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Psychological Adjustment and Coping in Adults With Prosthetic Limbs

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The potential mediating effects of different coping strategies on the adjustment to living with a prosthetic limb were investigated in 44 adult amputees. Participants completed a questionnaire inquiring about coping, pain, emotional well-being, demographics, and disability-related variables. The coping strategy adopted and the extent of the adjustment to the prosthetic limb varied with age, site of limb loss, and cause of amputation. Furthermore, coping style mediated the adjustment to wearing a prosthetic limb. The results are discussed in terms of future applications and research.

Index Terms: *adjustment, amputation, coping, prosthesis*

The fitting of a prosthetic limb confronts patients with the irrevocable fact that they have lost a limb, must now adjust to wearing a prosthesis, and must learn to be proficient in its use. Thus, amputees have to make permanent behavioral, social, and emotional adjustments to cope with the multiple problems engendered by amputation. However, although people with physical disabilities as a group have been found to be at risk for psychological and social adjustment problems,[1] relatively little attention has been paid to amputees as a specific subgroup of disabled persons in terms of describing their adjustment to physical illness and disability and to the specific factors that increase risk.[2]

As amputees begin to regain strength and develop some security in coping on a physical level, their focus shifts to learning how to survive emotionally with limb loss.[3] Not only have they sustained a loss in ability and function but they have also sustained a loss to their psychological being. It is widely recognized that amputees frequently manifest a pattern of emotional reaction involving shock, denial, grief, anxiety, depression, and, eventually, adjustment.[4–8] Rates of clinical depression detected in outpatient settings have been found to range from 21% to 35% in four studies employing standardized self-report measures.[2, 9–11] Reactions of anxiety and grief among people with amputations have also been reported.[12–16]

Physical factors involved in adjustment include the prosthesis itself and accompanying medical issues. Patients who express dissatisfaction with their prostheses may be doing so as a form of denial or as an excuse for an inability to cope with the prosthesis.[17,18] Ham and Cotton[19] found that the less trouble the patient experiences with the prosthesis, the fewer emotional problems will be exhibited and the better social integration will be. Prolonged pain can impair general functioning, ability to work, social relationships, and emotional adjustments. Therefore, it is apparent that an important factor molding the amputation experience is pain. Pain specific to amputation refers to phantom limb pain (PLP), which is defined as pain in the phantom limb. The phantom limb refers to the sensation of the presence of an amputated limb.[20] This is distinguished from stump pain, which is pain at the site of an extremity amputation. Phantom limb pain and stump have been found to vary in intensity from mild to debilitating.[21,22] Furthermore, the pain has been found to vary in duration from seconds to constant.[22,23] Lindesay[24] compared a group of amputees complaining of long-standing PLP with a group of noncomplainers and found that those with PLP had more complaints of other painful conditions, both related and unrelated to the amputation; they

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were also more depressed. Parkes[25] found that individuals suffering from PLP tended to develop greater degrees of despair and withdrawal than those who do not. Carabelli and Kellerman[26] found that the experience of PLP interfered with prosthetic training. Thus, the phantom limb is an expected healthy psychophysical response because individuals who are experiencing it also experience enhanced proprioceptive feedback that aids them in learning to walk.[27] However, PLP is an unwanted response to amputation that presents a major obstacle to successful rehabilitation and impedes adjustment to an artificial limb. Pain in the amputation stump also contributes to the distress of the amputee because the discomfort it induces can prevent the use of a prosthesis. Sriwatanakul and associates[28] demonstrated that the experience of stump pain is related to the amount of depression or anxiety that the person is experiencing. McCrae[29] emphasized the importance of considering the other effects of illness or injury that gave rise to the amputation because concomitant disease processes may exacerbate the maladaptive psychological impact of amputation and limit functional restoration and the return to an active lifestyle.[3,30,31] Only significant effects are reported here.

