Ruprecht-Karls-Universität Heidelberg
Medizinische Fakultät Mannheim
Dissertations-Kurzfassung

Neural activity and motor behaviours in subjects with congenital limb deficiency and traumatic amputees

Autor: Anja Thanner
Institut / Klinik: Zentralinstitut für Seelische Gesundheit Mannheim (ZI)
Doktormutter: Prof. Dr. H. Flor

Phantom limb pain (PLP) is very common after amputation and has been associated with neural reorganization. The aetiology of PLP and its underlying mechanisms remain however unclear. Amelics are born with a missing limb and suffer from PLP extremely rarely, which makes them an interesting group to investigate cortical reorganization without the influence of chronic pain. Therefore, we decided to study amelics. The aim of this dissertation was to investigate cortical plasticity related to a missing limb and its relationship with motor behaviours and psychological factors. We also compared cortical plasticity between amelics, amputees with and without PLP and two-handed controls.

We used a virtual reality movement task with functional magnetic resonance imaging in amelics (n = 10), amputees with (n = 10) and without PLP (n = 10) and in two-handed matched controls (n = 10). Amelics had similar motor behaviour compared with controls in terms of bimanual arm usage. Amputees showed higher depression scores compared with amelics and controls.

There was no significant difference between amelics and two-handed controls in task-related activity and connectivity in primary somatomotor cortices. However, amelics showed decreased neural activity, functional connectivity and cortical distances compared with amputees. There was no significant difference between amputees with and without PLP. We found a trend towards a negative correlation between PLP intensity and neural activity, functional connectivity but not between PLP intensity and cortical distances in amputees. In amelics and amputees, depression scores were positively correlated with neural activity in the hemisphere contralateral to movement.

This work highlights that congenital limb deficiency and acquired amputation have different neural correlates, which may be the cause for differences in sensory perception (e.g. PLP). Amelics showed similar neural patterns to two-handed controls, possibly indicating early adaptive behaviours. The dissertation offers new insights into the understanding of the cortical representation related to a missing limb, and how it interacts with additional factors (hand usage, depression).