

Embodied Cognition

The concept of Embodied Cognition (EC) states that cognition is not confined to the brain. Instead, EC underlines that the body constraints cognition and stresses the importance of action for cognitive processes. Two main claims useful for the rehabilitation practice are that a) the environment is part of the cognition b) cognition exists for the guiding of action. Relating these claims to amputees, it can be stated that a prosthesis should ideally be part of the cognition. For this incorporation of the prosthesis, voluntary action with the prosthesis is required. Furthermore, phantom limb sensations are found in both congenital amputees and amputees. Phantom limb pain, however, is thought to be caused by a discrepancy between motor commands and sensory feedback, since limbs endure a lot more phantom pain than body parts without voluntary movement control.

Methods

The theoretical part (*theory*) is the result of a non-systematic review about EC and the products of an amputation (phantom limb sensations, phantom limb pain and telescoping). For the part of the rehabilitation practice (*practice*), 29 rehabilitation practitioners have been interviewed. The participants were 15 physiotherapists and 14 prosthetists treating amputees in rehabilitation centres in the Netherlands. The interviews had an open character while following a checklist with fixed topics. The answers have been translated in percentages of rehabilitation practitioners that are familiar with or treating certain phantom limb phenomena. On this poster some of the main outcomes are presented. Since this research is a first *indicative study*, the results of the interviews need further investigation.



Phantom Limb Sensation

Practice

- Known, but cause unknown
- Treated (50%)
- Advantageous
 - No (80%)
 - Yes (20%)
- Feeling in prosthesis



Theory

- Probable body image by genetic pressure
- Experienced by 75-90% of amputees
- Advantageous to treat phantom limb pain
- Incorporates the prosthesis, possibly leading to better acceptance of the prosthesis

Phantom Limb Pain

Practice

- Known, but cause unknown
- Treated with movement, pressure from prosthesis and mirror therapy
- Not advantageous



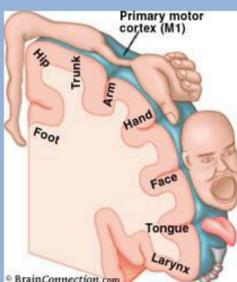
Theory

- Caused by uncoupling voluntary movement and sensory feedback
- Restoration sensori-motorloop with mirror, motor imagery or active use of prosthesis
- Not advantageous

Telescoping

Practice

- Known (57%), cause known
- Hardly treated (7%)
- Prosthesis are fitted early enough in most cases to prevent telescoping.
- Not advantageous



Theory

- Reorganizing of the cortex, with weak sensorimotor regions being overtaking by the strong regions
- Immediate fitting of prostheses keeps neural networks intact: no telescoping will occur
- Not advantageous

Environment

Practice

- Floors with flat surface
- Gyms with exercise equipment
- First stage mainly uses non-specific exercises
- Prosthesis is seen as an object instead of a body part

Theory

- Homelike environment
- Specific training in a specific environment
- Use of ego centric language (my leg vs. the prosthesis) helps incorporation prosthesis



Conclusion

- Concept of Embodied Cognition can improve the rehabilitation practice.
- Cognition is not centralized, but spread over body and environment. The prosthesis is part of the environment, while it should become part of the body.
- Restoring the sensorimotor loop with active use of prosthesis, mirror treatment or imagery prevents patients from experiencing phantom limb pain.
- The patients should train in homelike environments to enhance the rehabilitation.

Recommendations

- Start treatment and provide prosthesis as soon as possible.
- Patients should use prostheses actively.
- When prostheses can not be worn yet, patients should use mirror treatment and motor imagery to prevent telescoping and phantom limb pain.
- Patients should be encouraged to think of their prosthesis as their limb, rehabilitation practitioners have a leading role in language use.
- Let patients train with specific movements in a natural environment.