

Psychosocial perspectives on post-amputation rehabilitation: a review of disease, traumatic and war-related literature

Deirdre M Desmond, B.A. (Psychology), Professor Malcolm MacLachlan, PhD*

Dublin Psychoprosthetics Group, Department of Psychology, Trinity College Dublin

*Correspondence & Requests for Reprints: Professor Malcolm MacLachlan, Dublin Psychoprosthetics Group, Department of Psychology, Trinity College Dublin, Ireland.

E-mail: malcolm.maclachlan@tcd.ie

Telephone: 353-1-6081453 Fax: 353-1-6712006

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Abstract

Interest in the psychosocial dimensions of adaptation to limb amputation has grown at a tremendous rate in recent decades as increasing emphasis is placed on understanding the complexity of the lived experience of amputation at personal, social, and cultural levels. The multidimensional nature of psychosocial adjustment and indeed the lack of a clear definition of 'optimal' adaptation have stimulated investigation of a diverse range of indicators of psychosocial status. This burgeoning literature reflects considerable inconsistencies and ambiguities in terms of methodology and sampling, and evidences equivocal conclusions thus severely limiting generalisability. This review critically summarises extant research on post-amputation psychosocial well-being and determinants of psychosocial adaptation, including post-amputation pain, health-related quality of life, depression and anxiety, coping responses, and the psychosocial dimensions of prosthetic provision. The primary objective is to clarify the state of knowledge in this domain and highlight issues of relevance for future research.

Keywords: Amputation, Amputees, Rehabilitation, Traumatic, Psychosocial, Review article

Introduction

Developments in physical rehabilitation medicine and technology in general, advances in amputation surgery and prosthetic design in particular, have been stimulated and necessitated by the progression of successive violent conflicts and the ensuing numbers of casualties who survive despite severe and debilitating injuries.⁽¹⁻³⁾ Amputation as a result of military conflict or civilian violence continues to constitute a serious public health problem in some regions.^(e.g. 4, 5-7) Indeed, an estimated 90 to 110 million antipersonnel landmines, in both active conflict and post-conflict regions around the world, represent a significant amputation threat to civilian residents, military personnel, and peacekeepers alike.⁽⁸⁻¹⁰⁾

In the modern Western world however, the vast majority of amputations are performed secondary to peripheral vascular disease (PVD).⁽¹¹⁻¹³⁾ The incidence of peripheral vascular disease increases with age, hence those typically undergoing PVD-related amputation are older than 60 years of age⁽¹⁴⁾ and commonly experience concurrent medical conditions, concomitant diabetes mellitus in particular.⁽¹²⁾ Consequently today many limb-fitting and rehabilitation centres predominantly apply principles and practices developed to treat veterans and war-injured civilians with amputations to the treatment of elderly dysvascular patients.⁽³⁾ As individuals undergoing traumatic limb amputation, military or civilian, are characteristically working-age adults in otherwise good health, it is clear that the circumstances surrounding disease-related amputation differ substantially from those surrounding traumatic amputation.⁽¹⁵⁾ In fact, Houghton et al.⁽¹⁶⁾ suggest that patients with amputations comprise two distinct groups: (1) the fit individual with trauma-related amputation who has a long survival and rehabilitates well; and (2) the older, medically unwell patient who has vascular disease and a poor prognosis. Fletcher et al.⁽¹⁷⁾ further divide the latter group suggesting two distinct subgroups, one of which has a good chance of being fitted with a prosthesis, the other being unsuitable.

Much of the extant adjustment literature is premised on populations comprising individuals with both disease-related and traumatic amputations, thus potentially confounding results and limiting generalisability. Relatively little research has been directed at the incidence and outcomes of amputation related to trauma.⁽¹⁸⁻²⁰⁾ Furthermore, the immediacy of the physical demands engendered by limb amputation and restoration of functional capabilities has led to a primary research focus on aspects of physical adjustment and prosthetic rehabilitation, largely overshadowing, until recently, the investigation of psychosocial adjustment to an amputation. While there is no clear definition of what constitutes 'optimal' psychosocial adaptation,^(21, 22) a surge of interest in this area has led to the investigation of various indicators of psychosocial well-being and their determinants^(e.g. 23, 24-30) reflecting the multidimensional nature of psychosocial adjustment and highlighting the complex and evolutionary nature of the process of adaptation to disability.⁽³¹⁾ This review provides a critical summary of research investigating the wider process of post-amputation psychosocial adaptation for people with limb amputations. We begin by reviewing extant literature on indicators of psychosocial well-being, and then consider determinants of psychosocial adaptation.

Indicators of psychosocial adaptation

Health-related quality of life and post-amputation pain

It is widely believed that the rehabilitation of individuals with traumatic amputations results in more favourable functional outcomes than is the case for those with disease-related amputations.⁽³²⁻³⁵⁾ This may be because of the systemic nature of vascular insufficiency, the associated likelihood of complications in the residual and contralateral limbs, the characteristically older age of dysvascular patients, and the high energy costs associated with prosthesis use.^(e.g. 17, 36) However, assessment of functional outcomes is complicated by the variety of assessment instruments and procedures used and by lack of consensus regarding 'successful' prosthesis use and 'optimal' rehabilitation outcome.⁽³⁷⁾ In addition, assessment of capability versus actual behaviour, differing selection and exclusion criteria (perhaps most significantly the exclusion of individuals not referred for prosthetic fitting), the variety of amputation levels and causes, and the variation in and typically restricted durations of follow-up periods, severely limit comparability, reliability and generalisability of existing research.

