

Power vest supports the back without restricting freedom of movement

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The CareJack vest supports the back without restricting freedom of movement.
Credit: Fraunhofer IPK/IZM

Each year millions of people within the EU injure themselves in the course of their work due to picking up heavy loads or from one-sided movements – ending up with serious health issues. Together with the

industry, Fraunhofer researchers are developing a vest designed to take the burden off caregivers and others with physically demanding jobs.

In Germany, back pain is a national complaint, with nearly ten percent of all lost working days attributable to lower back problems, according to the 2014 Health Report published by the Techniker Krankenkasse. The study found that occupation had a significant impact on the duration and frequency of time taken off due to poor health. Caregivers are particularly affected, because working in a hospital or nursing home requires physical strength. There are patients to move, mobilize and help up – and all that puts the musculoskeletal system under stress. Now, modern technology offers [caregivers](#)' backs extra support. In the "CareJack" project, researchers from the Fraunhofer Institute for Production Systems and Design Technology IPK and the Fraunhofer Institute for Reliability and Microintegration IZM, both in Berlin, are working together with industry partners to develop an active vest designed for these kinds of workers. Cleverly, this non-bulky orthosis (a short form of orthopedic prosthesis) is light, soft and comfortable to wear. That means it can be worn over regular clothes like a coat. Experts call it soft robotics.

"Until now, there haven't been any efficient support systems to help caregivers with the heavy work they encounter in their extremely varied day-to-day work," says IPK expert Henning Schmidt, who heads up the project. Anyone working in hospitals, nursing homes or outpatient care needs a strong back. But how can you provide the spine with support without limiting its abundant range of motion? Schmidt and his team have joined forces with company partners to strike out on a new path. Rather than relying on the hard shells often used in orthoses, they've instead opted for a material that is flexible and comfortable to wear. All the electronics are incorporated into the material.

The energy required comes from the wearers themselves, through their

movements. When a caregiver bends down to lift a patient up, the smart medical aid stores the kinetic energy and can release it again when required.

Orthosis helps avoid incorrect movements

Above all, the orthosis ensures that caregivers perform movements correctly. Lots of orthopedic problems are a result of improper movements: the classic example is lifting something heavy with a rounded back instead of squatting down to lift the object with a straight back. The smart vest features a myriad of sensors that continuously monitor the way the wearer is moving. A processor compares these data against the optimum movement pattern. As soon as it detects any irregularity, a warning lamp is activated. Not only that, but innovative synthetic actuators with adjustable rigidity help avoid incorrect movements and support correct ones. "The wearer can decide themselves what level of support they want," says Schmidt.

Functions of this sophistication call for a large amount of electronic equipment. "Still, nobody wants to haul around a backpack full of electronics," says IZM expert Erik Jung. In the CareJack project, he and his team collaborated with company partners to develop miniaturized components, flexible circuit boards and all the necessary sensors. A prototype of the vest should appear in 2015, and Schmidt estimates it will be in series production in one to two years. The demand, he points out, is extremely high. It's not just caregivers who could make use of this sort of active support, but anyone performing heavy physical work – construction workers, roofers, garbage collectors, brick layers and many more.

Provided by Fraunhofer-Gesellschaft

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