



Reflexology treatment for patients with lower limb amputations and phantom limb pain—An exploratory pilot study

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KEYWORDS

Intensity;
Duration;
Self-treatment;
Psychoneuroimmunology

Summary

Objectives: The objectives of the study were to evaluate the possibility of reflexology being used as a non-invasive form of phantom limb pain relief and of empowering patients to maintain any positive results with self-treatment.

Setting: Prosthetic Services Centre, Herbert Street, Wolverhampton, West Midlands, England

Design: A same-subject, experimental pilot study, recording the intensity of phantom limb pain in weekly pain diaries over a 30-week period, which was divided into five phases: phase 1 gave a baseline of pain, whilst phase 3 was a resting phase. Phases 2, 4 and 5 provided the reflexology interventions.

Sample: Ten participants with unilateral lower limb amputations and phantom limb pain were selected from the database at the Prosthetic Centre.

Reflexology interventions: In phase 2, six weekly reflexology treatments were given, which consisted of: full foot reflexology to the remaining foot and full hand reflexology to the hand of the amputated side of the body.

In phase 4, six weekly hand reflexology teaching sessions were carried out; patients copied on their own hands what the therapist did on hers. A hand reflexology booklet gave the sequence of the treatment and was used as a reference.

In phase 5, the patients self-treated for 6 weeks at home, using the reference material.

Results: Over the 30-week period, there was an improvement in the perception of the presence and the intensity of the phantom limb pain, with a corresponding improvement in the duration of the pain and the affect on the person's lifestyle. The improvement was maintained when the clients self-treated.

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Follow-up questionnaire: A follow-up questionnaire was carried out in 2007–12 months after the project had ended—to elicit whether the patients had suffered from phantom pain over the previous 12 months, whether they still had relief from phantom limb pain and whether they still self-treated.

Conclusions: The project indicated that reflexology treatment, teaching and self-treatment were effective in eradicating or reducing the intensity and duration of phantom limb pain, in this group of clients.

The follow-up questionnaire revealed that there was a maintained improvement in the intensity of phantom limb pain the patients experienced and that the majority still self-treated.

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Introduction

Phantom limb pain is the experience of pain in a limb that is no longer (or has never been) there. Ambrose Paré first described the phenomenon of phantom limb pain in the 16th century.¹ However, the term was actually coined by Mitchell in 1872.^{2,3}

In 1980, Berger⁴ noted that many attempts have been made to find a cure for phantom limb pain, but with varying degrees of success. Surgical techniques, such as regional sympathectomies, section of the spinothalamic tract, resectioning of neuromas and even re-amputation have been used, along with vibrational therapy. Transcutaneous electrical nerve stimulation (TENS)⁵ has been used for many years, whilst opiate drugs⁶ and the epileptic drugs carbamazepine and gabapentin⁷ are now more frequently used.

Reflexology is a complementary therapy used by health professionals in the NHS.⁸ The principles behind reflexology state that bodily structures are reflected, primarily, upon the palms of the hands and the feet soles. These reflexes lie within the 10 energy zones that run from the fingers and toes up to the head. Applying pressure to the reflexes helps the body maintain homeostasis.⁹

Many theories have been put forward as explanations of how reflexology works, such as: the electro-magnetic theory of healing, the pain gate control theory, the endorphin release (similar to TENS), the subtle energy/meridian theories, the relaxation effect, the facilitation theory and the placebo effect.¹⁰ However, the development of psychoneuroimmunology (PNI) may bring all of these theories together.

Pert¹¹ describes the actions of molecules within the body, which has a striking resemblance to the theory of reflexology. Her work helped to develop the field of PNI, which links the mind (psychology), the brain (neurology) and the body's defence system (immunology). It is postulated that "the mind and body communicate with each other in a

bidirectional flow of hormones, neuropeptides and cytokines" (Watkins A, 1997).

