputation. They can then be directed to be accepting of coping mechanisms positively associated with rehabilitation such as denial of disability in early stages of rehabilitation, allowing patients to utilize this coping mechanism at that point in time.

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