Recently, post-amputation health related quality of life has become a nidus for research and perhaps unsurprisingly results typically suggest that in cases of disease-related, civilian-traumatic and military-traumatic amputations, the greatest decrements are found in the domain of *physical functioning*, if indeed decrements are evident.^(e.g. 19, 35, 38, 39-44) For example, Pezzin et al.⁽¹⁹⁾ compared the health profiles of civilians with traumatic amputations and the general US population using the Medical Outcomes Study Short Form (SF-36)⁽⁴⁵⁾ and determined that individuals with amputations had poorer profiles on all dimensions. The differences were most pronounced in the physical functioning, role limitation due to physical health, and bodily pain dimensions. Consistent with these findings, Smith et al.⁽⁴⁶⁾ using data from 20 people with traumatic transtibial amputations, found that those with amputations scored significantly lower on the domains of physical functioning, pain, and role limitations due to physical health problems, relative to an age-matched general population sample, but were within the normal range on all other dimensions. Similarly, Pell et al.⁽³⁹⁾ found physical disability to be the most impaired category for older individuals with dysvascular amputations; however, amongst these individuals energy levels and sleep were the next most impaired categories.

In accord with results based on populations comprising individuals with disease-related and civilian traumatic amputations, a long-term follow-up of 46 people with amputations at the transfemoral level sustained during the Vietnam War⁽²⁰⁾ found that respondents had lower scores on all dimensions of the SF-36, with the exceptions of mental health and vitality, when compared to an age- and gender-matched norm group. Decrements were most pronounced in the physical function and role-physical dimensions. Dougherty⁽⁴⁴⁾ reported that with the exception of the physical functioning dimension, 23 Vietnam War veterans with bilateral above knee amputations, who were followed up an average of 27.5 years later, were not significantly different from controls on the other dimensions of the SF-36. It was argued that the strong personalities and characters of respondents, who were mainly fulfilling military leadership roles at the time of their injuries, and the stereotypical image of heroism associated with bilateral limb amputation in the military setting may explain this finding. Finally, in a 28-year follow-up of 72 people with

transtibial amputations sustained during the Vietnam War, Dougherty⁽¹⁵⁾ found that individuals who sustained major injury in addition to amputation had significantly poorer profiles on all dimensions of the SF-36 compared to age-matched controls; however, there were no significant differences between controls and those who sustained transtibial amputations alone. The results of this study indicate that, on one hand, relatively young and fit individuals who sustain isolated unilateral traumatic amputations at comparatively distal levels and receive early prosthetic fitting and treatment in a dedicated rehabilitation setting, can recover and return to their 'normal lives'. On the other hand, the occurrence of severe comorbid injury substantially reduces quality of life outcomes.

A comparison of health-related quality of life amongst individuals with traumatic and dysvascular amputations carried out by Demet, Martinet, Guillemin et al.⁽³⁵⁾ using the Nottingham Health Profile (NHP)⁽⁴⁷⁾ also revealed that overall greatest impairment was documented in the physical disability and pain categories. When gender and age were controlled, younger age at the time of amputation, traumatic aetiology and upper extremity amputation were independently associated with better health related quality of life. Specifically, vascular amputation was related to greater physical disability and social isolation and older age at the time of amputation was associated with more limited mobility. Younger age at the time of amputation was associated with better health related quality of life scores in the physical disability, emotional reactions, energy level and social isolation dimensions. Individuals with amputations of an upper extremity had better health related quality of life in all categories excluding social isolation.

Many individuals with amputations experience significant pain at more than one anatomical site.⁽⁴⁸⁻⁵²⁾ Pain can have a substantial negative impact on mobility and quality of life^(51, 53-55) and pain constituting a significant physical and psychological stressor may induce or exacerbate psychological distress.⁽⁵⁶⁻⁵⁸⁾ The influence of amputation aetiology in the pathogenesis and persistence of phantom and residual limb pain remains controversial.^(52, 59-61) Early researchers⁽⁶²⁾ hypothesized, on the basis of the high morale and motivation evident in some military contexts, that traumatic amputations resulting from military service would result in lower rates of phantom pain than either civilian accidents or cases where disease necessitated amputation in older people. In contrast, Kristen et al.⁽⁶³⁾ speculated that phantom pain would be more common amongst individuals with military traumatic amputations than civilians with vascular amputations, as a consequence of sub-optimal residual limb characteristics. However, subsequent research has demonstrated similar incidence of phantom pain following civilian or military injuries.⁽⁶⁴⁾ Nonetheless, health related quality of life is substantially lower amongst those reporting phantom and/or residual limb pain than amongst those who are pain free⁽³⁸⁾ and in a minority of cases phantom pain and/or residual limb pain results in greater disability and moderate to severe limitation and suffering.^(49, 52, 54, 65-68)

The wider literature on coping with chronic pain indicates that the coping strategies individuals adopt to manage their pain are associated with variable degrees of pain and physical disability and differential psychosocial outcomes,⁽⁶⁹⁾ nonetheless, little is known about the specific coping efforts and outcomes of individuals with post-amputation pain.⁽⁷⁰⁾ Although limited research has investigated strategies utilized to cope with

phantom pain,^(e.g. 30, 71) coping with residual limb pain, and in fact, residual limb pain in general, is considerably less well researched.⁽⁵²⁾ This dearth of research is likely an artefact of the customary view that residual limb pain resolves with time and surgical healing and is less common than phantom pain in the years and months after amputation.^(e.g. 72, 73, 74) Recent research suggests however, that residual limb pain is responsible for greater pain-related impairment than phantom pain^(49, 51) and thus warrants greater research and clinical attention.

