CASE REPORT

Denervation of the ear and the 'folding flower' illusion

David Bruce Williams

Department of Neurology,
John Hunter Hospital,
Newcastle, New South Wales,
Australia

Correspondence to
Dr David Bruce Williams,
dvdbwilliams@gmail.com

SUMMARY

Following acute denervation of the ear, I experienced altered cutaneous sensory perception analogous to that reported by patients after limb amputation. This suggests that any sudden, complete loss of somaesthetic sensation can result in cortical reorganisation reflecting lost peripheral input. Although the short time course of the phenomenon suggests an initial functional reorganisation, it does not preclude longer time course structural alterations at multiple levels of the nervous system.

BACKGROUND

Neither the subjective consequences, nor the perceptual changes following denervation of the ear have previously been reported. If, as one may surmise, the conscious illusion of the 'folding flower' is a reflection of the initial, dynamic cortical responses to loss of sensory input, it suggests boundaries to the possible neural mechanisms that could be responsible.

CASE PRESENTATION

Recently, I underwent a modified radical neck dissection for metastatic squamous cell carcinoma of the throat. Part of the procedure involved sectioning of the great auricular nerve, thereby denervating the pinna, or the external ear. The innervation to the external ear canal, arising from branches of cranial nerves III, VII and X was unaffected by the surgery. Therefore, on waking after the operation, I was not surprised to find that the external ear was completely anaesthetic, but that I could still feel my external auditory canal normally.

However, quite unexpectedly, during the first few postoperative days I experienced the utterly convincing sensory illusion that my denervated external ear was folding in upon itself and becoming quite small, much as a flower folds its petals at night. This experience did not appear to have any obvious precipitant, would last for some minutes, and then abate. Observers confirmed my strong suspicion that no movement was occurring at the time of the sensory illusion. The experience occurred in a stereotyped fashion approximately five times in 72 h, and then ceased completely. The pinna remains largely anaesthetic months after the procedure, but the 'folding flower' illusions have ceased. Given that the external ear is not normally capable of volitional movement, the conscious experience of the external ear 'folding' in upon itself was both vivid, and notable for its novelty. An illusory movement that reduced the area subsumed by a two-dimensional projection of the external ear appears to be a remarkable conscious

rationalisation of the lost sensory input and (presumed) reduction in cortical representation.

DISCUSSION

Experiments in both primates and humans demonstrate that reorganisation of the cortical map may commence within hours of denervation or amputation.¹ However, most of this reported work has concerned denervation or amputation of limbs, which have much larger cortical representations than the ear. Patients with amputated hands have been reported to experience their 'phantom' hands as tightly clenched fists, analogous to the 'folded flower' of the ear described here.

This report suggests that the principles of cortical reorganisation deduced from studying limbs might apply more broadly to all denervated or amputated tissue with somaesthetic representation in the cerebral cortex. Both the nature and the timing of the reported 'folding flower' illusion would be consistent with the hypothesis that the cortical representation of the ear diminishes in total area once sensory input from that region ceases, and that the diminution, occurring initially within 24 h of denervation is, at least at that time, likely to be a functional rather than a structural reorganisation of the relevant cortex. There is good reason to think, however, that this does not exclude additional reorganisation of sensory input at more caudal or peripheral levels of the nervous system.² Unfortunately, at this time functional MR scanning lacks the temporal resolution, and electroencephalography/magnetoencephalography lack the spatial resolution to image rapid functional changes in small areas of cortex.

Learning points

- ▶ Denervation of any somatic structure with consciously accessible cortical representation may result in an altered (illusory) body image analogous to those described following limb amputation.
- ▶ Revision of cortical somaesthetic representation occurs quite rapidly following denervation.
- ▶ Revision of cortical somaesthetic representation may have both functional and structural aspects.

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