Research

A qualitative pilot study exploring reasons for prosthetic preference in a veteran amputee population

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Abstract

Background/Aims For transfemoral amputees, newer technology, microprocessor-controlled prosthetic limbs, offer a level of performance that exceeds that of older, non-microprocessor controlled limbs. Within a population of veteran amputees, these limbs are often requested during applications for replacement limbs, post discharge from the military. However, as microprocessor-controlled prosthetic limbs cost far exceeds that of non-microprocessor controlled limbs, justification for their provision is essential in ensuring value for money for the National Health Service in the United Kingdom. To date, literature focuses upon measures of objective performance as demonstrating the value of one limb over another but it ignores individual lifestyles within this process. This project aims to explore the reasons underpinning individual requests for specific types of prosthetic lower limb in a population of veteran amputees.

Methods This pilot study explored secondary data, consisting of patient statements, from the evaluation process associated with applications for new microprocessor-controlled prosthetic limbs. The data referred to a sample population of non-serving veteran amputees, attending a veteran prosthetic centre for the ongoing maintenance and replacement of their prosthetic limbs (n=15).

Results Findings from the study suggest an interconnection between function, psychology and emotional context. Individual statements demonstrate that while functional performance influences choice, it is the application of function to life and lifestyle that underpins the meaning of improvements in performance for the individual.

Conclusions Further research, investigating the meaning of limb performance to the life of an individual, is essential in facilitating effective prescription of limbs that meet individual need, and ensuring accurate distribution of what are currently limited funds.

Key words

Amputees, Individual need, Outcome measures, Prosthetics

Introduction

Prosthetics provision and maintenance in the UK is subject to controversy. While civilian care is provided through the NHS and reflects NHS England Clinical Commissioning policy (NHS England, 2016), care for military amputees is more complex. At present, the British Ministry of Defense's approach to rehabilitation of military amputees reflects a duty of care; providing the highest possible standard of prosthetics (Ministry of Defence, 2013), with the routine issue of expensive, contemporary limbs. While increasingly high numbers of amputees return to active duty, there remains a high percentage that are ultimately discharged (Dharm-Datta et al, 2011). As such, the maintenance and replacement of prosthetic limbs becomes the responsibility of the NHS.

Veteran prosthetic replacement is provided via a different funding stream from civilian amputee care (Murrison, 2011), with different levels of care being heavily contested by charities and societies supporting limbless individuals (Limbcare, 2011). With perceptions of a 'have and have not' disparity, justifying the provision of expensive prosthetic limbs to veterans becomes important.

In the field of amputee research, investigation into the benefits or otherwise of using microprocessor controlled prosthetic limbs compared with less expensive, non-microprocessor controlled limbs is relatively new. Advances in technology over the last decade have seen movement away from older, friction-assisted devices, to fluid-controlled mechanisms and those with adaptable or power assisted movement (Howard et al, 2018; Kaufman et al, 2018). NHS England did not endorse the routine provision of microprocessor controlled prosthetic limbs to civilian amputees, based upon 'insufficient evidence' to support their use (NHS England, 2016). However, in 2016, the building strength of literature surrounding microprocessor controlled prosthetic limbs and their impact upon function (NHS England, 2016) led to a change in recommendations and policy. A patient pathway to direct prescribers in considering allocating microprocessor prosthetics was developed (NHS England, 2016).

These recommendations appear underpinned by two systematic reviews (Highsmith et al, 2010; Sawers and Hafner, 2013) that demonstrate clear, objective, performance-related justifications for prescription, which focused on value for money. However, emphasis on objective measures ignores wider psychosocial aspects associated with the prescription of prosthetic limbs (Smith et al, 2013; Suls et al, 2013; Hafner and Askew, 2015). As is demonstrated by the *International Classification of Functioning, Disability and Health* model (World Health Organization, 2001), exploration of wider factors is necessary to understand an individual's health needs to more accurately reflect the impact of microprocessor controlled prosthetic limbs.