Hill, Niven & Knussen et al.⁽⁷¹⁾ investigated the use of coping strategies and psychosocial adjustment to amputation amongst individuals with phantom limb pain. They found that re-interpretation of pain symptoms was positively correlated with psychosocial dysfunction, adjustment was principally explained by coping strategies in the ‘helplessness’ domain, and ‘catastrophizing’, i.e. having excessively negative and unrealistic thoughts about pain, explained the greatest amount of variance in both physical and psychosocial dysfunction. Jensen et al.⁽⁵⁸⁾ also investigated coping and adjustment in a sample of people with newly acquired amputations and determined that catastrophizing and pain contingent rest were associated with greater phantom pain intensity and greater pain interference and that catastrophizing was also associated with depression one-month post-operatively. Furthermore, they concluded that higher levels of catastrophizing and social support, and lower levels of solicitous responding (i.e. solicitous responding by a friend or family member such as taking over duties and encouraging the individual to rest) at 1-month post-amputation were significantly associated with greater improvement in both depression and pain interference, at the six-month follow-up. Machin & Williams⁽⁷⁵⁾ interviewed 26 WWII veterans with reference to the coping strategies they employed to deal with post-amputation phantom limb pain. “Accepting the problem” was the most prevalent strategy while active problem solving and “seeing the problem in a different light” were the least frequently used approaches leading the authors to conclude that war veterans attempts to cope with phantom pain characteristically involve silent acceptance and resignation to the condition with limited recourse to social support or medical intervention. In addition, Gallagher et al.⁽⁵²⁾ highlight the subjective perception of pre-amputation social support as a potential determinant of phantom pain. In their sample of 104 people with lower limb amputations, 55% of those reporting that they received social support prior to their amputations did not experience phantom pain, while 79% who reported not receiving social support did experience phantom pain.

Post-traumatic stress

Post-traumatic stress disorder (PTSD) is a symptom-cluster evidenced following exposure to a traumatic, life-threatening stressor which involves actual or threatened death or serious injury.⁽⁷⁶⁾ Significant PTSD symptoms can be evident for several decades following a variety of traumatic events including military combat, prisoner-of-war confinement, natural disasters, accidents and violent crime.^(77, 78) Individuals who experience moderate-to-severe physical injury or indeed diagnosis of a serious illness may also experience significant PTSD symptoms.^(e.g. 76, 79, 80, 81) Nonetheless, to date, PTSD symptoms following amputation have rarely been investigated and the extant

research,⁽⁸²⁻⁸⁵⁾ which is restricted to traumatic cases, is limited by methodological difficulties.^(see 86, for a review of methodological considerations in PTSD assessment)

For example, Cheung, Alvaro & Colotla⁽⁸²⁾ compared posttraumatic stress symptoms amongst people with upper (n = 30) and lower (n=25) extremity amputations following work-related traumatic injury and concluded that individuals with upper extremity amputations reported significantly higher frequency of post-traumatic stress symptoms than those with lower extremity amputations. However, the reliability and interpretability of this study is severely compromised by the retrospective design, lack of a standardized assessment of posttraumatic stress symptoms and small sample size. An interesting examination of PTSD caseness amongst U.S. veterans with six different types of traumatic impairments conducted by Martz & Cook⁽⁸³⁾ also used a retrospective design, a case-control method. They reported a statistically significant relationship between having a diagnosis of PTSD and the experience of physical impairment due to amputation and identified the relative risk of PTSD as being 1.64 times greater for individuals with amputations compared to individuals without amputation. Nonetheless, a direct association between physical impairment and symptoms of PTSD could not be confirmed.

Although the burgeoning literature on PTSD after medical illness and treatment has not yet extended to amputation specifically, it is clearly an area that merits explicit enquiry. In the instance of medical illness generally, and indeed amputation, the traumatic stressor may not be temporally delineated, but rather experienced across time. For example, it may incorporate aspects of the initial amputation surgery, subsequent management of the wound and residual limb, and prosthetic prescription and rehabilitation.⁽⁸⁷⁾ Preliminary research suggests that aspects of injury such as injury mechanism,⁽⁸⁸⁾ particular body areas affected⁽⁸⁹⁾ and permanent body changes such as disfigurement⁽⁹⁰⁾ are associated with poor psychosocial adjustment. Systematic, long-term prospective studies incorporating these factors are necessary to elucidate the risk factors and expression of PTSD amongst various patient groups.

Depression

Depression is one of the most frequently investigated facets of psychosocial adjustment in the amputation literature, yet there is little consensus regarding whether people with amputations face an elevated risk of depressive symptoms.^(e.g. 23, 25, 28, 91) The issue is complicated by the diversity of methods, instruments and cut-off criteria used to measure depressive symptomatology, the absence data on pre-existing psychological morbidity, and the varied timing of assessments. Moreover, the assessment of depressive symptomatology is typically carried out using standardized self-report measures and although such tests are not intended as the sole basis for diagnosis of depression they are routinely presented in the literature as the exclusive substantiation of diagnosis.^(92, 93) Indeed clinical evaluations generally demonstrate that substantial numbers of individuals with elevated screening scale scores are not in fact clinically depressed.⁽⁹⁴⁾ Clearly, the significance of such findings is greater for those assuming categorical rather than continuous models of depressive symptomatology. A further difficulty that arises in the

assessment of depression involves the somatic symptoms of depression such as loss of appetite, disturbed sleep, and lowered energy levels, which may also be attributable to physical illness or its treatment.^(e.g. 95) Sherman, Camfield & Arena⁽⁹⁶⁾ concluded in a review of the literature on measures to diagnose psychopathology that many measures include items that confound emotional distress with physical disorder thus overestimating it. In the following section, studies of depressive symptomatology amongst individuals with amputations are grouped according to the assessment instrument utilised in order to facilitate comparability for the purposes of this review.

