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"The Magic Mirror": Community-Based Mirror Treatment of Stump and Phantom Limb Pain In 1,600 War- And Mine-Amputees In Rural Cambodia

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Abstract

Background: Cambodia has around 40,000 war amputees. The vast majority suffer stump and phantom limb pain affecting the quality of life of both amputees and their families.

Methods: Two pilot studies in the actual catchments area showed that mirror treatment significantly reduced pain in lower limb amputees. Therefore, a campaign of community-based mirror treatment was conducted from 2021 to 2025. By open inclusion a total of 1,600 participants with upper or lower limb amputation participated. At the first encounter pain was registered by VAS scale, pain education and mirror training were provided, and all participants took a mirror back home. VAS ratings were again registered after a four-week treatment period. The campaign was implemented in three rural provinces in Northwest Cambodia. Most participants were poor farmers who had suffered amputation years and decades earlier.

Results: In lower limb amputees the mean VAS score before treatment was 8.0 (95% confidence interval 82.8% to 83.9%), in upper limb amputees 6.9 (95% confidence interval 6.6 to 7.3). After mirror treatment we observed a mean VAS reduction of 83.3% in the lower limb amputees (95% confidence interval 82.8% - 83.9%), and 82.2% in upper limb amputees (95% confidence interval 80.0% - 84.5%).

Conclusion: Severe post-amputation pain is the rule in poor communities. Mirror treatment is an effective, cheap, and safe treatment method. The efficacy of home-based treatment makes it possible to conduct large-scale community-based treatment programs in low-resource settings.

Introduction

Why Something Must be Done

Persistent stump and phantom limb pain are common after traumatic amputations, prevalence rates from 50% to 75% are reported in Western studies [1,2]. However, despite extensive research the underlying cause of the misery remains unclear. Several explanatory models focus on the plasticity of the brain, that body image and patterns of pain can be

modified by external input [3,4,5]. This has been a take-home message for the actual authors. Having worked in the catchments area for thirty years, close to the villagers, providing lifesaving first aid and rehabilitation, we have reasons to believe that extreme poverty is a potent trigger of pain, pushing the prevalence of post-amputation pain even higher in low-resource communities [6].

In 2014 the authors did a small pilot study of mirror treatment in a village located inside the actual study area: 18 below-knee amputees reported to their great surprise excellent effect of three weeks mirror treatment. This encouraged the authors to conduct a randomized controlled clinical trial (RCT) in 2015: 45 poor farmers with below knee landmine amputation were included for study, 15 participants used mirror treatment each morning and night for four weeks, 15 used tactile therapy applying sensory stimuli to the stump, and 15 used both mirror and tactile therapy. In all three treatment groups the participants reported more than 50% reduction in visual analogue scale-rated pain [7].

Rumors about the 2015-RCT rapidly spread by the jungle telegraph in the minefields along the Cambodian-Thai border, numerous amputees wanted to try this novel treatment. In 2020 the Provincial Health Department in Battambang agreed to conduct a major campaign of home-based pain treatment for amputees. The authors decided to use just mirror treatment in this intervention as the plastic mirror is robust and can be carried anywhere to the field. In addition, there is no need for assistance from family members during the treatment sessions.

Material And Methods

Community-Based Mirror Treatment

The intervention was carried out in the rural areas of Banteay Meanchey, Pailin, and Samlout along the North-western border of Cambodia. The people living in this area have experienced war and mine explosions since the 1970-ies. In 2021 the amputees in the catchment area were invited to take part in a community-based campaign where they would receive instruction in mirror therapy and thereafter take a mirror home for self-treatment. The recruitment was open; to avoid selection bias the local village- or commune leaders took on the responsibility to invite all potential participants in their area. The instructors (YVH, HC, and HSO, HC) are all experienced health workers. They have lived and worked in the war zones and mine fields along the border for 30 years and are native to the cultural context in the study area. The instructors examined all participants before inclusion, amputees with wounds or active stump infections were sent for medical treatment before being later included for mirror therapy. The participants were gathered in groups of 5 – 20 in the nearest commune centre. From January 2021 to May 2025 a total of 1.600 upper or lower limb amputees took part in the intervention.

