

Practical application of hypnosis in treatment of phantom limb pain

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Abstract

Phantom pain results in up to 85 % of amputees. It is very difficult to treat and remains puzzling phenomenon. This article focuses on practical application of hypnosis in treating phantom limb pain as a promising approach to phantom pain management. Review of studies using hypnotherapy is introduced as an opportunity for practicing hypnotherapist to familiarize themselves with possible proceedings. The outcome reports for hypnotherapy have been mainly positive and show a reduction in phantom limb pain as can be also seen in four author's case studies included. However, firm conclusion cannot be made as we lack well controlled and randomized trials of effectiveness of hypnotherapy in the treatment of phantom limb pain.

Key words

amputation, brachial plexus avulsion, hypnotherapy, phantom limb pain.

Introduction

Phantom pain is developed after surgical or traumatic remove of a body part in 54 to 85 % of patients (Nikolajsen & Jensen, 2001; Ehde et al., 2000, Melzack, 1992, Jensen, Krebs, Nielsen, & Rasmussen, 1985). Phantom pain can be also experienced in patients after avulsion of brachial plexus (Melzack, 1992; Shankar, Hansen, & Thomas, 2015; Son, Ha, 2015), after spine injury and also in 20% of children with congenital limb deficiency (Melzack, Israel, Lacroix, & Schultz, 1997). This article and case reports will be focused on phantom limb pain (PLP).

Phantom limb pain involves (Nikolajsen & Jensen, 2001):

- Phantom pain: painful sensations referred to the absent limb.
- Phantom limb sensation: any sensation in the absent limb, except pain.
- Stump pain: pain localized in the stump.

All of these elements very often coexist in each patient and it can be difficult to separate them. The experience of PLP is highly individual and includes stabbing, bur-

ning, “pins and needles”, clamping and clenching spasms. These sensations are very often those patient experienced before the amputation. Patients also refer of feelings of wrenching of the limb into unnatural positions, and feelings of shrinking of the limb. We can also find patients who state the beginning of the pain in a certain hour during the day.

Hypnotherapy approaches the amputated limb as a real limb and uses same methods as in managing pain in an existing limb. Many patients with PLP expect managing pain in phantom limb and not in the stump (Oakly, Whitman & Halligan, 2002), which is in accordance with the practice of the author.

Mechanisms of phantom pain

The exact mechanism of phantom pain has not been clarified, but we can find three main theoretical pathways: psychologic factors, peripheral factors and central neural mechanisms.

Psychological factors

The PLP is suggested to be a manifestation of some emotional problem or evolving on the basic personality structure. An early study found that patients with PLP highly scored in „compulsive self-reliance“ and „rigidity“ (Parkers, 1973). This theory hasn't been accepted. Following research suggests that psychologic factors don't play important role in PLP. Nevertheless, under certain conditions psychologic factors such as depression, anxiety, fatigue, and insomnia may trigger or aggravate the PLP in psychologically healthy individuals (Sherman, Sherman, & Gall, 1987; Arena, Sherman, Bruno, & Smith, 1990; Giummarra, & Moseley, 2011). Loss of a limb has profound consequences and it is not surprising that 20–60 % of amputees are assessed as clinically depressed (Whyte, & Niven, 2001; Durmus, et al., 2015). Also patients with lack of coping strategies and expecting the worst are more affected by the pain and report more interference compare to patients who cope well with their new situation (Hill, Niven, & Knussen, 1995).

Peripheral factors

Theories that focus on the peripheral nervous system suggest that phantom limb pain occurs due to the abnormal discharges at dorsal horn of the spinal cord caused by a loss of afferent input from the missing limb (Flor, Nikolajsen, & Jensen, 2006). The end of a cut or damaged nervous fiber grows into neuromas that produce spontaneous and abnormal activity. This can be potential source of PLP and stump pain. However, this theory does not explain the mechanisms of PLP in patients with congenital absence of limbs (Flor, Nikolajsen, & Jensen, 2006).