Studies using the Center for Epidemiological Studies Depression scale (CES-D)⁽⁹⁷⁾ with cut-off scores of ≥ 16 as a measure of depressed affect, reveal rates of depressive symptomatology in the range of 18% to 28% amongst individuals with amputations.^(24, 26, 27, 98-101) These results are higher than average rates found, using the same instrument and cut-off points, in the general population, but similar to a 35% prevalence reported for individuals with a variety of physical disabilities,⁽¹⁰²⁾ and a 24% prevalence rate found among individuals with chronic pain.⁽¹⁰³⁾ For example, Williamson, Schulz, Bridges et al.⁽²⁷⁾ assessed depressive symptomatology in a sample people with predominantly lower extremity amputations, three quarters of whom attributed their amputations to vascular disorder. The average time elapsed since amputation was approximately 4 years and the average age of respondents was 65.4 years, 68% were older than 60 years of age. The average CES-D score for the sample was 9.6 (SD 8.7) indicating comparable scores to those found in the general population. Twenty-one per cent were at risk for developing clinical depression with scores of 16 or greater. In a population-based study, Blazer & Williams⁽¹⁰⁴⁾ found that 15% of older adults met this criterion thus suggesting slightly elevated rates of depressive symptoms amongst this group of individuals with amputations. In a somewhat younger sample of 435 predominantly dysvascular lower extremity amputation patients (mean age 62 years, SD 15.7), with a longer average duration since amputation (mean 14.7 years, SD 16.7), Miller et al.⁽⁹⁸⁾ reported prevalence of depressive symptoms of 24%. Behel, Rybarczyk, Elliot et al.⁽⁹⁹⁾ also reported that 24% of their lower extremity amputation sample, which mainly comprised of individuals with disease-related amputations, who were an average of 17 years post-amputation, had scores greater than 16 on the CES-D. In a longer term follow-up extending an average of 20 years after predominantly traumatic amputation, Dunn⁽¹⁰¹⁾ reported that 18.2% of the sample scored within the clinical range. Caution is urged in the interpretation of the above findings, as numerous studies have suggested that depression is over diagnosed with the CES-D in a variety of populations, including medical patients⁽¹⁰⁵⁾ and community residing adult populations.⁽¹⁰⁶⁾ Indeed some authors (e.g. 107, 108) have argued that amongst medical populations and older persons the standardized cut-off score of ≥ 16 should be increased to as much as 24 or 27, and 20, respectively, to reduce the rate of false positives to an acceptable level. Furthermore, research by Roberts, Lewinsohn & Seeley⁽¹⁰⁹⁾ indicated that only 11% of individuals identified as at risk for depression using the standard cut-off points were subsequently diagnosed as depressed following diagnostic interviews.

Using a different and widely validated⁽¹¹⁰⁾ measure of depression the Beck Depression Inventory (BDI),⁽¹¹¹⁾ Bodenheimer, Kerrigan, Garber et al.⁽¹¹²⁾ assessed depressive

symptomatology in a sample of 30 males with lower extremity amputations. They reported no evidence of increased depression amongst the majority of those surveyed compared with other outpatient groups. However, 30% of respondents scored 10 or higher suggesting mild depressive symptomatology and of those six (20%) scored in the range 19-22 suggesting moderate depression. The average time elapsed since amputation was 23 months (range 3 – 634 months). Similar findings were reported by Whyte & Niven⁽¹¹³⁾ who found that only 15% of their sample had BDI scores indicating moderate to severe depression, figures comparable with those found in the general population. Frank et al.⁽⁹¹⁾ reported that mean BDI scores of 66 individuals who were an average of three and a half years post-amputation were considerably lower than the cut-off of 10 used to designate mild depression. They therefore concluded that overall, people with amputations did not differ significantly in terms of levels of distress from the general population. Despite the potential for the overestimation of depression in medical samples when using the BDI, because the mere presence of medical conditions may influence the endorsement of items assessing somatic symptoms, there is empirical support to advocate use of the full-version BDI with a number of patient groups, including people with diabetes,⁽¹¹⁴⁾ chronic pain⁽¹¹⁵⁾ and multiple sclerosis.⁽¹¹⁶⁾ Somatic items of the BDI may be valid depression indicators in some patient groups.⁽¹¹⁶⁾

Critical of studies potentially confounding somatic disorders and the identification of depression, Fisher & Hanspal^(23, 117) utilised the Hospital Anxiety and Depression Scale (HADS)⁽¹¹⁸⁾, a scale that specifically excludes reference to affective symptoms that may have a physical causes, to assess depressive symptoms amongst individuals with long-term amputations. Their results concur with findings based on BDI scores indicating that individuals with amputations are not at higher than average risk for depression. Amongst 93 individuals, an average of 9.7 years post-amputation, with amputations predominantly resulting from vascular disease they reported an average depression score of 2.9.⁽²³⁾ This is substantially lower than the designated cut-off of 8 indicating caseness, in fact, only one individual scored within the clinical range. Furthermore, amongst 107 established limb wearers an average of 13.9 years post-amputation they found that only one person scored in the clinical range.⁽¹¹⁷⁾