For the majority of civilian amputees, amputation most often occurs later in life and after periods of physical challenge that have reduced overall exercise tolerance and demands (Ahmad et al, 2014). Contrary to this, veteran amputees from conflicts post the year 2000 are unique in terms of their age, physical disability, mental health requirements and expectations for careers and lifestyle: Due to changes in warfare techniques and military medicine, individuals who may not have previously survived combat injuries, are being successfully treated and recovered. These individuals present with high levels of injury, often multiple amputations and accompanying mental health difficulties. In addition, despite their often young age and high levels of physical fitness, they are no longer able to continue service within the military, and need to transition to civilian employment and lifestyles. (Murrison, 2011 pp 5). Consequently, while all amputee care requires holistic consideration, veteran prosthetic provision requires specific investigation of wider issues in order to ensure that prosthetics meet the needs of the user and that inappropriate limbs are not prescribed unnecessarily.

Background literature

Overall, literature in the field of limbless veterans is limited and primarily focuses upon costings and satisfaction with artificial limbs. As such, there is a lack of exploration of the true impact of high technology limbs upon the life of individual veterans. Research in the civilian field is less limited and although subject to criticism provides a body of work that may aid in directing future, veteran orientated studies. A brief description of some of the available literature outlines the focus of work to date, and illustrates some of the difficulties associated with applying this research as an appropriate evidence base in veteran practice.

Functional performance

A number of authors compare a variety of prosthetic limbs with reference to functional performance (Kahle et al, 2008; Bellmann et al, 2010; Hafner and Askew, 2015; Prinsen et al, 2015). Overall, these authors report perceived improvements in performance as a result of using microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs. However, the studies vary considerably in the performance indicators used, from balance confidence and decreased efficiency over an obstacle course (Prinsen et al, 2015); to perceived function (Hafner and Askew, 2015) to reduced stumbles and falls (Kahle et al, 2008; Bellmann et al, 2010). This lack of comparable measures is further complicated as the age ranges and levels of mobility also vary between studies, and sample populations are small. Thus, while microprocessor controlled prosthetic limbs appear to improve functional performance on the surface, recommendations for prescription, based on functional performance data, lack credibility.

Energy expenditure

Older studies use specific indicators of function as a means of studying performance improvements of microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs. Jepson et al (2008) found little difference between in terms of metabolic change as a consequence of activity. Seymour et al (2007) found improvement in energy requirements for gait, while Kaufman et al (2008) found increased engagement and satisfaction with active living and, therefore, higher energy expenditure using microprocessor controlled prosthetic limbs. The latter authors were supported by Highsmith et al's (2010) review of eight publications, which highlighted improvements not only in energy expenditure but also in safety and cost.

Biomechanics

In the field of biomechanics, research aims to establish whether there are impacts on loading and symmetry when using microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs. Both Berry et al (2009) and Kaufman et al (2012) found decreased contralateral loading and improved symmetry. It was surprising that Sawers and Hafner (2013), in their systematic review, found no difference in symmetry of gait between the two prosthetic types across a variety of publications, as this is thought to be responsible for a reduction in back pain experienced by users of microprocessor controlled prosthetic limbs. As with function-orientated research, these studies struggle with a lack of comparable data across studies, and ignorance of factors outside of clinical performance.

Limitations highlighted in systematic review

Exploration of systematic reviews demonstrates, in more detail, the limitations of literature in this field and illuminates the need for caution in applying any findings to health care planning and in particular to the young, veteran amputee population.

Two key literature reviews exploring the experiences of civilian prosthetic limb users (Hafner and Sawers, 2016; Samuelsson et al, 2012), cite methodological rigour, poor sample size and lack of comparable interventions or outcome measures, as barriers to greater understanding of the value of microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs. Both reviews demonstrate sound methodological rigour and provide a comprehensive outline of the literature cited. Hafner and Sawers 2016; reviewed 27 publications from 240 that explore the use of microprocessor controlled prosthetic limbs in non-vascular amputees. As such, their population may be representative of military service men and women in terms of mechanisms of injury. However, investigation of their cited publications demonstrates a propensity towards older amputee populations that may not be representative of the demographics of veteran amputees.