In this theory, emotions have a direct effect on the body via communication of the neuropeptides.¹¹ It could also help to understand why factors such as weather, temperature and stress affect the presence or/and the severity of phantom limb pain. A recent study investigating the relationship between local and systemic inflammatory markers and phantom limb pain concluded that:

The immune status existing before the amputation, and the local immunological milieu influence the onset of phantom limb pain.¹²

The idea to use reflexology as a treatment for phantom limb pain developed after the author experienced reflexology and subsequent pain relief from a shoulder muscle injury.

A search on the medical databases at the time revealed that there were no studies in this area. The only evidence found was a single case study¹³ and anecdotal reports. As a consequence, the only way to test this treatment was to put forward a protocol, in the form of a pilot study, to the local ethics committee.

The experimental hypothesis stated, "reflexology may help to provide pain relief for sufferers of phantom limb pain".

The objectives were to test the experimental hypothesis with the view of trying to find a non-invasive form of phantom limb pain relief and to test the possibility that patients may be able to maintain any positive results with self-treatment.

Methods

Design

The pilot study was an experimental design. The independent variable was reflexology and the

Table 1 Time line for project—five phases of six weekly pain diaries.

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Weeks 1–6 Pain diaries for baseline of pain	Weeks 7–12 Pain diaries and 6 weekly reflexology treatments	Weeks 13–18 Pain diaries, resting period	Weeks 19–24 Pain diaries and 6 weekly teaching sessions	Weeks 25–30 Pain diaries and 6 weekly self- treatment sessions

dependent variable was phantom limb pain. The data were recorded by the patients in weekly pain diaries over a 30 week period (see Table 1). The results were analysed by a statistician using the Statistical Package for the Social Sciences (SPSS). Although the data analysed in SPSS were ordinal and non-parametric tests would normally be used,¹⁴ a repeated measures analysis of variance (ANOVA) parametric test was used in the final analysis along with least significant difference (LSD) and effect size tests.

Sample

The sample was made up from prosthetic service patients living in the Wolverhampton area, who were registered at the Maltings Mobility Centre. A list of patients, 6 months post-operative, was produced from the Centre's database, which fulfilled the first of the criteria.

Selection criteria

- Patients must be more than 6 months post-amputation to avoid confusion with residual limb pain.
- Phantom limb pain must be present on at least 1 day out of each week.
- The patient should not have any contraindications to reflexology.
- The patient will have a unilateral amputation in order to give foot reflexology on one side.
- There will be no distinction about the level of amputation.
- The patient must be willing to give accurate feedback by completing five sets of six weekly pain diaries.

The researcher worked down the list of patients systematically; phoning the patients and eliciting their interest in taking part in the project. An appointment was made to visit interested patients at their home to discuss the project and its implications; this was known as the selection assessment.

Selection assessment

An information sheet was given to the clients to read that explained the project, the reflexology treatment and the requirements needed to take part. There were also explanations about what would happen during the project, other forms of treatment for phantom limb pain, confidentiality and what would happen afterwards. The researcher then explained about the pre-selection questionnaire, which was to determine whether they matched the criteria or had any contraindications to reflexology.

Reflexology is thought not to have any side effects, but some conditions are either best avoided or medical advice sought before treatment is given. Patients signed to give permission to contact the GP, if necessary, and also signed a consent form.

If there were any conditions noted, a letter to the GP went out with an explanation of the project, reflexology and the possible contraindication. A GP consent form, which would indicate whether the GP was happy/not happy for the patient to be included in the project, was also enclosed together with a return envelope.

Twelve patients were recruited but of these, two were excluded: one dropped out due to family commitments and a second due to an undiagnosed pedal infection. Ten patients commenced the study; seven men and three women. Five patients had experienced below-knee amputations, three had above-knee amputations, one had a through-hip amputation, and one had a hindquarter amputation. The mean age was 62.5 years, and the mean years since the amputation was 13.9 years. The reasons for the amputations were osteomyelitis, tumour, ulceration, trauma and gangrene, ruptured artery, necrotizing fasciitis and diabetes.

Pain log

A patient assessment was carried out at the beginning of the project to assess pre-amputation pain and the onset and severity of phantom limb

pain. The hospital anxiety and depression scale was used at the beginning and end of the project and kept in the pain log along with an evaluation form.