Perhaps contributing to the confused picture regarding depression associated with amputation, elevated rates of depressive symptomatology have been reported in studies using clinical interviews as means of diagnosis. For example, Kashani, Frank, Kashani et al.⁽²⁵⁾ reported 35% prevalence of major depressive disorder in a study of 65 people with amputations consecutively referred to a rehabilitation facility over a twelve month period, a significantly higher frequency than would be expected in the general population. Similarly, Cansever⁽¹¹⁹⁾ reported that 41.7% out of 80 individuals with amputations (mean time since amputation = 1 year & 10 months) met the DSM-IV criteria for depressive disorder, 26 (74.3%) were diagnosed with major depression and 9 (25.7%) with dysthymia. Although the time elapsed between amputation and assessment is not reported, it seems likely that in Kashani et al.'s⁽²⁵⁾ study participants were in the early post-operative/rehabilitative phase. Similarly, participants in the Cansever⁽¹¹⁹⁾ study were on average less than 2 years post-amputation. Elevated rates of depressive symptomatology in the early post-operative and rehabilitative phases have also been

suggested elsewhere,^(120, 121) but a reduction in such symptoms over time has also been found.⁽¹²²⁾ Thus the high rates of depression reported in the studies above reflect varying reactions across the time course of adjustment to amputation.

Given the limitations previously highlighted and despite elevated rates of depressive symptomatology in the early post-amputation period there is inconclusive evidence regarding the longer-term association between adjustment to amputation and increased risk for depression. Investigation of the potential influence of amputation aetiology in the development of depressive symptomatology is limited. However, available evidence suggests that the underlying cause of amputation is unrelated to depressive symptomatology.^(24, 25, 119) Nonetheless, the dearth of longitudinal research on this subject necessitates further investigation before definitive conclusions may be reached.

Anxiety

Although reactions of anxiety have been reported amongst individuals with amputations⁽¹²⁰⁾ research to date does not suggest elevated levels of anxiety amongst this group compared to the general public.^(e.g. 91) Assessment of anxiety in the early postoperative period or amongst inpatients commonly reveals increased anxiety levels;^(e.g. 120, 121) however, such findings also emerge in other patient groups and are considered a 'normal' or appropriate responses in light of potentially life threatening surgery or injury. Comparison of individuals with amputations with other patient groups reveals no differences in anxiety symptoms. For example, Carrington et al.⁽⁴²⁾ found no differences in anxiety levels as measured by the HADS between diabetic individuals with chronic foot ulceration, unilateral lower extremity amputation or no history of foot ulceration. Similarly Marshall, Helmes & Deathe⁽²⁸⁾ found that while 40% of individuals with amputations in their sample had scores greater than the clinical cut-off score of 75 on the Millon Clinical Multiaxial Inventory⁽¹²³⁾ anxiety dimension, there were no significant differences in anxiety scores between chronic musculoskeletal pain patients and individuals with amputations.

Furthermore the assessment of anxiety following more extended post-amputation intervals does not support the suggestion of increased risk of anxiety symptoms.^(23, 91, 112, 124) For example, using the State-Trait Anxiety Inventory,⁽¹²⁵⁾ Bodenheimer et al.⁽¹¹²⁾ reported that 30 individuals with lower extremity amputations who were an average of 23 months post-amputation, scored within the range for non-clinical adult populations. Similarly, Frank et al.⁽⁹¹⁾ found no significant variations from the norm in terms of anxiety measured using the SCL-90 amongst a group of 66 people who were an average of three years and six months post-amputation.

Distinguishing between the sudden onset of disability resulting from trauma, and the more gradual, sometimes remitting, course of disability associated with chronic illness, Antonak & Livneh⁽²²⁾ propose that the manifestation and meaning of psychological distress may differ depending on the disabling condition. Although susceptibility to developing clinical levels of anxiety⁽¹²⁴⁾ has not been associated with the underlying aetiology of limb loss, the significance and focus of anxiety may be contingent on the

precipitating condition. For example, Antonak & Livneh ⁽²²⁾ suggest that chronic illness related anxiety is premised on uncertainty about the future, encompassing hopelessness and apprehension, whereas trauma-related anxiety is characteristically past-oriented and involves mourning loss. Implementation of qualitative research methodologies is necessary to identify and elucidate such relationships amongst different patient groups.

Characteristics associated with adjustment

Psychosocial variables

Body image changes and the role of the prosthesis

The image of one's body is a critical element of the individual's formulation of the 'sense of self', ⁽¹²⁶⁾ Experiences of one's own body are the basis for all other life experiences. ⁽¹²⁷⁾ The disruption of body image engendered by amputation can therefore have significant and long-lasting impact (positive and/or negative) on the individuals' sense of self and consequently on relationships and interactions with others. ^(87, 100) Breakey ⁽¹²⁸⁾ suggests that an individual who uses a prosthesis balances three distinct body images – the preamputation intact body, the body with the newly lost limb, and the image of the body with a prosthesis.

Despite the irrevocable physical alteration of one's body inherent in limb amputation, research on the associations between body-image disturbance/change prompted by amputation, (dis)satisfaction with one's prosthesis and subsequent physical and psychosocial adjustment, is limited. Rather the historical emphasis on physical adjustment and rehabilitation, evident in the amputation literature, has promoted a restricted view of the relationship between the individual with an amputation and their prosthesis. ⁽¹²⁹⁾ Characteristically such relationships are described in terms of prosthesis acceptance and rejection rates and associated factors. ^(e.g. 130, 131, 132) Recently however, body image concerns and the potential impact of prosthesis satisfaction in influencing quality of life and psychosocial outcomes, have begun to stimulate research. ^(e.g. 133, 134) Preliminary investigations have focused on the role of the prosthesis in restoring normal body image, reducing behavioural restrictions and psychological distress, ^(117, 129, 133) and on the associations between body image and psychosocial well-being. ^(e.g. 100)

