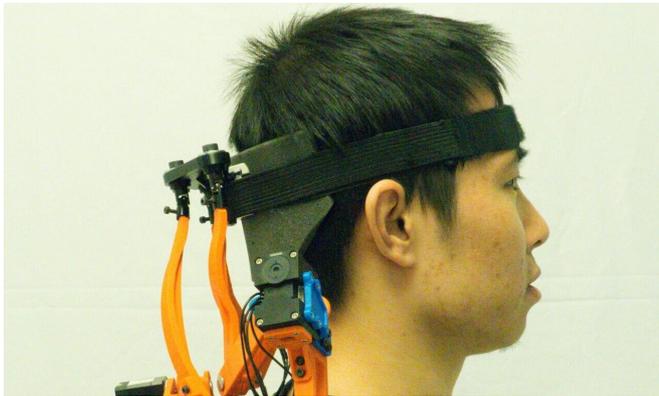


Robotic neck brace dramatically improves functions of ALS patients

12 August 2019



A study participant wearing the robotic neck brace that dramatically improves functions of ALS patients. The comfortable brace incorporates both sensors and actuators to restore roughly 70% of the active range of motion. Credit: Haohan Zhang and Sunil K. Agrawal/Columbia Engineering

A novel neck brace, which supports the neck during its natural motion, was designed by Columbia engineers. This is the first device shown to dramatically assist patients suffering from Amyotrophic Lateral Sclerosis (ALS) in holding their heads and actively supporting them during range of motion. This advance would result in improved quality of life for patients, not only in improving eye contact during conversation, but also in facilitating the use of eyes as a joystick to control movements on a computer, much as scientist Stephen Hawkins famously did.

A team of engineers and neurologists led by Sunil Agrawal, professor of mechanical engineering and of rehabilitation and [regenerative medicine](#), designed a comfortable and wearable robotic [neck](#) brace that incorporates both sensors and actuators to adjust the head posture, restoring roughly 70% of the active range of motion of the human head. Using simultaneous measurement of the motion

with sensors on the neck brace and surface electromyography (EMG) of the [neck muscles](#), it also becomes a new diagnostic tool for impaired motion of the head-neck. Their [pilot study](#) was published August 7 in the *Annals of Clinical and Translational Neurology*.

The brace also shows promise for [clinical use](#) beyond ALS, according to Agrawal, who directs the Robotics and Rehabilitation (ROAR) Laboratory. "The brace would also be useful to modulate rehabilitation for those who have suffered whiplash neck injuries from car accidents or have from poor neck control because of [neurological diseases](#) such as cerebral palsy," he said.

"To the best of my knowledge, Professor Agrawal and his team have investigated, for the first time, the muscle mechanisms in the neck muscles of patients with ALS. Their neck brace is such an important step in helping patients with ALS, a devastating and rapidly progressive terminal [disease](#)," said Hiroshi Mitsumoto, Wesley J. Howe Professor of neurology at the Eleanor and Lou Gehrig ALS Center at Columbia University Irving Medical Center who, along with Jinsy Andrews, assistant professor of neurology, co-led the study with Agrawal. "We have two medications that have been approved, but they only modestly slow down [disease progression](#). Although we cannot cure the disease at this time, we can improve the patient's [quality of life](#) by easing the difficult symptoms with the robotic neck brace."

Commonly known as Lou Gehrig's disease, ALS is a neurodegenerative disease characterized by progressive loss of muscle functions, leading to paralysis of the limbs and respiratory failure. Dropped head, due to declining neck muscle strength, is a defining feature of the disease. Over the course of their illness, which can range from several months to more than 10 years, patients completely lose mobility of the head, settling in to a chin-on-chest posture that impairs speech,

breathing, and swallowing. Current static neck braces become increasingly uncomfortable and ineffective as the disease progresses.

To test this new robotic device, the team recruited 11 ALS patients along with 10 healthy, age-matched subjects. The participants in the study were asked to perform single-plane motions of the head-neck that included flexion-extension, lateral bending, and axial rotation. The experiments showed that patients with ALS, even in the very early stages of the disease, use a different strategy of head-neck coordination compared to age-matched healthy subjects. These features are well correlated with clinical ALS scores routinely used by clinicians. The measurements collected by the device can be used clinically to better assess head drop and the ALS disease progression.

"In the next phase of our research, we will characterize how active assistance from the neck [brace](#) will impact ALS subjects with severe head drop to perform activities of daily life," said Agrawal, who is also a member of Columbia University's Data Science Institute. "For example, they can use their eyes as a joystick to move the head-neck to look at loved ones or objects around them."

More information: Haohan Zhang et al, A robotic neck brace to characterize head-neck motion and muscle electromyography in subjects with amyotrophic lateral sclerosis, *Annals of Clinical and Translational Neurology* (2019). [DOI: 10.1002/acn3.50864](#)

Provided by Columbia University School of Engineering and Applied Science

APA citation: Robotic neck brace dramatically improves functions of ALS patients (2019, August 12) retrieved 23 April 2021 from <https://medicalxpress.com/news/2019-08-robotic-neck-brace-functions-als.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.