Central neural mechanisms

There are three central neural mechanisms that have been described: cortical reorganization theory, spinal cord sensitization theory, and neuromatrix theory (Niraj, & Niraj, 2014).

Cortical reorganization is a process in which are both the somatosensory and motor functions of cortex that represent the amputated limb taken over by the neighboring zones (Flor, Nikolajsen, & Jensen, 2006; Baron, Binder, & Wasner, 2010).

Spinal cord sensitization occurs after injury to the peripheral nerve. There is increased neural activity, expansion of the neuronal receptive field, and hyperexcitability of the spinal neurons (Niraj, & Niraj, 2014). This process is called central sensitization.

The neuromatrix theory suggest that there is neuromatrix – a network of neurons in several brain areas, including thalamus, somatosensory cortex, the reticular formation, the limbic system, and the posterior parietal cortex, that responds to sensory input and constantly produces a specific pattern of impulses – neurosignature – that registers the body is intact (Melzack, 2005). In case some inputs from limbs are lost, the neurosignature becomes abnormal and it results in PLP (Melzack, 2005; Ianetti, & Mouraux, 2010). It does not explain why some amputees develop PLP and some are free of pain.

Hypnosis and phantom limb pain

Hypnosis can change the perception of pain by affecting the psychological and emotional components of pain, which implicitly affects physiological response. Two meta-analysis on the efficacy of hypnosis in pain management approved that hypnotic suggestion can work as an effective analgesic (Montgomery, DuHamel, & Redd, 2000; Hawkins, 2001). Review of randomized studies shows considerable effect of hypnosis in cases of procedural and chronic pain (Patterson, & Jensen, 2003). There are also proofs of changes in subjective perception of pain when using functional neuroimaging, when the hypnosis suggestions invoke change in activation of brain areas responsible for pain perception (Rosen, et al., 2001; Jensen, et al., 2012). Hypnotic analgesia is mediated by an increase in the functional connectivity between the mid-cingulate cortex and large cortico-subcortical network including the brainstem, thalamus, insulae, anterior cingulate cortex and premotor cortex, suggesting an alteration in the integration of sensory, affective, cognitive and behavioral aspects of the pain experience (Faymonville, et al., 2003).

The relation between the level of hypnotizability and treatment success is debatable. The clinical experience suggests that hypnotizability rate is not in due proportion to the therapy success. The patient's faith in the method and therapist and also active approach of the patient play important role. However, research reported that patients scoring moderate to high on hypnotizability scales are more likely to benefit from the hypnotic suggestions (Montgomery, DuHamel, & Red, 2000; Patterson, & Jensen, 2003). According to experimental studies the hypnotic analgesia correlates with general hypnotizability 0.50 (Kratochvíl, 2009).

The majority of studies of hypnotic management of PLP meat methodology problems but they are also valuable source of suggested approaches in hypnotherapy of PLP. These studies can be divided in to two groups: ipsative/imaginery (the hypnotic session is

specific to the patient's problem) and movement/imaginary (a patient is imagining the phantom limb moving or changing position in order to relieve the pain). Brief summary of these studies follows in table 1.

Table 1.