Pereira, Kour, Leow et al. ⁽¹³⁵⁾ argue that in some circumstances, prostheses can act to substantially 'repair' compromised body image, in addition to restoring relatively normal appearance and form, and improving physical capabilities. Examination of the role of prostheses in mediating body image distress by Fisher & Hanspal ⁽¹¹⁷⁾ revealed an association between moderate satisfaction with one's prosthesis and low levels of body image disruption. Similarly, Murray & Fox ⁽¹²⁹⁾ reported an association between higher levels of prosthesis satisfaction and lower levels of body image disturbance. Fisher & Hanspal ⁽¹¹⁷⁾ noted that amongst the relatively young people with traumatic amputations in their sample body image distress was associated with achieved mobility. However, associations between body image disruption, satisfaction with one's artificial limb, and mobility were not significant amongst older individuals with vascular amputations. Thus

the authors concluded that body image disruption is uncommon amongst longer-term prosthetic limb wearers. Furthermore, attitude towards the prosthesis was not associated with mobility, suggesting that although individuals with amputations can achieve high levels of mobility, they may still be dissatisfied with their prostheses.

Rybarczyk et al. ⁽¹⁰⁰⁾ investigated the relationship between body image concerns and psychosocial adjustment in a sample of 83 people with lower extremity amputations and found significant associations between body image concerns and each of depression, quality of life and prosthetist's ratings of adjustment. Similarly, Fisher & Hanspal ⁽¹¹⁷⁾ reported higher levels of anxiety, and to a lesser extent depression, amongst individuals with more negative body images. Findings from a qualitative study by Gallagher & MacLachlan ⁽¹³⁴⁾ indicate that prosthesis appearance is an integral component in establishing positive self-image. In their focus group discussions, concerns regarding public appearance and desires to appear normal emerged as dominant themes and many participants indicated that taking delivery of their prostheses was an important element in restoring normality to their lives.

Social discomfort and social functioning

Social discomfort has been proposed as a potential mediator of psychosocial adjustment to amputation.^(e.g. 24, 136) Changes and limitations in social activities are commonly reported after limb amputation.^(e.g. 19, 20, 137, 138, 139) Studies by Rybarczyk et al. ^(24, 100) demonstrate that perceived social stigma and social discomfort are significantly associated with increased levels of depression. Similarly, Williamson et al. ^(27, 140) demonstrate an association between less satisfaction with social contacts and greater depressive symptomatology, and between high public self-consciousness and greater activity restriction, which has in turn been related to poorer quality of life and psychosocial adjustment.^(e.g. 39, 141, 142)

Social support

An increasing body of literature highlights the importance of social support in mediating the relationship between life stress and health outcomes.⁽⁶⁹⁾ Although interpretation of the role of social support is complicated by its construal as both a coping resource and a coping strategy,⁽¹⁴³⁾ strong and positive social support is the only socioenvironmental variable consistently associated with successful psychosocial adaptation to amputation.^(24, 27, 100, 144) Lower levels of perceived social support are associated with lower subjective quality of life ratings ⁽¹⁰⁰⁾ and higher levels of depressive symptomatology.^(24, 27) In a longitudinal study, Jensen et al. ⁽⁵⁸⁾ found that social support was positively associated with improvements in depression; patients who reported receiving high levels of social support and low levels of solicitous responses, showed greatest decreases in depression and the extent to which phantom pain interfered with functioning.

Coping with amputation

The various strategies individuals adopt to cope with experiences of chronic illness or injury play critical mediating roles in psychosocial adjustment to disability.⁽¹⁴⁵⁻¹⁴⁸⁾ Although a relatively small number of researchers (e.g. 30, 101, 145) have investigated coping with amputation it is difficult to generalize on the basis of extant research because of the variety of different assessment methods used, the varying facets of coping assessed, and the diversity of research samples. Nonetheless these preliminary studies of coping offer a useful reference point for further investigation.

Dunn⁽¹⁰¹⁾ investigated the influence of three coping modes; namely finding positive meaning, adopting an optimistic outlook, and perceiving control; on depression and self-esteem, in adjustment to amputation. Finding positive meaning in one's amputation and perceiving greater control over one's impairment were associated with lower levels of depressive symptomatology and higher levels of self esteem. Livneh, Antonak & Gerhardt⁽¹⁴⁵⁾ investigated active problem solving, emotion focussing, problem disengagement, and cognitive disengagement, in analysis of the associations between sociodemographic variables, disability related variables, and coping strategies, as predictors of the psychosocial adaptation of 61 individuals with amputations. Their results indicated that greater active problem solving was negatively associated with depression and internalised anger and positively associated with adjustment and acceptance of disability. In contrast, emotion focused coping and cognitive disengagement, were positively associated with depression, externalised hostility and lack of acceptance of disability. Problem disengagement was related only to externalised hostility. The mediating effects of problem solving, support seeking and avoidance, on adjustment to prosthesis use in 44 individuals with lower extremity amputations were investigated by Gallagher & MacLachlan.⁽³⁰⁾ They reported that greater use of social support seeking, together with low use of avoidance as coping strategies were associated with poor psychological adjustment as measured by the General Health Questionnaire.⁽¹⁴⁹⁾ Furthermore they note that avoidant coping strategies were the predominant strategies employed by individuals with traumatic amputations, occurring significantly more often than amongst individuals whose amputations were disease-related. In general, avoidant coping styles are associated with negative emotional reactions and poor psychosocial adjustment.^(e.g. 150, 151)

Cognisant of the fact that previous coping research was reliant on measures formulated through factor analysis with general population samples, Livneh et al.⁽¹⁴⁷⁾ examined the dimensional structure of coping with disability-related stress among 61 individuals with lower extremity amputations and revealed three primary dimensions: a) active/confrontive versus passive/avoidance coping; b) pessimistic/fatalistic versus optimistic/positivistic coping; and c) social/emotional versus cognitive coping. The authors conclude that coping strategies used by individuals with amputations do not differ in a meaningful way from the coping efforts of those who are not physically disabled, thus providing justification for the use of psychometrically validated coping assessment instruments with such samples, and lending support to the findings of previous investigations.

