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Pathophysiology, Signs and Symptoms of Phantom Pain

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Introduction

Phantom pain is a sensation that a person has in relation to a limb or organ that is no longer physically attached to the body, either because it was removed or because it was never there in the first place. Phantom limb feelings can, however, occur as a result of nerve avulsion or spinal cord injury.

Sensations are most commonly reported after an arm or leg is amputated, although they can also occur after the removal of a breast, a tooth, or an internal organ. The sensation of pain in an absent limb or a portion of a limb is known as phantom limb pain. The sense of pain differs from person to person.

Description

Any sensory phenomena (excluding pain) that is perceived at an absent limb or a portion of the limb is known as phantom limb sensation. At least 80% of amputees have reported experiencing phantom sensations at some point in their lives. Some people have phantom pain and sensations in their missing limbs for the rest of their lives.

Silas Weir Mitchell, an American neurologist, created the phrase "phantom limb" in 1871 [1]. "Thousands of ghost limbs were haunting as many fine troops, taunting them now and then," Mitchell wrote [2]. However, in 1551, French military physician Ambroise Paré stated that "the victims, long after the amputation is made, say that they still feel anguish in the amputated part"[2].

Symptoms and signs

The sensation of pain in a part of the body that has been removed is known as phantom pain.

The beginning of phantom pain might happen as soon as a few days after the amputation. The sensation may come and go, but it can also last for a long time. While the sensation usually affects the part of the limb furthest from the body, such as the foot of an amputated leg, it can also affect other body parts closer to the brain, such as the arm or hand. Shooting, stabbing, boring, squeezing, throbbing, or burning is some of the sensations. Smaller limbs and digits, such as toes or fingers, have milder sensations. Sometimes it feels as if the phantom component is being pressed into an awkward position. Overall, pressure on the remaining part of the limb or emotional tension may cause the feelings.

Pathophysiology

Experimental ideas and observations have all been used to develop the neurological foundation and processes underlying phantom limb pain. Little is known about the true process that causes phantom pains, and several ideas contradict each other. Historically, phantom pains were considered to be caused by neuromas at the tip of the stump. Traumatic neuromas, also known as non-tumour nerve injuries, are caused by the abnormal development of wounded nerve fibres. Despite the fact that stump neuromas play a role in phantom pains, they are not the only reason. This is due to the fact that people with congenital limb deficit can occasionally, if infrequently, suffer phantom pains. This shows that the limb responsible for painful feelings has a central representation [3]. Currently, hypotheses are based on reorganised cortical networks and altered neural pathways.

Peripheral mechanisms

Neuromas, which are generated from injured nerve terminals at the stump site and are capable of firing aberrant action potentials, were once thought to be the primary cause of phantom limb discomfort. Although neuromas can cause phantom pain, when peripheral nerves are treated with conduction blocking drugs, pain is not totally removed [3]. Physical stimulation of neuromas can increase C fibre activity and consequently phantom pain, but discomfort persists even after the neuromas stop firing action potentials. On phantom limb pain, the peripheral nervous system is regarded to have just a modulating effect [2].

Spinal mechanisms

Spinal mechanisms, in addition to peripheral mechanisms, are hypothesised to play a role in phantom pains. Peripheral nerve damage can cause C fibres in the dorsal horn of the spinal cord to degenerate, causing terminating A fibres to branch into the same lamina [2]. A fibre inputs could be reported as noxious stimuli if this happens. Substance P, which is involved in the transmission of pain signals, is normally expressed by A and C fibres, whereas substance P is expressed by A fibres following peripheral nerve injury [2]. This causes hyper excitability of the spinal cord, which happens only when unpleasant stimuli are present. Because phantom pains have been reported in patients with full spinal cord injury, there must be an underlying central mechanism that causes them.

Conclusion

The genetically programmed circuitry in the brain remains essentially intact throughout life under normal circumstances. Until around 30 years ago, it was considered that mature mammalian brains could not generate new neuronal circuits [3]. Functional MRI investigations in amputees have recently revealed that nearly all of them have suffered motor cortical remapping [4]. The majority of motor restructuring has taken place as a downward shift of the hand area of the cortex onto the face representation area, particularly the lips. A side shift of the hand motor cortex to the ipsilateral cortex has been seen [3]. The remodelling was significant enough in patients with phantom limb pain to elicit a change in cortical lip representation into

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the hand areas exclusively during lip movements [3]. There is also a strong link between the severity of phantom limb pain and the extent to which the cortical representation of the mouth has shifted towards the hand area during motor and somatosensory cortical remodelling [5]. Additionally, there was a greater degree of medial shift of the face motor representation as phantom sensations in upper extremity amputees developed [5]. There are a number of theories that attempt to explain how cortical remapping happens in amputees, but none has received widespread support.

Acknowledgement

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Conflict of Interest

None

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