Welcome, Sisters and Brothers!

The gatherings start in a warm and friendly manner, the instructors sharing their personal experience with poverty, wars, and pain, and inviting the participants to also share their stories. Then pain education starts aiming at an open and active question-answer dialogue:

Why does the mirror work? Also for us, this is unbelievable, firstly we thought this was a foolish effort. However, to understand it we must consider how the brain works. We should keep in mind that the brain is desperate and confused, it cannot find the leg or the arm anymore, the limb has become like a ghost, communication impossible. But look here, when I am using the mirror and concentrate deeply on the image in the mirror, I am cheating the brain to believe that things are back to normal. Then the brain slowly settles down, less stress, less pain. Should we make a try?

Then the participants estimate the severity of their limb pain on a Visual Analogue Scale (VAS), ratings from 0 (no pain) to 10 (maximum pain). They are asked to rate the total limb pain, stump pain as well as contractions, itching, and pain in the phantom, all in one.

Then the practical instruction: The mirrors are made of plastic, portable, and sturdy. They are built at a local workshop, unit cost 8 USD. The three teachers instruct each participant hands-on: Slow flexion-extension movements in the wrist/ankle, full concentration is emphasized, the light must be ample, and nobody should disturb at the site of treatment – without focus, no effect. The treatment should be done for five full minutes morning and evening for four weeks.



Figure 1

The participants are invited to a follow-up session one month later. Here the second VAS pain rating is done. Treatment effect is estimated by the difference between the first and second VAS rating, a reduction by less than 50% being defined as non-response. At the second encounter the participants also informally share their experience with the mirror treatment with each other and with the instructors. Participants not attending the follow-up session are regarded as drop-out cases.

Ethical Considerations

As most study participants were illiterate, written consent forms were not functional in this intervention. However, oral informed consent was obtained from all participants during the village training sessions. The data were stored and processed by the instructors according to the guidelines from The Cambodian National Ethics Committee, ref. no. 081/2016 NEHCR and the Norwegian Social Science Data Service, ref. no. 2015/2193/REK-North.

Results

Most participants were old (mean age 60.5 years) and male (93%). The majority had below-knee amputation (75%), 16% had above-knee and 7% upper limb amputations. The majority reported severe pain problems before treatment with mean VAS score at 8.0 for lower limb amputees (95% confidence interval 7.9 to 8.1), and VAS score 6.9 in upper limb amputees (95% confidence interval 6.6 to 7.3). The mean VAS score after 4 weeks of treatment was 1.3 for lower limb amputees (95% confidence interval 1.27 to 1.35), and 1.1 for upper limb amputees (95% confidence interval 1.0 to 1.27). This represents a VAS reduction of 83.3% in the lower limb amputees (95% confidence interval 82.8% to 83.9%), and 82.2% in upper limb amputees (95% confidence interval 80.0% to 84.5%). Among the 1,600 participants there were 16 non-responders and 13 drop-outs.

