The Effect of Early Mobilization in Transtibial Amputees with an Unhealed Residuum—Detrimental or Beneficial to Patients: A Review of Literatures

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ABSTRACT

Objective: To systematically identify and summarize literatures on early mobilization of transtibial patient with unhealed wound or ulcers.

Setting: Published literatures up to and including December 2017 where transtibial amputee with unhealed wound or ulcers and the effect of mobilization on wound healing and rehabilitation were reviewed.

Participants: Lower limb transtibial amputees with primary or secondary wounds were followed up to see if mobilization was detrimental or beneficial to wound healing.

Results: A total of 1,250 literatures were identified from search database of MEDLINE, PubMed, Google Scholar, and Ovid. Duplicates were removed and 12 abstracts were screened. Seven full-text articles were assessed for eligibility, and two literatures were felt to meet the prescribed criteria. Both literatures were from the United Kingdom, and both literatures showed that there was no detrimental effect of early mobilization in patient with large unhealed wound or ulcers.

Strength and limitation of this study: Very few published literatures on the effect of early mobilization results in a small sample size. This highlights the need for more similar studies to be carried out. Only one reviewer performed the analysis, creating potential biasness.

Keywords: Amputee, Mobilization, Transtibial, Unhealed wound.

INTRODUCTION

In the United Kingdom, the cause of 70 to 80% of lower limb major amputation is vascular insufficiency (Peripheral arterial disease, PAD, with or without Diabetes mellitus). Any amputation above the ankle level is considered “major”1,2. The prevalence of transtibial amputation is slightly more than 50%, and higher than transfemoral level. In the United Kingdom, the national prevalence of lower limb amputation is 5/100 000, about eight times higher in diabetics than in non-diabetics, three times higher in men, higher in the Afro-Caribbean population, and lower in South East Asians. Smoking is the most important modifiable factor with a four-fold greater chance of developing intermittent claudication. The PAD with smoking has more chance of amputation and three times higher failure rate of surgical bypass graft.

The healing rates for below- and above-knee amputations vary considerably. It is thought that a total of 90% of above-knee major amputations heal, 70% primarily, whereas for below-knee amputations, primary healing rates range between 30 and 92% (about 1 in 3), with a re-fashioning rate of up to 30% (about 1 in 3).2,3

Mobilization early post-surgery is known to be essential to aid the rehabilitation process and prevent complications, such as contractures (shortening due to secondary change) or deconditioning of muscle, which will make the rehabilitation process complicated in the future. In ideal situations, patients wound would heal around two weeks post amputation4 and the patient would be able to carry out his or her rehabilitation process by using early walking aids. There are, however, no set guidelines or protocol on when would be the ideal time to commence walking training, should the wound fail to heal at this set period of time.1,4 Ulcers are a recognized complication in new and established prosthetic limb users as a result of pressure on bony prominences and sheer forces.5 Concern arises among physicians when is the ideal time to mobilize both these groups of patients, especially among juniors, if the unhealed wound or ulcer is large. Therefore, most physicians tend to take the conservative approach of “watching and waiting” instead of mobilizing the patient, as this is very much part of traditional medical teaching and natural caution.1 The question is therefore...
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MATERIALS AND METHODS

Search Strategy

A systemic search of MEDLINE, PubMed, Google scholar, and Ovid was conducted up to and including December 2017. Search keywords include “transtibial”, “amputee”, “unhealed wound,” and “mobilization”. Only the top 50 papers on Google scholar were screened to see if it meets the inclusion criteria. Search results were limited to English language. References from the identified paper were further reviewed to see if they meet the inclusion criteria.

Inclusion and Exclusion Criteria

An unhealed wound was defined as anything more than 1 x 1 cm, 2 weeks post-surgery. An ulcer was defined as a break in the skin, which was previously healed or never healed with primary intention, in a new or established amputee. A healed wound was defined by complete closure of wound or ulcer. Smokers, vasculopathy and diabetics with associated microvascular disease, sensory neuropathy, or both, although recognized as factors which would delay wound healing, were included in the inclusion criteria as most amputees in the United Kingdom arise from these cohorts of patients. Literatures which included transfemoral amputees were included in view of the limited published data. Literatures which looked at the effect of early mobilization in post-amputee, but did not have an unhealed wound or ulcer were excluded. Literatures which looked at the effect at the effect of different management of wound healing, such as different types of dressing or prosthesis, but not the effect of mobilization on wound healing, were not included.

Study Selection Process

The titles were independently examined by a single reviewer (LC). Abstracts from titles which meet the inclusion criteria were reviewed in which the full text was subsequently reviewed to see if the article meets all the inclusion criteria. The reference list was also examined with additional papers included by the same criteria. Literatures on the effect of early mobilization in below knee amputees with no wounds were rejected (Flow Chart 1).