Pain diaries

The 30-week period of diaries was divided into five phases; each phase had a set of six weekly pain diaries (Table 1). Within the pain diaries there were some simple questions to elicit whether phantom limb pain affected their sleep, the duration of the phantom limb pain and the effect on lifestyle.

The affect on sleep was a simple yes or no, which produced nominal data. A numerical, ordinal rating scale as a pain assessment tool, and a numeric ordinal lifestyle scale that gave a numerical value to a subjective opinion were used. Both of these produced ordinal data.

The first phase of diaries established the pattern of pain for the individual. Phase two introduced the first reflexology intervention, where a full foot treatment was given on the remaining limb and a full hand treatment on the hand of the amputated side of the body, once a week for 6 weeks. The foot and hand treatments were a matter of preference by the therapist.

The third phase consisted of diaries only to give a resting period, which would elicit whether the pain reverted back to its original level or whether there was a carryover effect from the treatment.

The second reflexology intervention came in phase 4—the teaching sessions; the patients were shown how to do a hand reflexology routine on both of their hands. The decision to use hand reflexology for this phase was due to simple logic: most people (especially the elderly) cannot bring their feet into a position whereby they could perform the foot reflexology treatment.

This teaching routine was repeated once a week over 6 weeks. The practice, with the therapist guiding them, formed the basis of knowledge needed for the final reflexology intervention in phase 5 on self-treatment sessions. To reinforce the education, they were given a small booklet that covered the hand reflexology routine for home use.

Results

Pain logs

Pre-amputation pain

Eight of the patients suffered from pre-amputation pain. Seven of these reported that it was severe

pain and one reported that it was moderate. Most of this pain was experienced for months to years. Five of these clients did not take medication for the pain, of the three clients that did take medication; two of them were taking it for years and one for days.

Phantom limb pain

The onset of phantom limb pain varied from 24 h (20%), 1–2 weeks (20%), 1–2 months (40%) and more than 2 months (20%). The pain was reported as being severe (70%), moderate (20%) and mild (10%), with medication being taken by 80% of the clients.

Factors affecting phantom limb pain

There was an equal split of 10% who felt that it: made it better, made it worse, increased the awareness of the pain, started it off and made it either better or worse. Fifty percent reported other factors also affected the phantom limb pain. Again there was an equal split of 10% who felt that the pain was affected by: cold weather, infections, hot weather, distraction, and evening time.

Pain diaries

The affect on sleep in the frequency data was not conclusive, there seemed to be an improvement, which gradually slipped back to the original levels. This did not seem to tie in with the results of the frequency data for intensity of pain, duration of the pain and the affect on lifestyle. There may have been other influences at work here that were not accounted for, e.g. medication to help them sleep; therefore, when analysing the data in the SPSS, the author wished to concentrate on pain intensity, pain duration and affect on lifestyle.

SPSS analysis

The raw data were entered into the SPSS. The data were analysed using both parametric and non-parametric tests, there was no difference between the results of these and therefore, parametric tests will be reported below as they are more powerful; however, effect sizes will also be reported in order to account for the small sample.

Despite the small *N*, given that the data points are taken consecutively and were roughly normally distributed, a repeated measures ANOVA was conducted on the average reported pain (over each of the 6 weeks) for each of the five phases. This test reveals a highly significant 'overall' difference,

whereby the treatment phase does indeed make a difference to pain; this is a very strong finding, given the small sample size: $F(4,28) = 4.38$, $p = .007$. This indicates that the probability of finding this pattern due to chance is less than 1%.

LSD tests for simple effects reveals significant differences as follows:

In Figure 1, at the reflexology, phase 2 participants report less pain than they report at their baseline (although, this does not reach significance, $p = .13$), but it does not differ from the resting phase following it ($p = .13$).

Phase 4, where individuals are self-taught reflexology and phase 5, where individuals self-administer reflexology are significantly lower than the initial phase ($p = .01$ and $.03$, respectively), but they do not differ significantly from each other.