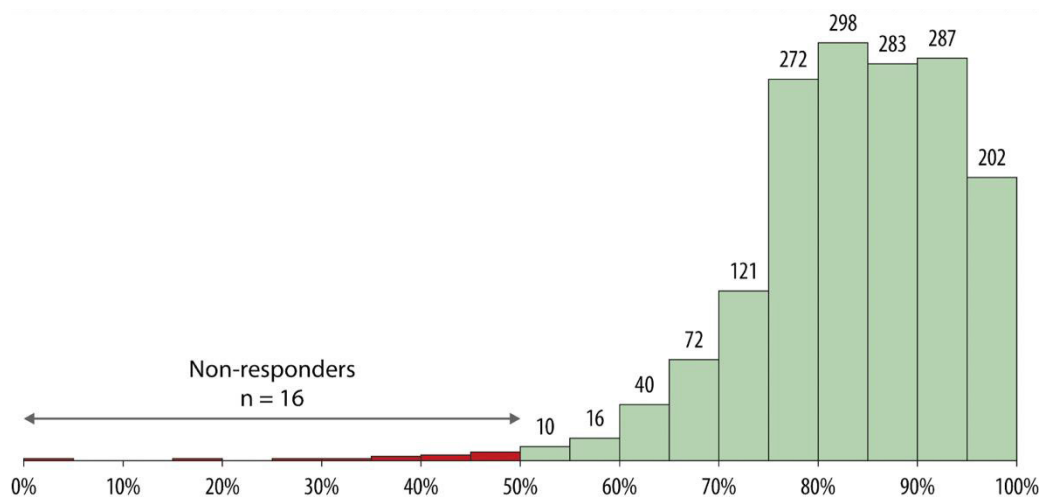


Figure 2

Distribution of treatment effect, defined as the % reduction in VAS rating before and after treatment. The figures on top of each column "represent patient counts".

There were no significant differences in treatment effect depending on gender, age, or level of amputation. We observed a minimal difference in treatment effect between the three study provinces (79% versus 84% and 86% VAS reduction).

Discussion

We report for the first time the outcome of a large-scale campaign of community-based mirror treatment for chronic pain in war and landmine amputees. The treatment effect in the actual intervention was considerably higher than results reported in previous studies [8,9]. Most participants were excited at the point of control, many said, this mirror is magic.

There may be several reasons for the robust treatment effect. First, most other studies of mirror therapy for stump and phantom limb pain have been done in high-resource settings, patients treated in centralized centres by white-coat experts they do not know. We believe that closeness and confidence between caregivers and patients are important healing factors [10,11]. In the Cambodian campaign the instructors were inborn to the participants' cultural context. They all know too well the burden of war, landmines, and poverty. Most participants thus came to regard the instructors as an extended part of their family, as 'sisters' and 'brothers'.

Second, we do believe that the poverty factor makes a difference. We did not collect exact data on the participants' occupation, income, and living conditions. However, we know and we could see that the vast majority of participants had suffered for years under the burden of austere poverty. When you do not know how to feed your children the next day, it becomes a life-or-death question to become able and bring income to the household again. The participants' motivation and hope for relief by a 'magic mirror' is hence very strong.

There are some limitations to the present study. First, estimating the pain severity we did not identify separately painful stump contractions versus pain and contractions in the phantom. We simply asked for information on 'degree of trouble in damaged limb'. This may be confusing for medical researchers, but still meaningful for pain-ridden poor amputees: Why should they need scientific explanatory models as long as the mirror works?

Second, we do not know if the observed pain relief by mirror treatment is permanent, neither have we explored the impact of persistent pain on the quality of life of amputees and their families.

Third, also differences in cultural context may contribute to treatment effect disparities between high- and low-resource study settings. Even if most Khmer campaign participants were not Buddhist believers, they were maybe to some degree marked by Buddhist understandings of body image, in which pain and fatigue are read as deep messages – change is both urgent and possible – rather than nuisances. Anthropological differences between study populations colored by Eastern philosophy versus Western materialism may be one explanatory variable regarding mirror treatment effect.

These limitations are now under exploration in an ongoing qualitative study among the campaign participants.

Conclusion

In a context of poverty, mirror treatment is highly efficient for stump and phantom limb pain, in upper as well as lower limb injuries. The authors feel it as a moral duty to expand the mirror campaign to other provinces in Cambodia where thousands of amputees suffer under the burden of pain and poverty. Where medical resources are minimal, the mirror treatment can easily be provided by non-doctors. The actual model of community-based treatment should therefore be

applicable in most low-resource societies ravaged by wars and natural catastrophes. We would especially encourage colleagues in low-income countries to initiate home-based mirror treatment programs for trauma victims. By sharing experiences, we may understand better why the mirror treatment yields such excellent results where poverty is endemic.

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Data Sharing

All anonymized data gathered in the mirror campaign will be made available by the author of correspondence to any person or institution providing documented research interests.

Declaration of Interests

No conflicts of interest are declared for any of the authors.

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