Quality Assessment

There was no suitable tool to grade the quality of included literature, and thus it was performed on an objective basis by the reviewer (LC), based on semi-objective assessment of factors influencing the generalizability, raising the risk of bias and reporting quality of included literatures.

RESULTS

The initial search revealed ten published papers on PubMed, twenty-four published papers on Ovid, zero relevant papers on MEDLINE, and 1,250 on Google scholar. Only the top fifty papers on Google scholar were screened and in which nine were identified as possibly relevant. Duplicated papers were removed, and after a full-text examination of five articles, only two were noted to be relevant.

Flow Chart 1: Study selection and methodology

- Literature identified through database searching (n = 1250)
- Duplicates removed (n = 1247)
- Abstract screened (n = 12)
- Full-text articles assessed for eligibility (n = 7)
- Articles included in synthesis n = 2
  1 clinical study
  1 observational study
Two studies from the United Kingdom were identified. A total of 188 transtibial and transfemoral amputees with an unhealed wound or ulcer were included (118 sizes ranging from 60 to 10 patients included). Each paper used a different walking training approach (Van Ross et al. used a Pneumatic Post-Amputation Mobility (PPAM) aid for approximately three weeks, before providing a transfemoral prostheses, while Salawu et al. continued with the patient's own prostheses, which was modified to reduce pressure on the ulcer). The mean age of study participants ranged from 60 to 62.8. There was no age limit set in both papers. One study looked at unhealed wounds in new transtibial amputees, while the other studied both unhealed wounds and ulcers in both transtibial and transfemoral amputees.

Both studies had high completion rate (90 and 92.1%). Van Ross et al. continued to follow up on the group of patients that fell out from the study (10%). Salawu et al. acknowledge in his paper that further studies should be performed to review the group of patients who were not put under pressure to heal. Smoking status which is a recognized factor to impair wound healing was considered by Van Ross et al., where smokers were noted to improve after therapy. For non-smokers, the mean TcpO2 levels of smoking was evident when the mean TcpO2 levels of smokers were noted to improve after therapy.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Conditions</th>
<th>Origin</th>
<th>Design</th>
<th>Patients included</th>
<th>Measures used</th>
<th>Results</th>
<th>Summary</th>
<th>Pros + and cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van Ross et al</td>
<td>Primary wound breakdown</td>
<td>United Kingdom</td>
<td>Clinical trial on new TT amputees of dysvascular origin with unhealed wound mobilised using PPA Maid over 3–6 weeks</td>
<td>66 new TT amputees</td>
<td>Mean age 62.8 ± 10.89</td>
<td>46% male, 54% female</td>
<td>90% completion rate, 74% achieved complete healing after 141 days (baseline stump wound 7.4 ± 3.2 cm × 3.5 ± 2.4 cm, 8% failed to heal, progressing to TF amputation, longer healing time in smokers (196 ± 142d vs 200 ± 123d)</td>
<td>Complete healing with no adverse effect to stump or general health</td>
</tr>
<tr>
<td>Salawu et al.</td>
<td>Primary and secondary wound breakdown</td>
<td>United Kingdom</td>
<td>Observational study on new and established prosthetic limb users with unhealed wound or ulcers divided into 3 groups:</td>
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<td>- Discontinue usage of prosthetic limb</td>
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<td>- Relatively small sample size</td>
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<td>- Continue usage of limb with</td>
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<td>- Stepping stone for further studies to be conducted</td>
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<td>cotton socks</td>
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<td>- Objective measurements of ulcer size</td>
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<td></td>
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<td></td>
<td>- Continue usage of limb with</td>
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<td>- Subjective assessment by patients themselves if prosthetic limb usage has been &quot;less&quot;, &quot;more&quot; or &quot;as usual&quot;</td>
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<td></td>
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<td>silicone sleeve</td>
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<td>- Did not look into smoking or vascularity status of patients</td>
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<td>followed over a period of 6 weeks</td>
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<td>- No follow up on patients who fell out of the study</td>
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Table 1: Suitable literature review
DISCUSSION

Both studies showed that despite an unhealed wound or ulcer, early mobilization is not detrimental to the wound but highly beneficial in the transtibial amputees’ rehabilitation process. This new method of management of unhealed wound would potentially lead to lower rates of muscle deconditioning, and contractures developing, as well as accelerated wound healing. Van Ross et al4 also showed that it improves early phantom pain and sensation relief as well as treat the edema of the residuum.

Both studies are relatively small in size and further studies should be undertaken to see the long-term effect of early mobilization on how patient’s mobility improves in the long run. The frequency of physiotherapy and type of dressing should also be looked at. Factors which affect wound healing, such as smoking, dysvascularity, and glycemic status should be taken into consideration. The Specialised Ability Centre in Manchester, which is a sub-regional center for amputee and prosthetic rehabilitation in the United Kingdom, has considerable experience in early mobilization protocol and in near future, we will publish our data.

REFERENCES