Hafner and Sawers' (2016) identified potential sources of bias resulting from:

- Inequalities between the periods of gait required for data collection.
- Incompatible data, for example, data collected during treadmill training versus outdoor ambulation.
- Failure to consider adaptation of gait and function in response to increased confidence and ability.

Samuelsson et al (2012) concur, citing a difference between efficacy (found under ideal circumstances) and effectiveness (in reality). They go on to discuss the inability of the available literature to support clinical decision making on the grounds that it required further, real-life trials that were challenging to complete.

Patient-centred care

Sawers and Hafner (2013: 295) stated that '… further investigation into … preferences among individuals with transfemoral amputation is warranted to better understand the social, physical and psychological characteristics associated with prosthetic knee preferences'. Even within literature that does acknowledge wider issues, there is still a tendency to focus objective measures of function (Parker et al, 2010; Hafner et al, 2016; Lansade et al, 2018). Parker et al (2010), for example, compared ambulation in a clinical environment with real living, in order to explore 'real experiences' of microprocessor controlled prosthetic limbs use, but still failed to explore the patient's purpose for ambulation in developing 'real' situations.

Through investigation, it seems apparent that there is a lack of clear understanding of the impact of microprocessor controlled prosthetic limbs on wider life. In order to understand factors that impact on health, and ultimately cost, a greater understanding of individual need is necessary.

In terms of the veteran amputee population, the psychological impact of injury, discharge from service and the need for long-term adaptation to civilian life, creates complex additional factors that may have an impact on prosthetic prescription. From anecdotal evidence, the author has become aware of situations in which veteran amputee lifestyles, home circumstances and hobbies have required simple, easy to maintain prosthetic limbs, in direct contradiction to the expected desire for higher performance microprocessor controlled prosthetic limbs. These cases supported the importance of factors, not related to ambulatory performance, within the prescriptive process. As a consequence, this pilot project was developed to begin an initial exploration into patient justification for prosthetic choice. The study aims to explore whether subjective statements, justifying a patient preference for microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs, involves themes other than functional improvement.

Methods

Study design

This was a small-scale, pragmatic pilot study, using the available data from a veteran prosthetic centre in the UK. As part of the ongoing review and maintenance of prosthetic limbs for this population, service users are able to request changes to their prosthetic limb prescription, through a process involving clinical trial and objective measurement of the performance of a new limb, individual patient completion of a request form stating their preference of limb, and a supporting (or otherwise) statement from the attending consultant. Numbers of service users participating in this process at each veteran centre are small. However, the inclusion of patients' subjective statements of preference was thought to provide an opportunity to explore whether themes

other than that of functional performance, were important. This study, therefore, hoped to underpin later, larger-scale investigations.

The aim of the pilot study was to explore whether subjective statements, justifying a patient's preference for microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs, involved themes other than functional improvement.

Study objectives were to:

- Identify whether functional improvement underpinned choice in prosthetic prescription.
- Identify any arising, common themes that underpinned justification for microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs.

Data set

The accessed secondary data referred to a sample population of 15 non-serving veteran amputees, attending a veteran, prosthetic centre for the ongoing maintenance and replacement of their prosthetic limbs. Patients were entitled to apply for a change in limb, following individual, clinical evaluation of performance, comparing existing prosthetic limb with alternative provision. Following on from successful clinical evaluation, patients were asked to independently write a brief statement, justifying their preference of limb. Further supporting (or otherwise) statements would then be completed separately by the lead consultant and submitted alongside clinical performance data and patient statements, to a review and funding board. The author was provided with access to the application statements of the individuals and the consultant, along with basic background information relating to current functional ability levels, demographics and levels of amputation. As such, data was anonymised and limited primarily to qualitative statements. The author was not privy to the details of clinical performance trials. However, it was made clear that application was only advocated, following successful clinical trials with the requested limb; demonstrating significant improvements in outcome measures, including speed and distance of ambulation and functional performance upon stairs and ramps. The researcher was not involved with participants, data collection processes, the writing of referral reviews or the decisions made regarding prosthetic prescription.