The adjustment to wearing a prosthesis can also vary depending on demographic variables—age and gender—and disability-related variables—length of time with the prosthesis and site and cause of amputation. For example, among young adults, the response to limb loss depends on its cause and the degree of disability and disfigurement resulting from it. For them, the greatest challenges are in terms of identity and social acceptance.[32] For the older patient, ill health, less psychological resilience, social isolation, and financial limitations can conspire to complicate the adjustment to the artificial limb.[33] Most women are concerned with creating an illusion of an intact body surface, whereas most men are concerned with the effective restoration of function.[34] As a working instrument, the functional efficiency of an artificial leg is greater than that of an artificial arm and is therefore more readily accepted as a substitute limb. Furthermore, an upper limb prosthesis is more noticeable and socially less acceptable.[19] In addition to the site of amputation, the ways in which limbs are lost may affect adjustment. Individuals who undergo an elective amputation fare better in the postsurgical period than those who suddenly lose a limb as a result of an accident.[19] Finally, increased time since amputation has been found to be associated with improved quality of life and less anxiety and depression.[35]

The considerable variability in people's adjustment to their prosthesis has resulted in a search for potential mediating factors. In the case of amputees, the process of adjustment to a prosthesis is crucial because patients who abandon their prostheses, repeatedly saying that they do not fit, will continue to abandon them; consequently, there is no point in prescribing another prosthesis for these individuals.[19] A potential mediator of the psychological adjustment to amputation and acquiring of an a artificial limb is the coping strategy employed. As Cohen and Lazarus[36(p218)] have noted "adjustment to an illness or injury which is life-threatening and potentially disabling may require considerable coping effort." The reason for studying coping strategies is to understand why people differ so greatly in their responses to the same significant life events and how differing responses relate to overall well-being.[37] The outcome or effects of coping can lead to changes in psychological well-being, somatic health, and social functioning.[38–41] Research on physical disability indicates that coping strategies may play a significant role in predicting adjustment.[42–46] In the case of the specific disability of amputation, one study undertaken by Hill and associates[47] sought to investigate the relationships among the use of coping modes and psychosocial adaptation among amputees experiencing phantom limb pain. Their results indicated that the coping strategy of catastrophizing explained the greatest amount of variance in both physical and psychosocial dysfunction.

Recent research, both in general physical disability and more specifically in the amputee literature, appears to indicate that coping may play an important role in the adjustment process. Consequently, we set out to explore the relation between adjustment to a prosthetic limb (emotional well-being, the acceptance and physical comfort of a prosthesis, and the pain experienced that is subdivided into phantom limb pain, stump pain, and other pain), demographics (age and gender), disability-related variables (length of time with a prosthesis, cause of amputation, and site of limb loss), and coping. On the basis of the above review of the relevant literature we hypothesized that (a) the use of coping strategies would vary across the demographic and disability-related variables; (b) the adjustment factors would vary across the demographic and disability-related variables; (c) as coping strategies influence psychological outcome, they would act as mediators in the individual's psychological adjustment to a prosthesis.

METHOD

Procedure

Two hundred patients who had received artificial limbs from the Limb Fitting Centre in the National Rehabilitation Hospital in Dublin, Ireland, who were more than 18 years of age were selected at random from records and sent a self-administered questionnaire. A covering letter requesting voluntary and anonymous participation from the patient and

a stamped-addressed envelope were also included. At the request of the clinic, we sent no follow-up reminders. This was to avoid placing unwanted pressure on the clinic's patients.

Questionnaires

The Coping Strategy Indicator (CSI)[48] is a self-report measure that contains three scales (Problem Solving, Seeking Social Support, and Avoidance), each scale consisting of 11 items. Participants are asked to describe a stressful event. Adjusting to an artificial limb was specified as the event in this study because it was the focus of the research. The extent to which the participants use the different coping strategies is indicated by means of a 3-point scale: *a lot* (3), *a little* (2), or *not at all* (1). Cronbach's alpha coefficient indicated high internal reliability for all Coping Strategy Indicator scales: .928 for Seeking Social Support, .894 for Problem Solving, and .839 for Avoidance.[48] Test-retest reliability, using Pearson coefficients for the Problem Solving Scale, was .83, for Seeking Social Support .86, and for Avoidance .82.[48]

The General Health Questionnaire (GHQ-12)[49] is the 12-item shortened version of the GHQ-60[50] designed to detect nonpsychotic psychiatric disorder in people in community and medical settings. Cronbach's alpha reliability ranges from .82 to .90.[51] Each of the 12 items in the questionnaire asks whether respondents have experienced a particular symptom or behavior recently, using a 4-point scale: *less than usual* (0), *no more than usual* (1), *rather more than usual* (2), or *much more than usual* (3).