Literature review for phantom limb pain and hypnosis

Article author	Problem	Treatment	Outcome
Ipsative/imaginary based			
Siegel (1979)	Amputation above left knee (pain before). PLP for several weeks.	10 sessions. Hypnosis, relaxation, self-hypnosis (cold imagery, glove anesthesia).	Pain medication reduced to 50 %. Able to control pain by herself.
Chaves (1986)	Arm amputation (pain before). PLP for 5 months: „tension“ and continuous movements in phantom limb.	3 sessions. Relaxation, tension reduction suggestions; warmth imagery; home use of hypnosis audiotape.	No pain at 5 year follow-up. Using tape once a month.
Chaves (1993)	Mid-tight amputation of right leg (pain before). PLP for 4 years: „biting ants“, tight bands, muscle tension, phantom leg in uncomfortable position.	Number of sessions not specified. Suggest phantom shrinking, hypnotic images of „decapitate ants“, „cut bands“, daily use of audiotape.	Decrease in pain by 30 %, occasionally pain free, phantom shrinking.
Sthalekar (1993)	Avulsion of right brachial plexus.	21 sessions over 8 weeks. Imagery, relax, future oriented suggestions.	Pain under control and no longer interfering with daily activity.
Brown et al. (1996)	Amputation at right knee (pain status before not reported). Severe PLP (no details reported).	3 sessions. Hypnotic metaphor of tree damaged by flood water, losing branches, then regrowing stronger.. Severe pain.	12 month follow-up: wearing prosthesis and mountain biking. No report of pain status.
Oakly et al. (2002)	Amputation above right knee (no pain before). Pins and needles, toes in a tight vice, cutting pain, chiseling pain in ankle.	8 sessions. Hypnotic imagery.	3 month follow-up: chiseling pain gone, other pain still there, coping better.

Article author	Problem	Treatment	Outcome
Chan (2006)	Amputation bellow left knee (no pain before), PLP for 7 years, began 2 years after the amputation: pins and needles in the leg, saw cutting into left toes, drill pushing into left heel.	20 sessions. Suggestions of „sock and bandages“ for left foot „acting as analgesia“; „imaging being injected with pethidine“; audiotape of hypnotic analgesic; self-hypnosis training.	Pain severity reduced, affective pain reduced significantly; increase in self-confidence, control over pain.
Rickard (2005)	20 patients with PLP: 19 lower limb amputation, 1 upper limb amputation.	Treatment group (n=10) and control group (n=10). Individual hypnotic suggestions in the therapeutic group. No treatment in control group.	Long term decrease of pain in therapeutic group. Control group without any change in pain level.
Movement/imagery based			
Muraoka (1996)	Amputation above left knee (no pain before), PLP for 25 years: „burning“ and continuous dull pain, limb in uncomfortable position and too short.	64 sessions over 3 years. 3 phases: a+b) suggested movements of leg and becoming normal size; c) suggested shrinking of phantom limb.	At end of treatment phantom limb change to more relaxed shape and had disappeared for most of time, with intermittent bursts of pain; overall pain reduced from 8 to 1 (on scale 0–10).
LeBaron & Zelter (1996)	Amputation of left leg (no pain status reported). PLP: „jerking“, „cracking“ in toes, „stabbing“ pain in sole.	3 sessions: relaxation, free movement in toes and leg; transfer of suggested numbness in hand to left leg.	2 week follow-up 50–100 % pain relief from self-suggestion or audiotape; considerable reduction in unpleasant sensations; less bothered by residual PLP and sleeps normally.
Ersland et al. (1996)	Amputation above right elbow (no pain status reported). PLP for 18 months in fingers and wrist, uncomfortable posture of fingers and wrist.	Hypnosis as a part of rehabilitation program, number of sessions not reported: relaxation and suggestions for finger movement and uncramping.	Reduction in PLP, feeling of control made residual pain more tolerable.