Sample

Data was collected from 15 patients, who were engaged with the applications process within a 2-year period. All participants had demonstrated significant improvement during clinical evaluation of performance with a new, microprocessor controlled prosthetic limb, compared with previous prosthetic. All participants were under the care of the same lead consultant and the same evaluation team.

Data collection

Personal statements formed a qualitative data set, suitable for thematic analysis in order to establish common arising themes (Kumar, 2014).

The author reviewed and recorded individual statements, in preparation for thematic review. All statements provided subjective reasons for prosthetic preference and, therefore, were included in the sample. Consultant comments focused on quantitative performance during clinical evaluation or repeated individual reasons for application. These comments were, therefore, excluded from the data set as they offered no additional, relevant data. No inclusion/exclusion criteria for patient statements were considered, due to the limited quantity of available data, and the pilot nature of this study.

Data analysis

Themes were identified from the personal statements using manual coding. Due to the limited size of the qualitative data set, complex computer analysis such as NVIVO was unnecessary. Thematic development was moderated by a colleague external to the study.

Ethics

Ethical approval was sought and granted from the Faculty Ethics committee at the researcher's University. Written permission to access the relevant secondary data was granted by the Trust Research and Development Department, and the clinical lead consultant for this project. All secondary data was anonymised before review.

Results

Background information

Of the sample population (*n*=15), amputees ranged in age from 23 to 51 years of age, with a mean age of 34.7 years and a median age of 31.5 years. All participants were male. With regards to functional ability, all participants were experienced users of prosthetic limbs, having a minimum of 2 years' prosthetic wear before assessment. Functional levels were indicated using the Special Interest Group in Amputee Medicine (Ryall et al, 2003) and K classification (Borrenpohl et al, 2016) validated scales. All participants had very high functional ability at level K4 and Special Interest Group in Amputee Medicine levels E or F (*Table 1*).

Table 1. Meaning of Special Interest Group in Amputee Medicine and K-classifications relevant to this study

K4	Patient has the ability or potential to ambulate in excess of basic needs, and is able to exhibit high impact, stress or energy levels
Special Interest Group in Amputee Medicine E	Patient is able to walk 50 metres or more without walking aids with an expectation to improve in adverse terrain or weather
Special Interest Group in Amputee Medicine F	Patient walks normally

Of the 15 participants, six participants were single amputees, while eight were double amputees and one was a triple amputee. Over half of those participants with more than one amputation experienced transfemoral amputation on one lower limb and transtibial on the other. The remaining double or triple amputees experienced other significant injuries to lower limb or trunk structures, impacting on movement ability. Injuries were primarily sustained in active duty within the Iraq and Afghanistan conflicts.

Themes

Qualitative data was available for all 15 participants. Following thematic analysis, five overarching themes were identified:

- *Functional changes* – considered as a change in physical movement and/or ability
- *Impact on lifestyle* – a change in performance in work, family engagement/activities and/or hobbies

- *Psychological impact* – any impact that involves a change in the way the individual feels or upon their emotional state
- *Practical changes* – such as changes in battery duration, portability, charging, weight, waterproofing
- *Cosmetic considerations* – comments about the way the limb looks.

Table 2 illustrates the numbers of participants commenting within each theme. While content analysis of data was not an objective of this study, the frequency of reference to specific themes within the qualitative data set was felt to be useful in illustrating the extent of particular issues, raised within applications for prosthetic limbs.

Table 2. Numerical data identifying numbers of participants responding within each qualitative theme

Themes	**Number of respondents**
Functional changes	14
Impact on lifestyle	14
Psychological changes	10
Practical differences in the leg (such as waterproofing or weight)	13
Cosmetic considerations	9

The results from the qualitative data set demonstrate a focus not only on functional performance, but also on a further four themes. While a number of the statements made were very straightforward, and made direct reference to one or more of the themes, more complex statements were more commonplace and demonstrated integration of themes. Specific statements are explored below in the following sections.