It should be noted that the sample size is extremely small and therefore, the mean difference findings are particularly impressive with an overall effect size of $\eta^2 = .52$ (on a scale from 0 to 1, 1 indicating a strong effect/difference).

A repeated measures ANOVA on pain duration (over each of the five phases) reveals a very highly significant ‘overall’ difference that the treatment phases makes to pain duration: $F(4,36) = 4.98$, $p = .003$. This means that the probability that this result occurred due to chance is less than 1%.

LSD tests for simple effects reveals significant differences as follows:

In Figure 2, at the reflexology, phase 2 participants report significantly shorter pain duration than in the initial phase 1 prior to reflexology ($p = .02$). And as above, all subsequent phases reveal significantly shorter pain duration than the initial phase 1 (ranging from $p = .02$ to $.004$), however, phases 4 and 5 do not significantly differ from each other.

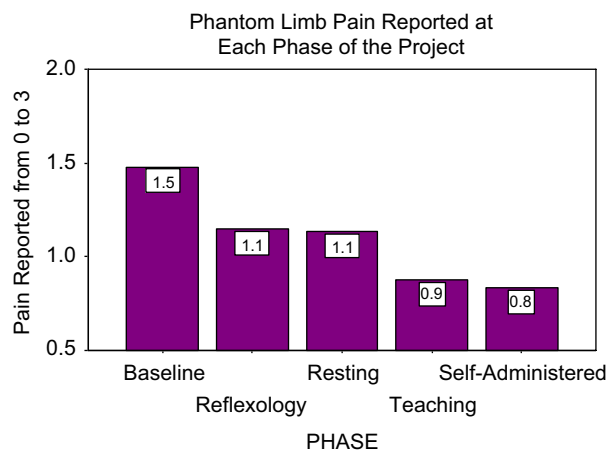


Figure 1 Findings for phantom limb pain: phantom limb pain reported at each phase of the project.

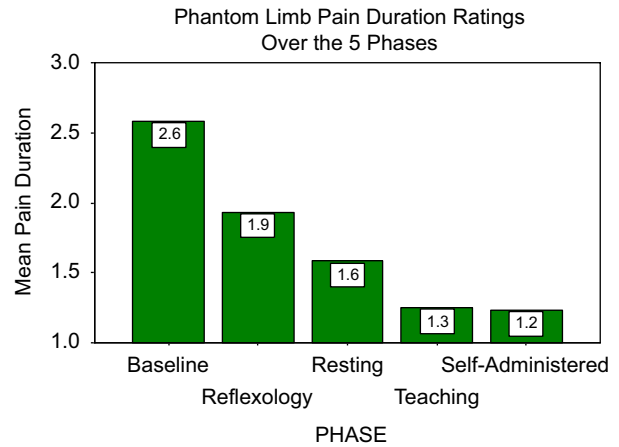


Figure 2 Findings for phantom limb pain duration: phantom limb pain duration ratings over the five phases.

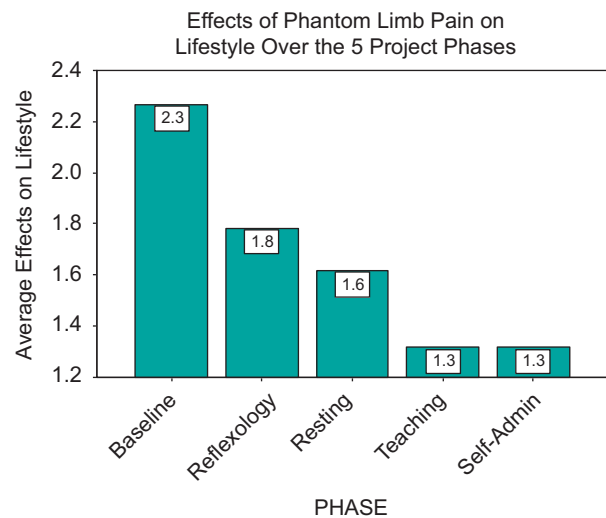


Figure 3 Findings for lifestyle effects: effects of phantom limb pain on lifestyle over the five project phases.