Article author	Problem	Treatment	Outcome
Rosen et al. (2002)	Traumatic amputation of right arm (no pain before). PLP for 5 years: radiating heat pain, abnormal posture/contraction in fingers and arm, felt fingers crumpling with cramping pain.	12 sessions over 6 months: CBT with hypnosis; in hypnosis imagined phantom in comfortable position or moving in a comfortable way; also imagined skiing, both arms moving in rhythm.	No pain during first hypnosis session, after 1 day pain returned intermittently; at the end of treatment pain intensity down from 80 to 50; pain frequency reduced by 55 %, shrinking phantom limb.
Rosen et al. (2002)	Traumatic amputation of fingers on left hand (no pain before). Severe pain in entire hand, „cutting“ feeling.	12 sessions over 6 months: CBT with hypnosis; in hypnosis imagined phantom in comfortable position or moving in a comfortable way; imagined pain are shrinking.	At the end of treatment pain intensity down from 40 to 20 and pain frequency reduced by 50 %.
Oakly et al. (2002)	Avulsion of left brachial plexus (no pain before). PLP for 5 years, intermittent cramping in „denervated arm“ and burning sensation; more frequent „shooting“ pains through arm; „throbbing“ in knuckles; hand in uncomfortable „clenched“ posture.	Previous experience of pain control and subjective movement of left hand in mirror apparatus; 1 hypnosis session with suggestion of a return to the mirror experience and of age regression to time before the injury.	PLP lost during experience of moving left hand in hypnotic virtual „mirror“ and during age regression. Pain was rated 4 before hypnosis, 0 during hypnotic mirror and 2,5 after hypnosis on 10-point scale.
Bamford (2006)	PLP in 25 amputees: 18 lower limb, 7 upper limb.	6 sessions: visualization, guided imagery of penitent's choice (garden, beach, woods), and movement of phantom limb; relaxation and training self-hypnosis.	Statistical analysis revealed significant change in pain scores at baseline, after treatment, and at follow-up for 22 cases (3 patients did not return questionnaires at 6-month follow-up).

The studies in the Table 1 were inspiration for practical use of hypnosis in amputees in the Hospital Havlíčkův Brod. Following case studies were not intended to be used as a research and therefore lack systematic approach. In case of problematic managing the PLP with analgesics, a patient is offered hypnotherapy. The cooperation between the surgeon and psychologist is to the benefit of a patient. Hypnotherapy in all following case studies was performed by the author of this article. Four cases were chosen to present possible work with PLP and not always successful outcomes.

A considerable time is devoted to explanation to the patient what is hypnosis, what is the procedure; all questions are answered and the therapist makes sure the patient

feels comfortable with the idea of hypnotherapy. It is also clarified with the patient if, during the hypnosis, the therapist can refer to the phantom as to an existing limb and if it is comfortable for the patient to imagine his/her limb as real. All patients agreed with hypnosis as they hoped it will help them to manage the PLP, and all patients felt comfortable with the imagination of a missing limb. Hypnotizability was evaluated on the basis of Forel three level classification described in detail by Kratochvíl (2009).

Case report 1 – Mrs S. J. (age 79)

Problem: Polymorbid patient with amputation of right leg above knee (pain before amputation – gangrene). PLP for two weeks after amputation. Cooperation with this patient was difficult, she wasn't able to describe the pain closely.

Hypnotizability: Moderate.

Treatment: 3 sessions in 3 days (this patient was hospitalized at the surgery department after the amputation). Hypnotic suggestions: relaxation, imagining a place in nature she liked to visit, imagining herself as 40 year-old in that place (she said this is the time she was the happiest and healthiest), suggestion of healthy legs, warmth flowing through the phantom leg. Training of relaxation with imagination of that place and time in her life.

Outcome: Before the first session overall pain reduce from 10 to 8 (on scale 0–10), the next day patient refers the pain as less severe and after second session reduce to 6. She also uses relaxation and imagination during the day. The last day of hypnotherapy pain reduce to 4. During these three days nurses inform of diminishing demands for pain killers from the patient. No pain at one month follow-up.

Case report 2 – Mr. V. Z. (age 65)

Problem: Amputation above left knee in patient with atherosclerosis and pain before amputation. PLP for 2 weeks and begun a week after amputation: “pins and needles” through the phantom limb, “burning” pain and “tension”, feeling of toes twisting into unnatural positions. These are the same feelings he had before the amputation. He cannot sleep and focus on anything during the day. The pain is static.

Hypnotizability: Low.

Treatment: 6 hypnotherapy sessions in 21 days. Hypnotic suggestion: imagination of a peaceful place, relaxation, suggestions of warmth flowing through the phantom, imagining his amputated leg as healthy and resting in soft grass.