Functional changes

Numerically, the data suggested a predominant interest in improvements to functional outcomes. Nearly all participants made mention of functional change within their applications for a microprocessor controlled prosthetic limb and the impact on lifestyle. Many of these statements were quite straightforward with participants (P) 5, 7 and 9 outlining how the new limb improved their walking speed, duration of wear and/or endurance. However, most included reference to how functional changes impacted upon lifestyle within work or home. For example, P2 stated that the ability, '*to negotiate small spaces … is good',* and goes on to reference his working environment. However, he also comments that it allows him to *'safely carry'* his small son around the home and outside. Thus, separation of functional performance and its meaning to 'life' becomes challenging and illustrates the limitations of functional measures that focus on only one aspect of performance within a clinical environment.

Cosmetic

Of interest, nine participants commented upon the cosmetic nature of the limb. However, comments were primarily orientated around the limb being less bulky and/or less 'technical looking' (P11), rather than whether the limb was natural or less objectionable to others, as could be expected from previous research in this field (Murray, 2009; Sansoni et al, 2015).

Practical

Comments regarding practical changes included reference to the waterproof nature of the limb (P6 and 10) and the duration of the battery life (P11). However, similar to functional changes, most comments integrated practical changes with statements about 'why' a practical change was important. Participant 12 for example, outlines how the variable resistance to flexion of the microprocessor controlled prosthetic knee that he preferred, allowed him to *'rest the good leg'.* More specifically, he felt that:

'Shaving is a lot more comfortable with the new limb as it allows me to shave while weight bearing through both legs … shaving previously involved standing on my good leg and was tiring, uncomfortable and caused breakdown in my stump at times'.

He goes on to state that *'back pain overnight as a consequence of walking during the day is also no longer a problem'*. This clearly illustrates the integration of both functional and practical differences in limb is more than just performance and highlights the personal nature of functional performance to the individual.

Anecdotally, the author has met with individuals who have made similar statements in reference to 'leaning against a wall' during meetings. The act of leaning in order to relieve stress on limbs is second nature to most individuals. However, when only one limb is capable of supporting this position, the restorative value of this action is negated. P1 and P5 also support the bilateral nature of microprocessor controlled prosthetic limbs as, '*reducing pain in other limbs and the back after use'*, as the locking and resistive knee in some modern microprocessor controlled prosthetic limbs allows for bilateral stance, unlike older non-microprocessor controlled limbs.

This importance to participants of this study, exposes the limitations of current outcome measures in evaluating the benefits, or otherwise, of different limbs. For an individual for whom 'leaning against a wall' in order to attend meetings is paramount, measures of distance walking or function on stairs becomes meaningless. The implications of performance changes upon life, personal wellbeing and medical complications becomes clearer when the individual 'story' is considered, rather than just objective measures of improvement.

Lifestyle

While statements throughout varied in complexity and the degree of integration, a number provided greater insight into the impact of microprocessor controlled prosthetic limbs upon 'health' in its broadest classification (WHO, 2001).

Participant 1 commented that the microprocessor controlled prosthetic limbs has improved his ability to:

'*engage with hill walking….and as it is waterproof, it supports all weather walking with the wife*'.

This illustrates the connections between function, practicality, lifestyle and now family. While not all participants made comments about family, many referenced friends and social interaction, which underpins recognition of the psychological importance of prosthetic limbs.

Table 3 below paraphrases the more complex comments made within personal statements and demonstrates the challenges with separating comments into individual themes.