The Pain questionnaire asks respondents to indicate the location of their current pain. For this study, the experience of PLP or stump pain is distinguished from other types of pain experienced. The experience of each type of pain was allocated a value of 1 if experienced and of 0 if not experienced.

The Demographic and Disability-Related Questionnaire sought information on the length of time since acquiring the prosthesis, site of limb loss, and the acceptance of and physical comfort of the prosthesis. The latter two were measured on a 5-point scale. We also sought information on the cause of the amputation, which we categorized into trauma (accident), disease (cancer, vascular disease, or diabetes), or congenital. Finally, participants were asked to indicate on a body diagram the area and extent of their amputation or amputations.

Sample

Of the 200 potential respondents, 34 were excluded as a result of death or change of address. Consequently, of a potential sample of 166 people, 44 responded (26.51% response rate). Thus, 44 people (20 women and 24 men) participated in the study. The mean age of the individuals in the sample was 53.47 years (SD = 20.94), with a range from 20 to 83 years. There were 13 (30%) above-knee amputees, 15 (34%) below-knee amputees, 10 (23%) below-elbow amputees, and 5 (11%) bilateral lower-limb amputees. Nineteen (43%) cases resulted from trauma, 19 (43%) from disease, and 6 (14%) from congenital causes. The mean length of time the individuals in the sample had had an artificial limb was 118.74 months (SD = 160.62), ranging from 2 to 720 months.

RESULTS

Coping Strategies and Demographic and Disability-Related Variables

We conducted three separate multiple analyses of variance (MANOVAs) to determine whether there were significant differences in the extent to which Avoidance, Seeking Social Support, or Problem Solving were adopted as coping strategies across gender, cause of amputation (trauma, disease, and congenital), and site of limb loss (above knee, below knee, below elbow, and bilateral lower limb). We employed correlations to investigate the relationships among the coping strategies, age, and length of time with a prosthesis. Only significant effects are reported here.

Cause of Amputation

Cause of amputation significantly affected the differences in Avoidance scores, $F(2, 41) = 5.72$, $p < .01$. In investigating the Bonferroni post hoc tests, we found a significant difference ($p < .01$) in the means of Avoidance scores for those who acquired their prostheses as a result of disease (M = 18.26, SD = 3.26) and trauma (M = 21.32, SD = 3.40). Furthermore, there was a significant difference ($p < .05$) in the means of Avoidance scores for those whose prosthesis resulted from congenital causes (M = 17.33, SD = 2.42) and trauma (M = 21.32, SD = 3.40). Thus, amputees whose prosthesis resulted from trauma used avoidance as a coping strategy to a greater extent than did amputees whose prosthesis resulted from either disease or congenital causes.

Adjustment and Demographic and Disability-Related Variables

We conducted three separate MANOVAs to determine whether there were significant differences in the means of the adjustment factors (emotional well-being, the acceptance and physical comfort of a prosthesis, and the pain experienced—PLP, stump pain, and other pain) across gender, site of amputation, and cause of amputation.

Cause of Amputation

The only adjustment factor that differed significantly by cause of amputation was the presence of stump pain, $F(2, 4) = 3.6$, $p < .05$. In investigating the Bonferroni post hoc tests, we found a significant difference ($p < .01$) in the experience of stump pain for those who acquired their prostheses as a result of disease (no occurrence) and trauma ($M = .263$, $SD = .452$). Thus, amputees whose prosthesis resulted from trauma experienced stump pain to a greater extent than amputees whose prosthesis resulted from disease.

Site of Limb Loss

Adjustment factors with means that differed significantly according to the site of limb loss were acceptance and stump pain. We found that individuals with different sites of amputation did not experience the same amount of stump pain, $F(3, 40) = 3.9$, $p < .02$. It appears that above-knee amputees ($M = 0.39$, $SD = 0.51$) experience stump pain to a greater extent than below-knee amputees ($M = 0.07$, $SD = 0.29$).