Outcome: Before the first session overall pain reduces from 7 to 4 (on scale 0–10). Nevertheless, the pain relief lasted for a very short time after every session. Hypnotherapy was effective while the patient was in the hospital building and on the way home. As

soon as he got home the pain came back. Other psychology intervention didn't help to solve this problem and patient seek help of our fellow colleague – medical doctor who practice acupuncture. After three sessions the pain was gone and never returned.

Case report 3 – Mrs. P. H. (age 55)

Problem: Amputation bellow left knee for gangrene in patient with diabetes. PLP for several weeks and begun after the amputation: pain is coming in certain hour in the day, “burning” pain in toes, “pins and needles” and “stabbing”.

Hypnotizability: Moderate.

Treatment: 7 hypnotherapy sessions in 2.5 months. Hypnotic suggestion of relaxation in a peaceful place, suggestion of warmth travelling through the phantom limb, imagining phantom limb as healthy. Posthypnotic suggestion was applied (pressing thumb and index fingers against each other) that was supposed to recall the painless, relaxing state in vigilant state.

Outcome: The effect of the first session couldn't be evaluated as the patient didn't have any pain in the moment. The next visit she informed of reduced pain and reduces frequency of pain bursts during the day. The treatment was negatively affected by a fall on a stump which caused setback of the state but very quickly we gained back the improvement. The last weeks of the treatment patient rated her pain as 80 % better, the pain started always at 8 p.m. but with help of posthypnotic suggestion it diminished in several minutes. As the state of the patient remained same for several weeks we decided to finish the treatment. At the two months follow-up the patient doesn't complain about any pain and is starting to use prosthesis.

Case report 4 – Mr. M. S. (age 46)

Problem: Avulsion of the right brachial plexus after an accident 7 years ago (no pain before). During the first months after the accident patient underwent EEG test and this examination started his “stabbing” pain in his right denervated arm. The pain was inhibiting with medication but the patient still suffers from “pins and needles” in fingers and in hand coming in waves. He finds this very irritating and exhausting – his mood is changing, he is “grumpy” and cannot sleep. The pain becomes severe with the change of weather and change of seasons.

Hypnotizability: High.

Treatment: 15 sessions in 6 months. Hypnotic suggestion of relaxation in a peaceful place – sitting on a bench in an orchard in a lovely sunny day; suggestion of warmth moving through his body as he is basking in the sun, imagining his nervous system is like the branches above his head, strong and healthy and the warmth is traveling to his

denervated arm, healing it, removing all unpleasant feelings from it, suggestion of lightness of the right arm and feeling of the right arm becoming again a part of his body; suggestions of good quality sleep. Posthypnotic suggestion was applied (as in the case of Mrs PH). First two months sessions every week, then gradually prolonging time between sessions.

Outcome: After the first session the posthypnotic suggestion was active only for a day, but overall he felt better. During the following weeks his sleeping problems disappeared and the posthypnotic suggestion became active. He didn't experienced any "stabbing", only "pins and needles". As he was used to improvement of his state for a month in the past, he wasn't sure if current improvement is on regard of the hypnosis. After 6 weeks of treatment he became sure. He didn't experienced any changes in the pain during season and weather changes, his mood was good, slept well and gradually became very confident in controlling his pain. At the end of the treatment he didn't had to use posthypnotic suggestion as he felt his state is very stable. He was able to finish the treatment with confidence and at the two-months follow up his state is stable – no "pins and needles" or "stabbing", feeling of light right arm.

Conclusion

It is clear from the considerable small number of papers on hypnosis and PLP that more research has to be done. But on the basis of everyday hypnotherapy practice it is evident that hypnosis can be very effective tool for PLP treatment. Hypnosis is safe method with great possibilities and long tradition. Thus, it has a great potential to become regular treatment for phantom limb pain.