Sociodemographic characteristics

Age

With few exceptions,^(e.g. 24, 99, 120) investigations of the influence of age on psychosocial adjustment to amputation, associate younger age with less favourable psychological outcomes. Relative youth has been associated with higher rates of depressive symptomatology,^(27, 91, 101, 145, 152) anxiety,^(91, 117, 145, 152) poorer adjustment and acceptance of disability,^(145, 152) body image disruption,^(117, 152) and elevated levels of interpersonal sensitivity, hostility, and paranoid ideation.⁽¹⁵²⁾

Numerous explanations have been suggested for poorer psychosocial adjustment amongst relatively younger individuals. For example, Frank et al.⁽⁹¹⁾ suggest that willingness to alter one's body-image after amputation mediates adjustment and as older people may be more prepared for such changes because of previous adaptation to the ageing process, they are more successful in negotiating post-amputation changes. Similarly, Rybarczyk et al.⁽¹⁵³⁾ propose that older adults may not experience as extreme a reaction as younger adults because the amputation and resulting changes in body image and mobility, while undesirable, are perceived as relatively "on time". Dunn⁽¹⁰¹⁾ and Williamson & Schulz⁽¹⁴²⁾ suggest that activity restriction and pain mediate the relationship between age and depression. In general, similar levels of disease related chronic pain are tolerated better by older than by younger individuals,^(154, 155) perhaps due to a process of normalization whereby older individuals habituate to pain or learn to cope more effectively with pain as a consequence of more frequent and intense pain experiences, associated with age related decrements in health.⁽¹⁵⁵⁾ Another possibility is that older adults are functionally less incapacitated because they may be willing to accept some pain and discomfort as part of growing old.⁽¹⁵⁶⁾ Indeed, Riley, Wade, Robinson et al.⁽¹⁵⁷⁾ found that older adults reported diminished emotional responses to pain and exhibited less pain behaviour than younger adults. In addition,, age may influence the extent to which individuals are distressed by restriction of normal activities because older individuals have different expectations about functional ability compared with younger individuals.⁽¹⁵⁸⁾ Hence, younger adults, for whom functional limitation and pain are not considered normative for their time, would be expected to experience more distress associated with declines in the ability to perform routine activities than would their older counterparts.⁽¹⁴²⁾

Interactions between age and time elapsed since amputation have also been documented.^(e.g. 91, 145) For example, Livneh et al.⁽¹⁴⁵⁾ found that greater acceptance of disability was reported amongst older individuals (65-84 years) with a longer duration since amputation, whereas both younger (15 to 49 years) and older (65-84 years) with shorter time elapsed since amputation, had the lowest adjustment to disability scores, indicating greater rejection of disability.

Gender

Although many studies have found no association between gender and various dimensions of psychosocial adjustment including activity restriction,⁽¹⁴⁰⁾ depression,^(24, 99) acceptance of disability,⁽¹⁵⁹⁾ or general psychiatric symptoms,⁽¹²⁰⁾ others suggest less favourable post-amputation outcomes for females. Pezzin et al.⁽¹⁹⁾ for example, found

that females scored significantly worse on the emotional adaptation to role changes dimension of the SF-36. Using the NHP, Demet et al. ⁽³⁵⁾ reported that women had poorer health related quality of life on the dimensions physical disability, energy level, emotional reactions and social isolation; however, they caution that such findings are also evident in the general population. Kashani et al. ⁽²⁵⁾ found that significantly more females than males with amputations met the DSM-III criteria for major depression. With respect to the prevalence of PTSD symptoms evidenced following digital amputation, Fukunishi ⁽⁸⁹⁾ reported that, regardless of degree of physical functioning after replantation, females reported more symptoms of PTSD.

Disability related variables

Functional ability and activity restriction

Successful psychosocial adaptation amongst individuals with amputations is positively associated with greater functional ability⁽¹²²⁾ and negatively related to activity restriction.^(27, 39, 101) Indeed Weiss et al. ⁽¹⁶⁰⁾ found that the ability to perform activities of daily living was the most important predictor of quality of life. Pell et al. ⁽³⁹⁾ found that individuals with lower extremity amputations resulting from dysvascular disease reported significantly more social and emotional problems, as measured by the NHP,⁽⁴⁷⁾ than age matched controls; however, these differences became non-significant when adjusted for mobility. In fact, physical mobility was significantly correlated with all other health modalities (i.e. energy, pain, sleep and social isolation) and was the only outcome for which the difference between people with amputations and controls remained significant after stepwise logistic regression. This led the authors to suggest that overall quality of life may be improved by targeting rehabilitative efforts on improving mobility. Williamson et al. ^(27, 140) reached a similar conclusion; they found that greater activity restriction was associated with greater depressive symptomatology and that the association between prosthesis use and symptoms of depression was mediated by activity restriction. Less use of a prosthesis resulted in greater restriction of activities, which in turn lead to greater depressive symptomatology.

Time since amputation

Results of investigations concerning the impact of time since amputation on adjustment have been inconclusive. Time elapsed since amputation has been significantly and negatively associated with both anxiety and depression;^(e.g. 145) however, other authors have failed to confirm this relationship.^(e.g. 27, 99, 117, 119) Although Frank et al. ⁽⁹¹⁾ report a significant association between time since amputation and depression the relationship differs for young and older individuals. Older people with amputations exhibited less depressive symptomatology as time since amputation increased, while younger people, in contrast, displayed greater depressive and symptoms of distress as time since amputation increased.