Table 3. Key qualitative comments from personal statements illustrating complexity within perceptions

Participant number	Comments from personal statement
P1	The microprocessor controlled prosthetic limbs has improved the ability to '*engage with hill walking … and as it is waterproof, it supports all-weather walking with the wife*'.
P2	The ability to negotiate small spaces … is good, not only for the working environment, but also allows him to '*safely carry*' his small son around the home and outside. The microprocessor controlled prosthetic limbs *'reduces pain in my other leg and in my back'*
P3	He has taken his children swimming and has had to '*shuffle to the side of the pool on his backside'*. This has been '*undignified*' and that the waterproof microprocessor controlled prosthetic limbs will allow him to '*walk to the side of the pool with his children with dignity*'.
P4	He requires a limb that is *'stable and can function in dusty, wet and dangerous environments ... it has the added benefit that I can play outdoors and swim with my children'.*
P8	*'The showers in many accommodations … are often old, communal and not always clean. Until now I've had to go in to the showers on my backside ... this is embarrassing with the lads, dirty and carries an infection risk among other things'.* He emphasises the importance of the microprocessor controlled prosthetic limbs in allowing him safer and more hygienic access to basic functions, and in enabling him to go in to communal showers '*like a man'*.
P12	The microprocessor controlled prosthetic limbs allows him to *'rest the good leg'.* In particular, P12 comments that *'shaving is a lot more comfortable with the new limb as it allows me to shave* while *weight bearing through both legs … shaving previously involved standing on my good leg and was tiring, uncomfortable and caused breakdown in my stump at times'* He goes on to state that *'back pain overnight as a consequence of walking during the day is also no longer a problem'*.

Psychology

Participants, 2, 3, 13 and 14 all commented on the importance of being able to pick up or carry children. As such, function is inextricably linked with daily living, and the role of emotive influences is highlighted. This is further supported by P4 who stated that he requires a limb that is, '*stable and can function in dusty, wet and dangerous environments … it has the added benefit that I can play outdoors and swim with my children'.*

This combination of career and home life, illustrates the interconnection between function, employment, lifestyle and emotion. At present, measures of performance used in assessment focus on function. However, for example, a measure of performance in ascending or descending stairs, while functional, does not reflect the application of this activity when carrying an unpredictable, moving load (ie a child). A lack of awareness of the context of application of outcome measures makes them a guide at best.

From a psychological perspective, P3 provides an unexpected insight, discussing how he has to normally, '… *shuffle to the side of the pool on his backside'.* He goes on to highlight how this is *'undignified'* and that the waterproof microprocessor controlled prosthetic limbs will allow him to, '*walk to the side of the pool with his children with dignity'*. Focusing on his lack of dignity in everyday activities such as swimming with the children demonstrates how, while function is indeed important, it is the impact on wider factors for this individual, that makes the difference to his life.

While swimming legs can be prescribed for keen swimmers, production companies continue to struggle to balance functionality while swimming with the ability to ambulate safely and 'normally' poolside (Crotti, 2018).

Dignity features strongly in the current '6 Cs' of health care (Cummings and Bennett, 2012) supported by the Nursing and Midwifery Council's Code (Nursing and Midwifery Council, 2016). Recognition of the right to dignity is also featured more widely in the underpinning tenets of human rights (United Nations General Assembly, 1948). As such, it would seem an important factor for consideration within prosthetic prescription and rehabilitation.

The importance of dignity is further illustrated by P8, whose sporting activities involve international travel and stay. He states that, *'The showers in many accommodations … are often old, communal and not always clean. Until now I've had to go in to the showers on my backside ... this is embarrassing with the lads, dirty and carries an infection risk among other things'.* While he emphasises the importance of the microprocessor controlled prosthetic limbs in allowing him more hygienic access, his statement, that it allows him to *'shower…like a man*' provides a rich illustration of dignity in life. While his statement encompasses both dignity and practical infection control, it is perhaps the picture that is created by his statement that is more important. The concept of entering dirty, communal showers with a group of other men in the manner described could be considered to be inhumane and contradicts the principles of 'health care' within the UK. The potential for a change in prosthesis to facilitate a dignified shower becomes vitally important in consideration of the individual.

While health care professionals are charged with upholding the professional values and standards of governing bodies in working practice (Health and Care Professions Council, 2012), it is questioned whether this is sufficient, when considering individuals' needs that move outside of the capabilities of functional outcome measures.

