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Understanding Phantom Limb Pain

Causes, Symptoms & Treatment Options

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Medically reviewed: August 2026 | Last updated: August 2026

What Is Phantom Limb Pain?

The term “phantom limb” refers to the feeling that a missing limb is still attached to the body.[3] Most patients experience sensations of movement or the existence of a missing limb after amputation. Any nonpainful sensation felt in a missing limb or body part is considered a phantom sensation. These sensations can also include feelings of cold, heat, itching, or tingling.

When phantom sensations become painful, they are considered “phantom limb pain”, which can be severe and debilitating. Phantom limb pain is real pain that feels as if it is coming from a limb that has been amputated — most commonly an arm or leg.

Amputees may also feel pain in the remaining portion of their amputated limb, also referred to as “residual limb pain”. This is a different type of post-amputation pain than phantom limb pain.[1] Many amputees will experience both phantom limb pain and residual limb pain, and both types of pain may be felt at the same time.

This article explains the science behind phantom limb pain — what it is, what causes it, and what treatment options exist. For personalized medical advice, please consult your healthcare provider.

What Does Phantom Limb Pain Feel Like?

People experience phantom limb pain in many ways. This type of pain has been described as sharp, burning, shooting, stabbing, throbbing, tingling, or aching, and can vary widely from one person to the next.[5,9]

Phantom limb pain intensity is often evaluated using a scale from 0 to 10, where 0 represents "no pain" and 10 represents "pain as bad as you can imagine."[10] Average phantom limb pain has been reported by patients as moderate (approximately 5.5 out of 10 on the Numerical Rating Scale).[5,6] Studies have shown that 30% to 40% of patients rate their phantom limb pain as severe (at least 7 out of 10 on the Numerical Rating Scale).[5,6]

How Common is Phantom Limb Pain?

While not everyone who undergoes an arm or leg amputation will experience phantom limb pain, it is a fairly common experience. Based on a review of published studies, approximately 64% of amputees (or about 6 in 10) reported having phantom limb pain.[7]

How Long Does Phantom Limb Pain Last?

Phantom limb pain often begins soon after amputation, sometimes immediately after surgery, although for some people it may not develop until months or even years later.[4] For some people, phantom limb pain will go away on its own over time. However, for others, it may persist long after amputation. Studies of people living with limb loss have found that approximately 70%-

80% continue to report phantom limb pain more than 6 months after amputation.[5–7] At least 40% of amputees continue to experience phantom limb pain for decades.[3]

For people with persistent phantom limb pain, symptoms are often experienced intermittently as pain “episodes” lasting a few minutes to an hour, although some patients describe their pain as constant.[5,6] Pain episodes may occur once to multiple times per day, once to several times per week, or less frequently.[5] Some people continue to have pain even after trying multiple treatment options.[8]

What Causes Phantom Limb Pain?

While phantom limb pain is not fully understood, it is thought to involve changes in each of the following[2,3]:

1. Damaged nerve endings
2. The spinal cord
3. The brain.

Psychological factors can also influence phantom limb pain. While the body part or limb may be gone, the parts of the spinal cord and brain that used to process information from that body part are still present. These parts of the nervous system are still active and receptive to the pain signals, causing real pain that appears to be coming from a part of the body that isn’t there.

1. How Damaged Nerves Trigger Phantom Limb Pain

Wherever we can feel pain in our bodies, there are nerve endings present that sense the pain and tell the brain something painful is happening in that area. When a body part and the nerve(s) within it are removed, the remaining nerve endings are damaged and the nerve fibers within them try to make new connections with their surroundings.[2,3] The damage also changes how the nerve fibers are organized, ultimately resulting in over-activity. In pain-sensing nerves, the over-activity causes generation of spontaneous pain signals, which are pain signals even

without any painful inputs. These excessive pain signals are sent to the spinal cord from the nerve endings located near the site of amputation.

2. How the Spinal Cord Strengthens Phantom Limb Pain Signals

The spinal cord is part of the central nervous system. One feature of the central nervous system is the ability to adapt to more efficiently transfer information. When the spinal cord receives the same signal over and over, it makes the signal stronger before sending it to the brain in a process called “central sensitization”. Central sensitization causes the repetitive spontaneous pain signals coming from the amputated nerve to be made stronger as they pass through the spinal cord.[2,3] This process sets up the nervous system to be more sensitive to signals and can contribute to chronic pain.

3. How the Brain Processes Phantom Limb Pain

As pain signals reach the brain, different areas work together to process them. Like in the spinal cord, the signals can be strengthened or amplified via a process called central sensitization.[2]

Brain structures also contain sensory maps that correspond to the different parts of the body.[11] After loss of a limb, nearby brain structures may take over sensory map areas associated with the amputated limb.[12] This process – known as “cortical remapping” – can cause the brain to interpret pain signals as coming from the missing limb. Various emotional and cognitive factors also contribute to phantom limb pain. Stress, anxiety and depression can all amplify phantom limb pain through interactions within the brain impacting central sensitization and intensity of pain perception.[2]

How is Phantom Limb Pain Treated?

