Capturing the Phantom: a programme for recording sensory remapping

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Introduction

Since experimental evidence of neural plasticity was first demonstrated in the 1970's, there has been an explosion of interest in this area, primarily with regard to re-mapping in the sensory cortex. While descriptions of phantom limb sensation after amputation have been reported since the 16th Century, it is only recently that attempts have been made to understand the phenomenon. Much has been learnt from case studies and functional imaging techniques, however direct recording of cutaneous sensory changes remains cumbersome. Data collection is time consuming and difficult to analyse, normally entailing drawing diagrams on paper for each individual case.

We describe a computer programme that enables patients' sensations, either spontaneous or evoked, to be recorded and automatically stored in a database. The data may then be visually displayed or exported for analysis. This system thereby allows one patient to be directly compared to another and for these sensory changes to be reliably tracked over time. It is designed to be used in a ward or clinic setting.

Method

Part 1: Software Development. The design process was a collaboration between the Tayside Pain Service and the Department of Applied Computing, University of Dundee.

Part 2: Assessment of usability, validity and reliability. A study was conducted with volunteers in which they were touched on known points on their body with a felt tipped pen and asked to record, using the programme, where they felt the touch.

Results

Volunteers found the programme easy to use. Results show a variability between point touched (stimulus) and point reported (response) of 3-5mm on the face, and a lack of consistency on the shin.

Discussion

We have created and assessed a computer programme to record cutaneous sensory information as reported by patients. It is designed to be used as a standard research tool in further studies. In addition to sensory remapping studies it may be used to record sensory changes such as allodynia and hyperalgesia and follow these changes over time. Possible applications include studies of phantom sensations and pain, hyperalgesia after surgery or injury and the sensory changes in complex regional pain syndrome.

Analysis to date suggests that it has a consistent error margin when used on the face but its validity and reliability for use elsewhere on the body require further investigation. Factors which may influence this include sensory innervation, familiarity, the use of a standard 2D image and the specificity of facial processing.

Conclusions

This study has shown that it is feasible to capture sensory data, using a computer programme. It provides a useful tool for further studies and also lays the groundwork for the development of more refined research tools in the future. We are undertaking studies to assess usability and reliability in patient groups.

Conflict of interests none.