For example, wanting a prosthesis in order to facilitate entry to a swimming pool or shower area generates challenges for the rehabilitation team. From professional experience, planned therapy will be variable and is likely to range from rehabilitation of balance over uneven surfaces, to consideration of getting in or out of a pool or negotiation of slippery surfaces. However, what is unlikely to be considered is the context in which this will take place. The ability to balance on a prosthetic leg is paramount, but the mechanisms by which this is achieved need to change when bending to wash your hair for example, or rotating to help a child into the pool. These variations on a movement pattern necessitate different muscle activity and combinations of movement sequences and, therefore, require different advice or rehabilitation. Understanding the individuality of living can generate much greater empathy and, therefore, facilitate a much more effective approach to care.

Discussion

Representation

While the sample was small, background data indicated that participants were representative of veteran amputee populations post Iraq/Afghanistan conflicts regarding their demographics and levels of injury (Howard et al, 2019). In addition, the presence of more than one amputation (more commonly seen within veteran amputees in comparison with civilians) impacts significantly on function, greatly amplifying issues associated with energy expenditure, comorbidity onset and the development of complex adaptive movement strategies (Ladlow et al, 2019). The presence of other combat-induced injuries also complicates the process of ensuring comfortable and high functioning prosthetic prescription.

While young civilians who become amputees as a result from traffic accidents, for example, are arguably representative of the same demographic age, their level of physical fitness and sense of identity differs from that of previously serving military personnel (Messinger, 2010; Carless, 2014) Thus, this sample is representative of individuals with differing requirements of a prosthetic limb, from traditionally researched amputee populations.

Impact

Overall, the results from this study illustrate variation in influential factors between participants and the need for consideration of individuality within health. The *International Classification of Function, Disability and Health* (World Health Organization, 2001) underpins the NHS constitution (Department of Health, 2009), and emphasises the role of not only physical but also participatory, environmental, social and psychological factors in the definition of health. As such, it advocates acceptance of factors such as leisure time and dignity as acceptable inclusions with that definition.

Ultimately, it is difficult to contemplate how the value of a limb in enabling a father to carry his son safely down the stairs can be measured. However, financial constraints within the NHS challenge the ability of the existing health service to meet wider needs without objective demonstration of value. As the NICE guidelines for prosthetic care have demonstrated (NHS England, 2016), a focus is placed on functional performance rather than the impact of that performance on engagement with living. A lack of understanding not only limits health care for this population, but also potentially incurs unnecessary costs.

Recommendations for further research

The results of this pilot project illustrate the need for larger scale, in-depth investigation into the underpinning emotional and social factors impacting upon ‘prosthetic health’. While this study focused on the unique characteristics of veteran amputees, consideration of wider ‘life’ influencing factors for all amputees is advised. In the context of rehabilitation, understanding the limitations of objective measures in fully illustrating individual need is essential to develop effective and meaningful rehabilitation strategies for patients with amputations.

Limitations

Limitations of the size and population for this study advocate care in generalising to a larger population. The uniqueness of this population in terms of demographics and physical fitness makes generalising the results from this study to civilian amputee populations inadvisable.

While the use of a framework to underpin qualitative investigation ensures rigour, the small sample size and limited quantity of information within this study prevents effective application of criteria such as those outlined in COREQ (Tong et al, 2007). Further research within this area would endeavour to apply more rigorous investigative approaches.

Conclusions

This study aimed to explore whether subjective statements, justifying a patient preference for microprocessor controlled prosthetic limbs over non-microprocessor controlled limbs, involved themes other than functional improvement. Overall, issues associated with the need for recognition of wider psychological, social and environment factors have been identified. Understanding these factors is essential in providing an effective prosthetic service rather than being constrained by outcome measures. From the author’s perspective, it would seem that a greater understanding of

factors that are of importance to an individual amputee would enable a more effective prescriptive service, would provide appropriate limbs according to appropriate need, and would potentially facilitate accurate distribution of what are currently limited funds.

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