Treatment for phantom limb pain can vary from person to person and often involves multiple types of therapies. A broad range of treatment options are available, and may include both targeted and complementary therapies such as:

- Mirror therapy: A mirror is placed opposite the remaining limb, creating the visual illusion that the amputated limb is present when viewing the reflection. The visual feedback is perceived as the phantom limb by the brain and can help retrain the brain's sensory map through cortical remapping.[13]
- Acupuncture: Sterilized needles are inserted into the skin at specific locations on the body to stimulate the nervous system and reduce pain.[4]
- Therapeutic massage: Massage is a physical therapy generally included during rehabilitation that can help with pain.[4]
- Cognitive behavioral therapy: Structured therapy sessions focused on modifying thoughts and behaviors can influence the psychological amplification of pain to help reduce pain severity.[14]
- Medications: These may include over-the-counter pain medications like acetaminophen and nonsteroidal anti-inflammatory medications (NSAIDs) or prescription medications like antidepressants, anticonvulsants, and opioids.[4]
- Peripheral nerve blocks: Numbing medication is injected near the damaged nerve endings to prevent the nerve endings from sending pain signals.[11]
- Neuromodulation and neurostimulation therapies: These therapies change or modify how nerves communicate within the body by applying electrical signals.
    - Transcutaneous electrical nerve stimulation [TENS]: Current is applied via electrodes placed on the skin to interrupt the transmission of pain signals from the damaged nerve endings.[1]

- Spinal cord stimulation [SCS]: Current is applied by electrodes placed in or near the spine to interfere with pain signals as they enter the spinal cord on their way to the brain.[1]
- Peripheral nerve stimulation [PNS]: Current is applied by electrodes placed very near the damaged peripheral nerves to interfere with pain signals.[11]
- High-frequency nerve block: Current is applied directly to the damaged peripheral nerve to prevent the transmission of pain signals.[15]

Treatment plans are often individualized – what works for one person may not work for another. Talk to your healthcare provider about which options might be right for you.

Can Phantom Limb Pain Be Prevented?

While there is no known way to prevent phantom limb pain, surgical techniques performed at the time of amputation surgery may help reduce the chance of chronic pain developing in the future. These include:

- Targeted muscle reinnervation (TMR)[1]
- Regenerative peripheral nerve interface (RPNI)[11]

When to See a Health Care Provider for Phantom Limb Pain

Phantom limb pain is real pain for which there are treatment options. If you are experiencing pain that interferes with your ability to sleep or carry on with your daily activities, schedule an appointment with your healthcare provider.

Frequently Asked Questions About Phantom Limb Pain

- Is phantom limb pain real?

  Yes, phantom limb pain is real pain and not a psychological condition. Historically, phantom limb pain was dismissed by the medical community because it was thought to be a rare condition likely representing hallucinations.[16] However, phantom limb pain is now a well-documented neurological condition: studies show that 60%-80% of amputees experience chronic phantom limb pain.[5–7]

- What does phantom limb pain feel like?

  Phantom limb pain feels different for everyone. Pain sensations have been described as burning, shooting, stabbing, throbbing, tingling, or aching.[5,9] Some people may experience pain off and on as pain episodes while others may feel constant pain.[5,6]

- How long does phantom limb pain last?

  Phantom limb pain may begin immediately or develop in the months or years after amputation.[4] Approximately 60%-80% of amputees report chronic phantom limb pain, meaning the pain persists for more than 6 months.[5–7] At least 40% of amputees report phantom limb pain lasting for decades; however, pain can improve with treatment.[3]

- Can phantom limb pain go away on its own?

  For some patients phantom limb pain will resolve on its own, especially in the early months after amputation.[4] However, this pain may become chronic (lasting more than 6 months) for approximately 60%-80% of amputees.[5–7] There are many treatment options that may be able to help with phantom limb pain, so it is a good idea to talk to a health care provider.

- What causes phantom limb pain?

Phantom limb pain is caused by a combination of factors within the nervous system[2,3]. These factors include abnormal pain signals being sent from the damaged nerve at the site of amputation, amplification of pain signals at the spinal cord and brain, and the reorganization of the brain's sensory maps, or how the brain processes pain.

- What is the difference between phantom limb pain and residual limb pain?

  Phantom limb pain is pain that feels like it is coming from the missing limb. Residual limb pain is felt in the remaining portion of the amputated limb. Amputees often experience both types of pain, and both can occur at the same time.[1]

- Does phantom limb pain get worse over time?

  Phantom limb pain affects everyone differently. Some patients see improvement over time, especially with treatment; for others, pain can persist or come and go over time. Consult a pain specialist if pain is worsening.

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