Site of amputation also significantly affected the differences in Acceptance scores, $F(3, 40) = 2.90$, $p < .05$. Bonferroni post hoc tests indicated a significant difference ($p < .01$) in the means of Acceptance scores for an above-knee amputee ($M = 1.47$, $SD = 1.13$) and a below-knee amputee ($M = 3.08$, $SD = 1.61$).

Strategies for Coping and Adjusting and Demographic and Disability-Related Variables

Finally, we performed a MANCOVA to examine whether the adjustment factors as a group would differ significantly among the various coping strategies, having covaried the demographic and disability-related variables. We subdivided each coping strategy score into above-median (coded as 1) and below-median (coded as 0) scores. This removed the assumption of linearity and allowed potential interaction effects between the coping strategies to emerge.

Although the adjustment factors as a group did not significantly differ between the coping strategies after controlling for age, gender, cause of amputation, site of limb loss, and length of time with the prosthesis, an examination of the univariate F tests revealed that the amount of stump pain experienced differed significantly, depending on the coping strategies adopted, $F(5, 27) = 4.08$, $p < .01$. Stump pain was experienced significantly more by those respondents who were below the median than those above the median for Seeking Social Support, $F(1, 27) = 4.45$, $p < .05$, and by those who were above, rather than below, the median on Avoidance, $F(1, 27) = 7.25$, $p < .01$. Furthermore, emotional distress was significantly higher for those who had above-median scores than for those with below-median scores on Avoidance, $F(1, 27) = 4.41$, $p < .05$.

In terms of interaction effects, we found that the amount of stump pain and emotional adjustment differed significantly, depending on the amount of avoidance and of seeking social support that the respondent employed, $F(1, 27) = 4.01$, $p < .05$, and $F(1, 27) = 5.22$, $p < .03$, respectively. The interaction plots revealed that stump pain (see Figure 1) was more likely to be experienced when the Avoidance score was above the median and the score on Seeking Social Support was below the median. Higher GHQ scores (see Figure 2) were more likely to be associated with an above-median score on Seeking Social Support and a below-median score on Avoidance. Finally, individuals who had above-median

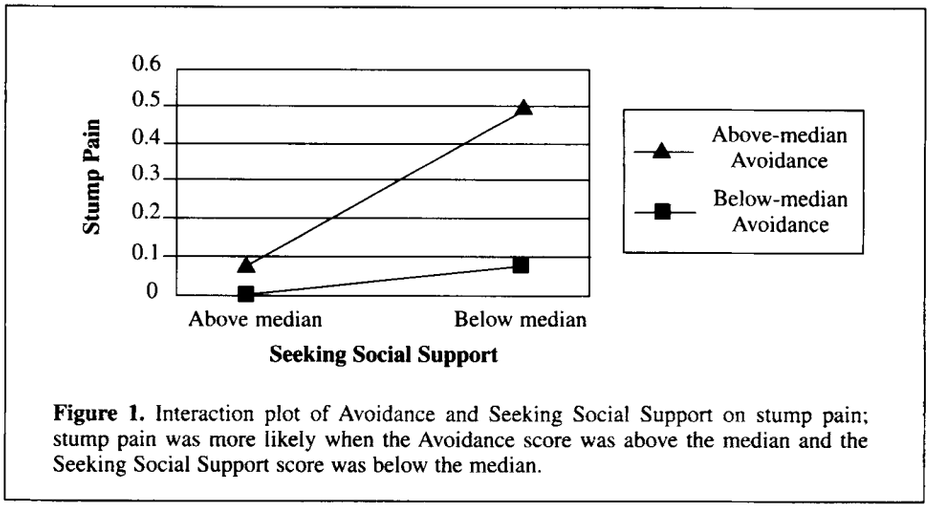

Figure 1. Interaction plot of Avoidance and Seeking Social Support on stump pain; stump pain was more likely when the Avoidance score was above the median and the Seeking Social Support score was below the median.