There was an overall effect size of $\eta^2 = .85$ (on a scale from 0 to 1, 1 indicating a strong effect/difference).

A repeated measures ANOVA on lifestyle (over each of the 5 phases) reveals a highly significant ‘overall’ difference that the treatment phases make to lifestyle: $F(4,36) = 3.57$, $p = .01$. This means that the probability of this result occurring due to chance is less than 1%.

LSD tests for simple effects reveals significant differences as follows:

In Figure 3, all phases are significantly lower than the initial baseline phase (ranging from $.01$ to $.03$).

The reflexology phase 2 participants report significantly less lifestyle interference than in the initial phase 1 prior to reflexology ($p = .01$), with the same effect in phase 3. Phases 4 and 5 do not

differ from each other. Phases 2–5 are significantly improved over the initial phase 1.

There was an overall effect size of $\eta^2 = .30$ (on a scale from 0 to 1, 1 indicating a medium to strong effect/difference).

HAD scales

The first anxiety score recorded 60% within the normal range for anxiety, 20% were border line, and 20% had significant psychological morbidity, at the end of the project 50% were in the normal range, 10% were border line and 30% had significant psychological morbidity.

The first depression score recorded 90% within the normal range and 10% boarder line morbidity; after the project 80% were within the normal range for depression, 10% were border line and 10% were unrecorded (loss of a participant).

The increase in anxiety levels was due to one patient. This patient was very anxious to stress that her anxiety had nothing to do with pain, but due to her marriage break up. The HAD scales were thought not to be a particularly good tool to use for the evaluation of the affects of pain since it could be influenced by emotional factors that have nothing to do with pain.

Discussion

Although reflexology can be performed on the hands and the feet, the therapist preferred to use the feet, as the reflexes on the feet are thought to be more accessible, due to the larger area of the foot compared to the hand. When the foot is not accessible then the hand on the same side can be utilised. The therapist therefore performed foot reflexology on the remaining foot and hand reflexology on the amputated side of the body.

However, the decision to teach a hand reflexology routine to the clients was made purely on a practical level; most people would find it difficult to reach the underside of their foot. Therefore, to make things easier for them, they had to treat only their hands. A further study could compare two groups; using hand and foot reflexology and the other using hand reflexology only.

Pre-amputation pain did not seem to be a prerequisite for phantom limb pain, as two out of the ten clients had no pain previous to the amputation. The vast majority of the eight clients suffering pre-amputation pain were in severe pain and most of this pain was experienced for months

to years. Interestingly, five out of the eight clients did not take medication for it, but two did and were on the medication for years.

The client who had necrotizing fasciitis had undergone a hindquarter amputation within a day of being admitted to hospital and consequently was on medication for a day only.

The variation of onset had quite a wide distribution over time, which raises the question of 'what actually triggers phantom limb pain'? A large proportion of the group described it as severe and 80% took medication for it. This is far greater than clients taking medication for pre-amputation pain, which was also described as severe. So, how does the perception of pain work? Why could they cope with severe pre-amputation pain and not take medication? Are the pain scales ineffective or did the patients take the medication because it was readily available post-operatively?

When considering factors that affect phantom limb pain, 50% claimed the prosthesis affected it. Analysing this revealed that there was an even split as to how the prosthesis affected phantom limb pain. Three out of five reasons were negative, one positive and one a mix of both. It would be interesting to look at this with a larger sample of clients.

A similar situation occurred when looking at other factors that affected phantom limb pain, with the weather (hot or cold) being cited three out of five times. Evening time, distraction and infections were also noted.

Many theories have been postulated about the aetiology of the phantom limb pain phenomenon, the influence of pre-amputation pain on post-amputation stump and phantom pain being one of them. One study found that high-intensity pre-amputation pain was more likely to produce high-intensity phantom limb pain, but that the duration of pre-amputation pain was not related to the intensity of phantom limb pain,¹⁵ whilst another study suggested that pre-operative pain played a role in the development of phantom limb pain immediately post-operatively, but not in late persistent phantom limb pain.¹⁶

Opiates have been used frequently and thought to be successful, even to the point where it is believed that they also influence cortical reorganisation.

