BRAIN INJURY

Severely disabled patients can communicate and control their environment using a sniffing mechanism

Severe disability can result in complete paralysis and inability to communicate. Plotkin *et al.* have now developed a device that measures 'sniffs', allowing severely disabled individuals to communicate and control their environment.

Surviving a severe injury can leave individuals with life-long disabilities ranging from quadriplegia to 'locked-in syndrome' (LIS), in which cognition is intact but the patient is completely paralyzed. Assistive technologies for such patients have focused on residual muscle control—usually of the eye or sphincter muscles—but no effective means of communication is available for LIS.

Humans can rapidly modulate their sniffs by changing the position of the soft palate, which is innervated by cranial nerves. Plotkin *et al.* surmised that sniff modulation abilities might be conserved in patients with LIS, thereby offering a potential means of communication.

The researchers built the 'sniff controller', which measures changes in nasal pressure resulting from movements of the soft palate, independent of respiration. They demonstrated that 36 healthy individuals could use the device to play computer games and operate text-writing software, indicating that rapid, accurate control was possible.

> "...sniff control offers the best chance of self-expression..."

Next, the researchers tested the device with a number of patients with LIS. LI1, who had been 'locked-in' for 7 months, LI2, who had been 'locked-in' for 18 years, and a further quadriplegic patient were all able to use the text-writing software. LI1 sent her first message to her family.

Plotkin *et al.* then built a sniff-dependent code for the control of a wheelchair, with which 10 healthy participants and one quadriplegic patient were all able to navigate a complex 35 m path. Functional MRI data from these participants showed that brain areas commonly associated with language and motor control were activated.

The researchers concluded that in comparison with other assistive technologies, sniff control is inexpensive and offers the best chance of meaningful self-expression in patients with LIS.

Further research will determine the utility of the sniff controller. For other researchers in the field, the development of a genuine brain–computer interface remains a key goal, as the prevalence of severe disability continues to grow with advances in emergency medicine.

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Original article Plotkin, A. *et al.* Sniffing enables communication and environmental control for the severely disabled. *Proc. Natl Acad. Sci. USA* **107**, 14413–14418 (2010)

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