References

- Arena, J. G., Sherman, R. A., Bruno, G. M., & Smith, J. D. (1990). The relationship between situational stress and phantom limb pain: Cross-lagged correlational data from six-month pain logs. *Journal of Psychosomatic Medicine*, 34, 71–77.
- Bamford, C. (2006). A multifaceted approach to the treatment of phantom limb pain using hypnosis. *Contemporary Hypnosis*, 23, 115–126.
- Baron, R., Binder, A., & Wasner, G. (2010). Neuropathic pain: Diagnosis, pathophysiological mechanisms, and treatment. *The Lancet Neurology*, 9, 807–819.
- Brown, G. W., Summers, D., Coffman, B., Riddell, R., & Poulsen, B. (1996). The use of hypnotherapy in school-age children: Five case studies. *Psychotherapy in Private Practice*, 15, 53–65.
- Chan, R. (2006). Hypnosis and phantom limb pain. *Australian Journal of Clinical and Experimental Hypnosis*, 34, 55–64.
- Chaves, J. F. (1986). *Hypnosis in the management of phantom limb pain*. In T. Dowd, J. Healy (Eds.), *Case studies in hypnotherapy* (pp. 198–209). New York: Guildford Press
- Chaves, J. F. (1993). Hypnosis in pain management. In Rhue, R. H., Lyn, S. J., Kirsch, I (Eds.). *Handbook of clinical hypnosis* (pp. 511–532). Washington, DC: American Psychological Association.

- Durmus, D., Safaz, I., Adigüzel, E., Uran, A., Sarisoy, G., Goktepe, A. S., et al. (2015). The relationship between prosthesis use, phantom limb pain and psychiatric symptoms in male traumatic limb amputees. *Comprehensive Psychiatry*, 59, 45–53.
- Ehde, D. M., Czerniecki, J. M., Smith, D. G., Cambell, K. M., Edwards, W. T., Jensen, M. P., et al. (2000). Chronic phantom sensations, phantom pain, residual limb pain, and other regional pain after lower limb amputation. *Archives of Physical Medicine and Rehabilitation*, 81, 1039–1044.
- Ersland, L., Rosen, G., Lundervold, A., Smievoll, A. I., Tillung, Tl., Sunderberg, et al. (1996). Phantom limb imaginary finger tapping causes primary motor cortex activation: An fMRI study. *NeuroReport*, 8, 207–210.
- Faymonville, M. E., Roediger, L., Del Fiore, G., Delguedre, C., Phillips, C., Lamy, et al. (2003). Increased cerebral functional connectivity underlying the antinociceptive effects of hypnosis. *Cognitive Brain Research*, 17, 255–262.
- Flor, H., Nikolajsen, L., & Jensen, T. S. (2006). Phantom limb pain: A case of maladaptive CNS plasticity? *Nature Reviews Neuroscience*, 7, 873–881.
- Giummarra, M. J., & Moseley, G. L. (2011). Phantom limb pain and bodily awareness: Current concepts and future directions. *Current Opinions in Anaesthesiology*, 24, 524–531.
- Hawkins, R. M. F. (2001). A systematic meta-review of hypnosis as an empirically supported treatment for pain. *Pain review*, 8, 47–73.
- Hill, A., Niven, C. A., & Knussen, C. (1995). The role of coping in adjustment to phantom limb pain. *Pain*, 62, 79–86.
- Iannetti, G. D., Mouraux, A. (2010). From the neuromatrix to the pain matrix (and back). *Experimental Brain Research*, 205, 1–12.
- Jensen, K. B., Berna, Ch., Loggia, M. L., Wasan, A. D., Edwards, R. R., & Gollub, R. L. (2012). The use of functional neuroimaging to evaluate psychological and other non-pharmacological treatments for clinical pain. *Neuroscience Letters*, 520, 156–164.
- Jensen, T. S., Krebs, B., Nielsen, J., & Rasmussen, P. (1985). Immediate and long-term phantom limb pain in amputees: Incidence, clinical characteristics and relationship to pre-amputation limb pain. *Pain*, 21, 267–278.
- Kratochvíl, S. (2009). *Klinická hypnóza*. 3. aktualizované vydání. Praha: Grada.
- LeBaron, S., & Zeltaer, L. K. (1996). Children in pain. In J. Barber (Ed.), *Hypnosis and suggestion in the treatment of pain: A clinical guide* (pp. 305–340). New York: Norton.
- Melzack, R. (1992). Phantom limbs. *Scientific American*, 266, 120–126.
- Melzack, R. (2005). Evolution of the neuromatrix theory of pain. The Prithvi Raj Lecture. Presented at the Third World Congress of World Institute of Pain, Barcelona 2004. *Pain Practice*, 5, 85–94.
- Melzack, R., Israel, R., Lacroix, R., & Schultz, G. (1997). Phantom limbs in people with congenital limb deficiency or amputation in early childhood. *Brain*, 120, 1603–1620.
- Montgomery, G. H., DuHamel, K. N., & Redd, K. N. (2000). A meta-analysis of hypnotically induced analgesia: How effective is hypnosis? *International Journal of Clinical and Experimental Hypnosis*, 48, 138–153.
- Muraoka, M., Komiyama, H., Hosoi, M., Mine, K., & Kubo, C. (1996). Psychosomatic treatment of phantom limb pain with post-traumatic stress disorder: A case report. *Pain*, 66, 385–388.
- Nikolajsen, L., & Jensen, T. S. (2001). Phantom limb pain. *British Journal of Anaesthesia*, 87, 107–116.
- Niraj, S., & Niraj, G. (2014). Phantom limb pain and psychologic management: A critical review. *Pain Management Nursing*, 15, 349–364.