Phantom limb pain has been closely associated with changes in the primary somatosensory cortex¹⁷ and patients with high levels of phantom limb pain show substantial cortical reorganisation. Test subjects who had a treatment of opioids were found to show a strong decrease in cortical reorganisation.⁶ Reductions in cortical reorganisation, through sensory discrimination training, have also been demonstrated.¹⁷

Future studies could isolate some variables for statistical testing and incorporate a design where a control group could be added.

The hospital anxiety and depression scale did not seem to have any relevance to the phantom limb pain as the only changes that seemed to influence it was anxiety brought on by emotional problems unrelated to the pain.

Reflexology treatment for phantom limb pain, although not a totally new thought, is a new area for research projects. A search for evidence-based literature regarding reflexology and phantom limb pain revealed a huge gap in this area. It is a new territory which could lead to understanding a phenomenon that has been around for centuries.

The follow-up questionnaire

The follow-up questionnaire was given to 9 of the participants of the original study—one having died. It revealed that 100% of these nine participants had experienced phantom limb pain during the 12 months following the end of the project. The pain scores show a sustained improvement in the intensity of the phantom limb pain (Figure 4) compared to the original pain score (Figure 5). The majority of the group (67%) still self-treated on a weekly basis.

Conclusion

Phantom limb pain is a phenomenon that can vary in intensity and duration for the individual suffering from it and thus (it was thought) could have a subsequent effect on the individuals, sleep and lifestyle. This project endeavoured to look at this

Severity of Phantom limb pain score:
12 months follow-up questionnaire 9 participants

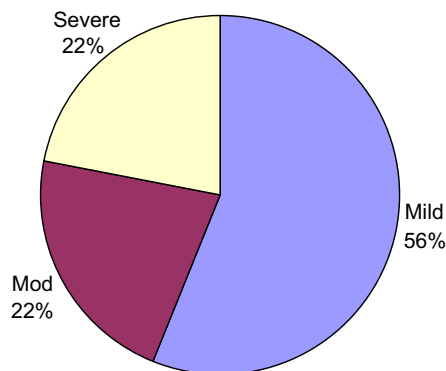


Figure 4 Follow-up questionnaire pain score distribution.

Phantom Limb Pain Score
Percentage of clients (whole group = 10 clients)

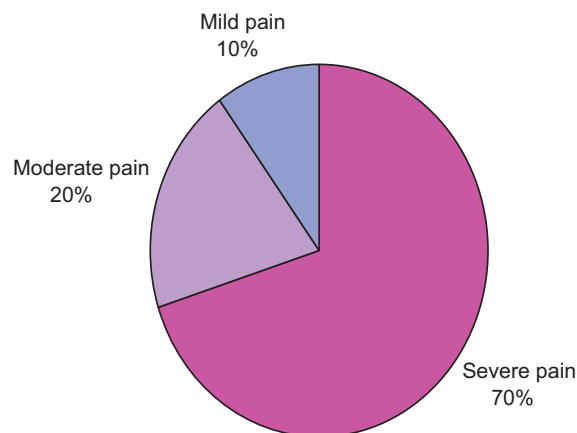


Figure 5 Original pain score distribution.

pattern of change and to evaluate it. It was a chance to look at the treatment of phantom limb pain from a completely different viewpoint; using a non-invasive technique and empowering the patient to self-treat. The project indicates that reflexology treatment and the teaching of a hand reflexology routine have had a positive effect on this group of clients.

The subsequent follow-up questionnaire revealed that there was a marked, sustained improvement in phantom limb pain and that patients could empower themselves to achieve their own level of improvement.

The project upheld the experimental hypothesis and the objectives were achieved.

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Conflict of interest statement

There are no conflicts of interest.

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Ethics approval

Wolverhampton District Local Research Ethics Committee Ethics no. 04/Q2701/31.

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