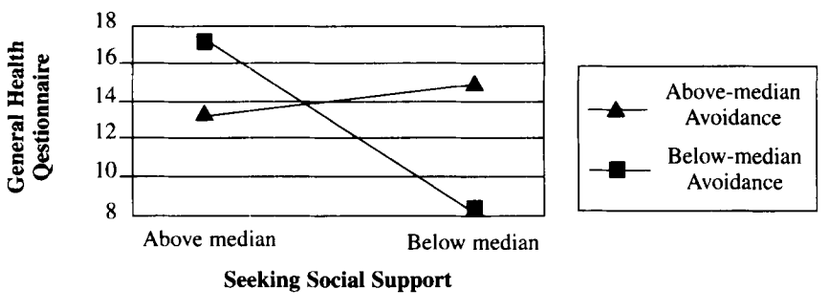

Figure 2. Interaction plot of Avoidance and Seeking Social Support on the General Health Questionnaire (GHQ); higher GHQ scores were more likely to be associated with above-median scores on Seeking Social Support and below-median scores on Avoidance.

scores on Problem Solving experienced a significantly higher amount of other pain than those who had below-median scores on Problem Solving, $F(1, 27) = 6.99$, $p < .01$.

COMMENT

Amputees whose prosthesis resulted from traumatic events denoted avoidance as being the predominant coping strategy significantly more often than those who acquired a prosthesis through disease. This is consistent with the finding that individuals who have not had adequate warning or preparation tend to react with denial.[4,52] An amputation that results from trauma is a sudden occurrence, therefore avoidance as an emotion-focused approach may be aimed at controlling the emotional response to the stressful situation.[53]

Trauma was also associated with the experience of stump pain. Those individuals who suffered from stump pain tended to develop greater degrees of despair and withdrawal than those who do not experience stump pain.[22] Excessive avoidance can soon become maladaptive to the patient's physical and psychological well-being, resulting in further physical symptoms.[38] In addition, those who use avoidance strategies to a greater extent gain less information about their condition than those who use these strategies to a lesser degree.[54] This may help to explain the interaction effect between low Seeking Social Support and high Avoidance scores and the experience of stump pain. That is, by not seeking social support and using avoidance as a predominant coping strategy, stump pain may result because these individuals are less aware of the various precautions necessary in looking after the stump.

In the case of the interaction effects among Avoidance and Seeking Social Support and the GHQ, the extent of social support sought becomes important when combined with low Avoidance scores. That is, individuals who had high Seeking Social Support and low Avoidance scores had higher GHQ scores than those who had low scores on Seeking Social Support and Avoidance. A possible explanation is that those individuals who confront the issue of wearing a prosthesis by seeking social support, as opposed to not seeking it and relying on their own capabilities, may be less successful in their adjustment and thus experience higher GHQ scores. This corroborates Dunn's[55] finding that perceiving more control was a significant predictor of lower depression and higher self-esteem.

An above-knee prosthesis was found to be associated with more stump pain than a below-knee prosthesis. In the instance of above-knee amputation, there is less residual limb to carry the weight of the prosthesis, which also increases the likelihood of skin breakdown. This may also be a contributing factor to a below-knee amputation being better accepted than an above-knee amputation. In addition, walking is made easier if the knee joint remains, thus increasing mobility and activity levels.[56,57] Williamson et al[2] reported that above-knee amputation was a significant predictor of activity restriction, which, in turn, predicted higher levels of depressed affect.

Reports of "other pain" (ie, pain not related to the limb that had been amputated) were associated with problem solving. This relationship, however, depends on the causal directionality—that is, does the experience of "other pain" result in a problem-solving strategy or does problem solving result in other types of pain? People tend to use problem-solving approaches when they believe that their resources or the demands of the situation are changeable.[53] Thus, problem solving may be employed as a means of reducing the stress of the painful situation if the crucial ele-

ment appears to be the concentration of attention on future function rather than on past loss.[4,58] However, others may go to the extreme and vehemently reject any suggestion that they might be disabled or require help in any way. A problem-solving strategy that causes the person to engage in excessive exercise on a tender stump, therefore, may result in the patient's experiencing other types of pain.

