



Step Count Levels during Rehabilitation of British Military Amputees – A Pilot Study

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Summary

Objective: The purpose of this pilot study was to ascertain the step count levels in lower-limb amputees within the British Armed Forces, both during and away from in-patient rehabilitation. The primary question was whether the mean daily step count changed when the amputee left the controlled rehabilitation process.

Results: 10 participants completed the study. The change in step count levels between in-patient and out-patient blocks was found to be significant ($p=0.004$) with a mean of 2296 +/- 1045 steps per day as an in-patient and 1354 +/- 715 steps per day as an out-patient. All participants were within three years of injury and 9 of the participants who completed the study were bilateral lower-limb amputees.

Conclusion: The results indicate a statistically significant drop in step-count levels between in-patient and out-patient blocks of data. However, this data gives an indication of what step count level can be achieved by multi-trauma amputees in the first three years of injury.

Introduction

Amputees within the British Armed Forces are primarily young (18-35 years of age) and have sustained their injuries through traumatic causes. They are a relatively small population, at the present date numbering approximately 300. This is in direct comparison to the amputee population on which research in the United Kingdom is more commonly carried out; that of the National Health Service (NHS) population where in 2006/7 there were over 4500 new referrals to the prosthetic services, the median age of these new referrals was over 65 and only 7% of the population had an amputation as a result of trauma (NHS Scotland, 2009). It has been suggested that the outcomes of younger patients who undergo amputation for trauma or cancer cannot be compared with the outcomes of diabetic patients and their associated co-morbidities such as cardiac disease, peripheral vascular disease and/or renal failure as these two groups have different expectations (Attinger and Brown, 2012).

Evrivades et al. (2011) stated that the hallmark injury for the conflict in Afghanistan is a blast injury produced by the improvised explosive device (IED), which causes a heterogeneous mix of sharp, blunt and penetrating trauma, unstable physiology, complex bony and soft-tissue defect, unusual infections, limited reconstructive donor sites, peripheral nerve injuries, traumatic amputations and later, heterotrophic ossification. Nonetheless, as discussed by Tintle et al. (2010), combat servicemen are young, previously healthy, and have the potential to rehabilitate to very high levels of activity.

As discussed by Dudek et al. in 2008, accurate monitoring of ambulation levels has the potential to facilitate better care of the amputee by assisting clinicians and researchers to prescribe and choose therapies, measure the effects of interventions, choose the most appropriate prosthetic components and predict post-amputation abilities. There is, therefore, a need to obtain objective measurements of the amount of activity carried out on a daily basis by military amputees to facilitate the Prosthetists choice of componentry and the clinical justification for funding. This could also potentially direct future prosthetic research and development and indeed more accurately direct the amputee rehabilitation programme.



Method

A convenience sample was used that utilised all of the mobilising lower-limb amputees admitted to the rehabilitation centre between Dec 2011 and March 2012, who were interested in the study and met the inclusion criteria.

Inclusion criteria:

- Participants were current serving military personnel with at least one lower limb amputation.
- Admitted to the Complex Trauma Team at DMRC Headley Court for rehabilitation.
- Participants were more than one month post delivery of primary prosthesis/prostheses. This time-scale was used to facilitate the fine-tuning of initial fit and comfort of the prosthetic socket, and allow the training required to enable the amputee to start using the prosthesis/prostheses.
- Where the participant was a unilateral lower-limb amputee, the remaining leg had to be able to at least partially weight-bear to allow walking.

A Long-term Activity Monitor 2 (LAM2™) was fitted to each set of prostheses used by each participant during a normal Prosthetics appointment. The amputees then continued to use their prostheses as normal for two weeks during the admission period and the consecutive two weeks of home leave. The LAM data was downloaded at the next Prosthetic appointment following this time period.



Results

All amputees accepted onto the study sustained injuries as a result of improvised explosive device (IED) blasts over the last three years. All were male and walked independently without walking aids, with the exception of one unilateral trans-femoral amputee (TFA) who used a walking stick. Of the 20 participants accepted onto the study, a drop-out rate of 50% was seen due to short-notice surgery, illness, changes to admissions, five faulty monitors and one participant having their monitor confiscated at an airport!

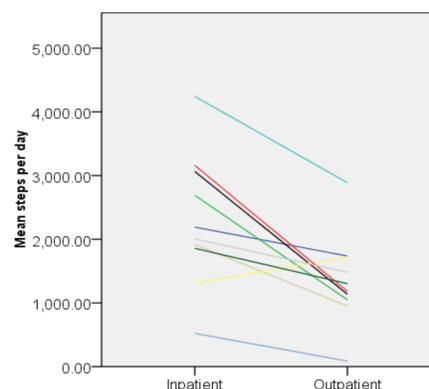
The following table describes the demographical data of the 10 participants:

	Age (years)	Time since Injury (months)	Time on Prosthesis (months)	Original height (cm)	Body Mass (kg)
Mean+/-SD (range) for participants	27+/-5 (20-35)	17+/-9 (2-30)	14+/-8 (1-24)	181+/-6 (172-190)	79+/-10 (56-91)

Those participants who completed the study were:

- One single transtibial amputee (TTA)
- Four bilateral TFA or knee disarticulation amputees (KDA)
- Two bilateral TFA/TTA
- Three triple amputees; two bilateral TFA + an upper limb amputation, one TFA/TTA + an upper limb amputation

The following ladder plot shows each participants mean in-patient and out-patient step counts:



The paired t-test calculation for in-patient versus out-patient pairs of data showed significantly more steps were taken as an in-patient than as an out-patient ($p=0.004$). On average, 942 +/- 771 more steps were taken as an in-patient (2296 +/- 1045) than as an out-patient (1354 +/- 715).

Of the 10 participants in the study, five had a clinically significant drop of 50% or more of their mean steps per day. Of those five participants, three had reported issues that they felt had caused a decrease in the amount they were doing; one with a bruised residual limb, one doing an adventurous training holiday and one with an office job.

Discussion

Although this pilot study only analyses step count, it does call into question some of the alternative physical activities that should also be considered when discussing functional outcomes of rehabilitation. This was demonstrated by the findings that one participant was already using running prostheses and went adventurous training during his hospital sick leave; another amputee went skiing during his hospital sick leave; whilst another participant returned to his unit to do an office-based job.

It must be remembered though that step count levels are only a small part of a complicated picture with regard to functional outcomes in this patient population. However, this pilot study does begin to give some indication of the step count which young, traumatic, often bilateral amputees can achieve during their first three years after injury.



References

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