- Oakly, D. A., Whitman, L. G., & Halligan, P. W. (2002). Hypnotic imagery as a treatment for phantom limb pain: two case reports and a review. *Clinical Rehabilitation*, 16, 368-377.
- Parkers, C. M. (1973). Factors determining the persistence of phantom pain in the amputee. *Journal of Psychosomatic Research*, 17, 97-108.
- Patterson, D. R., & Jensen, M. P. (2003). Hypnosis and clinical pain. *Psychological Bulletin*, 129, 495-521.
- Rickard, J. A. (2004). *Effects of hypnosis in the treatment of residual stump pain and phantom limb pain*. Unpublished doctoral thesis.
- Rosen, G., Willoch, F., Bartenstein, P., Berner, N., & Rosjo, S. (2001). Neuropsychological processes underlying the phantom limb pain experience and the use of hypnosis in its clinical management: An intensive examination of two patients. *International Journal of Clinical and Experimental Hypnosis*, 49, 38-55.
- Shankar, H., Hansen, J., & Thomas, K. (2015). Phantom pain in patient with brachial plexus avulsion injury. *Pain Medicine*, 16, 777-781.
- Sherman, R. A., Sherman, C. J., & Gall, N. G. (1987). Psychological factors influencing phantom limb pain. *Pain*, 28, 285-295.
- Siegel, E. F. (1979). Control of phantom limb pain by hypnosis. *American Journal of Clinical Hypnosis*, 21, 285-286.
- Son, B. C., & Ha, S. W. (2015). Phantom remodeling effect of dorsal root entry zone lesioning in phantom limb pain caused by brachial plexus avulsion. *Stereotactic and Functional Neurosurgery*, 93, 240-244.
- Sthalekar, H. A. (1993). Hypnosis for relief of chronic phantom pain in a paralyzed limb: A case study. *Australian Journal of Clinical Hypnotherapy and Hypnosis*, 14, 75-80.
- Whyte, A. N., & Niven, C. A. (2001). Psychological distress in amputees with phantom limb pain. *Journal of Pain and Symptom Management*, 22, 938-946.