Rybarczyk et al. ⁽¹⁰⁰⁾ reported a significant association between time since amputation and perceived quality of life amongst individuals with lower extremity amputations such

that length of time since amputation was associated with better perceived overall quality of life specifically in terms of leisure and social time, family life and relationships. Pezzin et al⁽¹⁹⁾ found that increased time since amputation was associated with an increased likelihood of scoring below the population norm on the physical component summary of the SF-36. It was also associated with lower likelihood of scoring below the population norm on the role emotional scale thus suggesting an emotional adaptation to the amputation over time.

Gallagher & MacLachlan⁽¹³⁴⁾ examined the role of time since amputation in adaptation to changes in body image and concluded that acceptance of changes in body image occurred over time. In contrast, neither Pucher, Kicking & Frischenschlager,⁽¹⁶¹⁾ Breakey⁽¹⁶²⁾ nor, Fisher & Hanspal⁽¹¹⁷⁾ found an association between the period of time elapsed since amputation and body image.

Site and level of limb loss

In light of the poorer physical rehabilitation and functional outcomes associated with more proximal amputation it might be expected that higher amputation levels would equate with greater difficulty in psychosocial adjustment. Numerous researchers have failed to identify an association between level of limb amputation and psychological distress.^(e.g. 25, 100, 163) However, Williamson, Schulz, Bridges et al.⁽²⁷⁾ found that higher levels of limb loss acted as a proxy for greater restriction of activities and thus predicted higher levels of depressed affect. Furthermore, Williamson⁽¹⁴⁰⁾ revealed that above knee level amputation was not only associated with activity restriction, but also with feelings of vulnerability and inability to defend oneself.

Investigations of differential psychosocial outcomes for upper versus lower extremity amputations have also been mixed. Some authors^(e.g. 159, 164) suggest that upper rather than lower extremity amputation is associated with better psychosocial adaptation to amputation, while others have found a greater frequency of symptoms of PTSD, depression,⁽⁸²⁾ and externalised anger,⁽¹⁴⁵⁾ amongst people with upper extremity amputations. Ham & Cotton⁽¹⁶⁵⁾ suggest that those with amputations of an upper limb experience more difficulty in adjusting to amputation than those with lower extremity amputations because of the importance of the hand and arm in social interaction, the greater visibility of the prosthesis and its lower social acceptability. However, Livneh et al.⁽¹⁴⁵⁾ have found no effect of site of amputation in terms of depression, anxiety, and adjustment to and acceptance of disability.

Findings with regard to the psychosocial outcomes for those sustaining multiple limb amputations have also been inconsistent. Cansever⁽¹¹⁹⁾ reports that all six individuals with bilateral lower extremity amputations in their sample were clinically depressed. Whereas, Dougherty⁽⁴⁴⁾ reported no differences between those with bilateral traumatic transtibial amputations and the general population in terms of mental health, social functioning or emotional role functioning.

Conclusions

Since World War II significant technological gains and innovations have emerged in prosthetic design and fabrication and a burgeoning literature has investigated facets of physical adaptation to amputation and prosthesis use. More recently investigation of the psychosocial dimensions of adaptation to amputation has gained prominence as increasing emphasis is placed on understanding the lived experience of amputation at both personal and social levels.⁽¹⁶⁶⁾ Psychosocial adaptation to amputation is indeed a complex and multifaceted process and has hence stimulated a wide-ranging array of research, as evidenced by this review. Yet while our understanding of these domains has been significantly enhanced, methodological inconsistencies have limited systematic comparisons and generalisability. In particular, lack of clear delineation between outcomes measured (for example symptoms of depression versus clinical diagnosis of depression) and heterogeneity amongst research samples in terms of age, amputation aetiology, and amputation levels have affected previous studies. Distinguishing between individuals with amputations with respect to these factors is likely to be of both theoretical and practical importance when identifying features of predictive value in psychosocial adaptation. Differences between the circumstances, prognoses, and personal expectations of younger and older individuals, and individuals who sustain traumatic versus disease-related amputations, require further elucidation in order to facilitate identification of realistic rehabilitation goals and development of effective and appropriate evidence-based care.

Furthermore, research on the cultural meanings and the wider societal and economic implications of amputation is now beginning to emerge (e.g. 7, 10, 167, 168), stimulated in particular by experiences in countries, such as Afghanistan, Mozambique and Cambodia, where the legacy of unexploded ordinance and landmines represents a significant threat to life and a major impediment to economic and social recovery⁽¹⁶⁹⁾.

The importance of such factors is succinctly illustrated in findings recently reported by Husum et al.⁽¹⁶⁷⁾ In their investigation of predictors of chronic pain following amputation due to landmine injuries the only factor associated with post-injury pain was the economic impact of the injury. The economic context of amputation is unlikely to influence this scenario alone, but is potentially of relevance to many other, indeed perhaps every other, rehabilitation outcome. As with many other areas of rehabilitation, we need longitudinal and multifactorial studies of a large number of people representing a range of amputation sites, causes, and rehabilitation outcomes so that the complex causal interplay between psychosocial variables and clinical outcomes can be elucidated. As it is unlikely that adjustment following amputation is independent of the socio-economic and cultural context in which people live, we also recommend several parallel studies across diverse research sites to investigate the influence of such factors. The use of quality of life measures that encompass a broad range of experience (both positive and negative)^(e.g. 170) is also encouraged in such research.

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