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Review article

The effectiveness of acupuncture/TENS for phantom limb syndrome. I: A systematic review of controlled clinical trials

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Abstract

Introduction: Phantom limb pain (PLP)/phantom limb sensation (PLS) is common in amputees and difficult to treat but either acupuncture or transcutaneous electrical nerve stimulation (TENS) may provide relief. A systematic review of controlled studies was carried out to explore clinical effectiveness, cost-effectiveness and adverse effects of these treatments on PLP/PLS.

Method: Literature searches were carried out using 18 databases (inception – February 2013). Reporting quality and risk of bias of controlled studies were assessed by independent reviewers.

Results: In two controlled studies, acupuncture significantly improved pain compared with usual care (visual analogue scale 0.17 ± 0.804 vs. 1.82 ± 1.919, $p < 0.05$; visual rating scale 1.45 ± 1.52 vs. 1.81 ± 2.22, p: not reported); two studies using TENS showed significant improvement in pain compared with sham TENS (pain rating index total $F(1.31) = 7.48$, $p < 0.01$; pain complain 0/12 vs. 7/12). One study showed better pain relief with TENS stimulation at stumps than stimulation on contralateral side. The reporting quality and methodological quality of controlled studies are critically discussed.

Conclusion: There is some evidence for the use of acupuncture and TENS for the treatment of PLP/PLS but insufficient high quality evidence is available. No studies evaluated cost effectiveness or adverse effects.

Keywords: Phantom limb pain; Phantom limb sensation; Phantom limb syndrome; Acupuncture; Transcutaneous electric nerve stimulation; Systematic review

Introduction

Phantom[2] limb pain (PLP) is the pain that results from where an amputated limb was previously located [1]. It is always positively associated with non-painful phantom phenomena/sensation, residual-limb pain/stump pain, and non-painful residual-limb phenomena/sensation [2]. These phantom complexes usually coexist and are difficult to separate [3] and affect up to 85% of amputees [3–7], with [3]phantom limb sensations (PLS) [8], experienced by most patients, followed by PLP and stump pain [5,6]. Extremely bothersome pain is thought to be experienced by 25% PLP sufferers, with depression closely linked [9].

The underlying mechanisms of this pathological pain requires further clarification. It is generally accepted that a series of neuropathic mechanisms are involved [10,11], including sensory cortical reorganization and adaptation within both peripheral [12,13] and central nervous systems [14–16] after amputation.

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[1] http://www.lsbu.ac.uk/.

[2] According to International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD 10), G54.6 represents PLP.

[3] G54.7 represents PLS.

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Physical factors or psychological factors may also affect the severity of the pain [3,17].

It is a condition that is difficult to treat, with few mechanism-based treatments, and only a few treatments with positive outcomes [18,19]. Conventional treatments include medications, anaesthetics, psychological interventions and, in severe cases, surgical revisions [3]. However, it is reported that less than 10% of patients receive lasting relief from prescribed medical treatments [20]. Most research has focused on conservative treatment – one survey claimed that non-surgical treatments were perceived more effective compared to surgical ones [19]. Opioids, ketamine, lidocaine, sensory discrimination training and TENS were suggested by Flor, as controlled studies demonstrated reduction in PLP [3]. However there is a general lack of controlled clinical trials.

Acupuncture has been shown to be effective for various chronic pain conditions [21–24]. Various studies have investigated the mechanism of acupuncture action in the central nervous system (CNS) [3,24–26]. It has been suggested that acupuncture evokes complex somatosensory sensations, which may modulate the cognitive and affective perception of pain [27]. These effects are mediated by the brain and extending CNS networks [25,26]. In Chinese medicine theory, 'Qi' and 'blood' runs throughout the body. PLP is believed to be a result of disturbance in segment meridians, which lead to Qi disorder and blood stagnation, and finally resulting in pain. A recent systematic review using English language databases evaluated the effectiveness of acupuncture treatment in the management of phantom limb syndrome, and indicated that acupuncture may have a positive effect on phantom limb symptom [28].

TENS is also commonly used as an effective treatment for various kinds of pain [4,29]. Significant improvements in several PLP case reports and case series have been reported, although the underlying mechanism has not been demonstrated [28,30,31]. Unfortunately, most acupuncture and TENS related studies (mostly surveys, case studies and reviews) were conducted in early 1980s, at a time when the recognition of neuroactive agents was inadequate. Halbert and colleagues conducted a systematic review in management of chronic and acute PLP and recommended the use of TENS in 2002 [18]. A Cochrane review aimed to evaluate the effectiveness of TENS for PLP and stump pain in adults in 2010, but failed to identify any relevant RCTs [32]. This systematic review aimed to explore the clinical effectiveness, cost-effectiveness and adverse effects of both acupuncture and TENS treatments on PLP, for the general population, by searching for controlled studies in English, Chinese and Korean databases.

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed through all stages of the design, implementation, and reporting of this review [33]. The protocol has been registered: CRD42013003918 [34].

Data sources and search terms

The literature searches were carried out in 18 databases. The search included: MEDLINE via Pubmed, all Cochrane Library resources, CINAHL, AMED, PsycINFO, ScienceDirect, Index to Theses in English databases; and for Chinese databases; China National Knowledge Infrastructure (CNKI), VIP, Wanfang, Chinese BioMedical (CBM); and for Korean databases; Korean Studies Information Service (KISS), DBPIA, Korea Institute of Science and Technology Information, Research Information Service System (RISS), Korea Med, Korean Medical Database (KM base), Oriental Medicine Advanced Searching Integrated System (OASIS), and National Assembly Library. All databases were searched from their inception to February 2013 using the terms: 'phantom limb' or 'traumatic amputation', AND 'acupuncture' or 'TENS'. Additional search terms and strategies in different languages are listed in Appendix 1.

Study selection

Inclusion/exclusion criteria

Participants: Studies with patients in all age groups, with any causation, and any stage of PLP or PLS were included in this review. *Interventions*: Studies of ear, scalp, electro or body acupuncture; laser/catgut embedding along acupuncture points/meridians; TENS. Intervention was used as the sole treatment or as an adjunct to other treatments (if the control group also received the same concomitant treatment as the acupuncture group). *Comparisons*: Studies which measured the effects on phantom limb pain by comparing an intervention (mentioned above) with a placebo or sham, no treatment or usual care were included. *Outcome measures*: Primary: any form of pain measurement, patient reported improvement (proportion of improvement or cured); secondary: quality of life; mental conditions (anxiety, depression, sleep conditions); adverse effects; costs. *Study design*: Controlled trials were appraised and clinical characteristics extracted; *Language*: Published in English, Chinese, or Korean. *Date*: Publications from inception of to Feb 2013. *Publication status*: fully published articles.

Data selection and collection

Three authors (XH, AL, NR) reviewed the search terms and strategies; three authors (XH, GY and ML) screened and selected eligible papers. Disagreements were resolved through discussion with AL and JL to meet final consensus. Authors were not blinded to the authors' affiliations, journal of publication, or study results.

Data extraction

A spreadsheet identifying clinical characteristics of acupuncture and TENS was designed for this review. Data extracted included: authors, year published, study design, sample size; characteristics of amputation; characteristics of interventions – i.e. treatment procedure with location of intervention, TENS machine/electro acupuncture machine, acupuncture points, and