Limitations and Implications

The findings from the present investigation have implications for identifying those adults with a prosthesis who may be at increased risk for psychological adjustment problems and who are in need of rehabilitation and intervention efforts to help them adjust. It is insufficient to discharge a patient from the hospital after a disabling illness into a bewildering situation for which he or she has no resources or coping experience. The rehabilitation team must be aware of the coping strategies that patients employ and whether they are likely to be adaptive or to interfere with the patient's recovery. To respond only to the physical aspects of amputation and the prosthetic limb provides only functional rehabilitation rather than rehabilitation of the whole person who has suffered the limb loss. Consequently, research delineating the effects of coping strategies is important for those people concerned with rehabilitating amputees. Furthermore, such research highlights the potential usefulness of including coping as part of the clinical assessment.

Few studies have documented the relationship between stump pain and psychological variables. Thus, the interaction between Avoidance and Seeking Social Support on GHQ scores and stump pain requires further attention and investigation. Furthermore, in screening and treatment of stump pain, the site of amputation, age of the patient, and cause of the amputation should continue to be taken into consideration because they are important predictors of pain. Interventions should also investigate the role of problem solving in the experience of other pain.

In addition to the problem of causal directionality, the clinician may find individual differences in the effectiveness of patients' coping strategies that may not be apparent on the coping inventory we used in this study.[37] The coping scale was constructed to determine whether a person used a particular strategy, but it does not assess whether the strategy was used successfully. To understand what constitutes "good" or "bad" coping, the care provider should know the purpose of a strategy, what its costs and benefits are, and how efficaciously it was used. Reducing coping to problem solving, seeking social support, and avoidance may be too simplistic to capture realistically the potential mediating effects of coping strategies on psychological adjustment. It would be useful for future research to employ prospective studies to see whether problem solving as a coping strategy was being used ineffectively, resulting in other types of pain, or whether it was employed as an effective strategy in response to the person's experience of other pain.

A final note of caution refers to the sample size of this study. It must be noted that the sample size (44 persons) is quite modest; further research with larger samples is needed before one can verify the generalizability of our findings. However, it is important to note that this research plays a role in providing initial evidence for the role of coping in adjustment to an artificial limb and forms a basis upon which future research can be based. Furthermore, although the response rates (52%) in other studies have been higher,[47] a more recent study[59] attained a response rate of only 30%. In addition, ours is the first study that surveyed a random sample of amputees. The studies previously mentioned deal with PLP sufferers and members of an amputee support association. Therefore, the results of our research, albeit on a modest sample, are an important first step in investigating the effect of coping on adjustment to an artificial limb in a random sample of people who have experienced the loss of a limb and fitting of a prosthesis.

Conclusion

Although many amputees adjust well to their prosthesis, some amputees experience emotional maladjustment or pain and may need something more than a well-fitting limb and training in its use. Our hypothesis that coping varies across demographic and disability-related variables received some support with the finding that the use of avoidance varied, depending on the cause of amputation. Furthermore, that acceptance differed between the different sites of amputation and that stump pain varied across cause and site of amputation provide support for the hypothesis that adjustment varies across the demographic and disability-related variables. The potential mediating effects of coping on adjustment may be seen in the relationship between avoidance and seeking social support and the experience of stump pain and emotional adjustment. It was also seen in the relationship between problem solving and the experience of other pain. It is clear that adjusting to the loss of a limb is a multifaceted endeavor that involves both physical and psychological adjustment.

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NOTE

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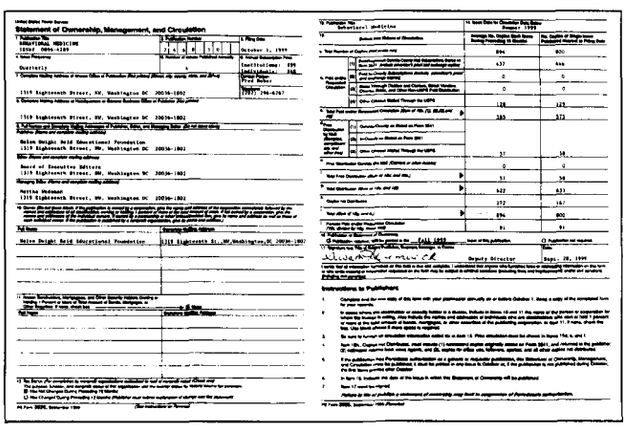

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