Exploring the advantages of the **EksoVest and Leg-X exoskeletons** for SMEs and construction workers

Research funded by:

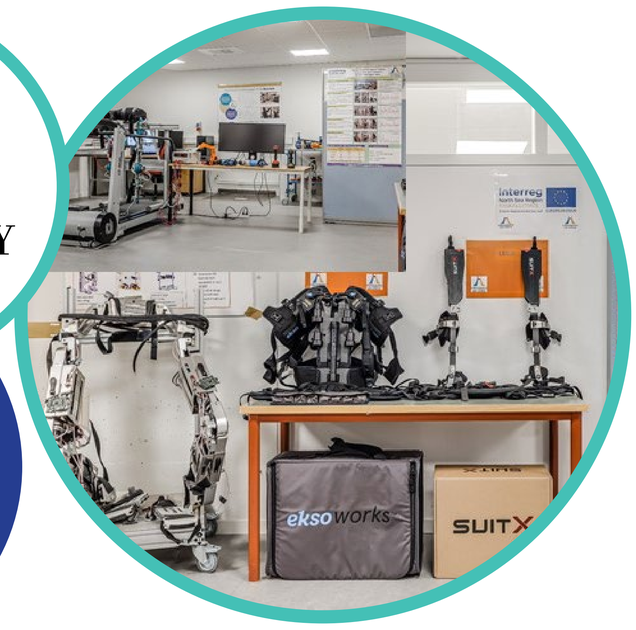
Interreg North Sea Region EXSKALLERATE
European Regional Development Fund

EUROPEAN UNION

In the European Union, up to **44 million workers are affected by workplace-related musculoskeletal disorders (MSDs),** fatigue, and injuries, representing a total annual cost of more than **€240 billion**.

UNIVERSITY OF GÄVLE

To assist workers in their jobs by reducing muscular stresses, the University of Gävle has tested upper and lower-body exoskeletons.

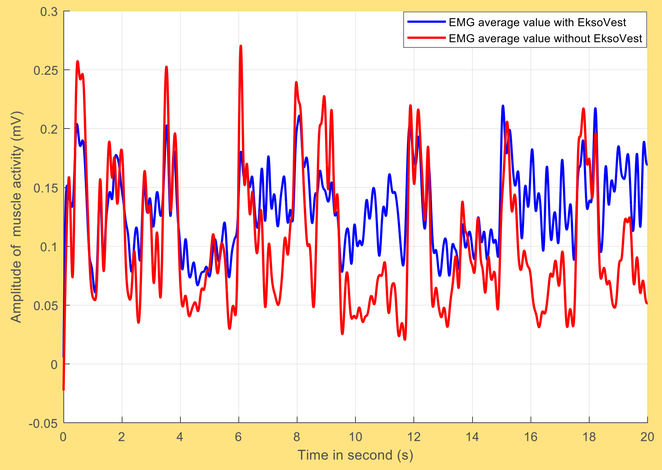


- SMEs and construction workers undertake physically strenuous activities that rapidly **increase risks of injury,** health problems, disability, and sick leave.
- Large companies such as **Ford, Audi and Toyota are already using exoskeletons** and have reported an 85% reduction in sick leave & work-related injuries.
- However, SMEs, construction and logistics workers are reluctant to use exoskeletons due to a lack of awareness.
- The University of Gävle, **through the EXSKALLERATE project,** aims to reach out to such SMEs through Lab visits, demos, training, and press coverage to create awareness.
- Below are the results of exoskeleton testing while performing workers' tasks, at the Assistive Exoskeletons Lab. Researchers found a **reduction of almost 60% in human effort.**

OVERHEAD POSITION

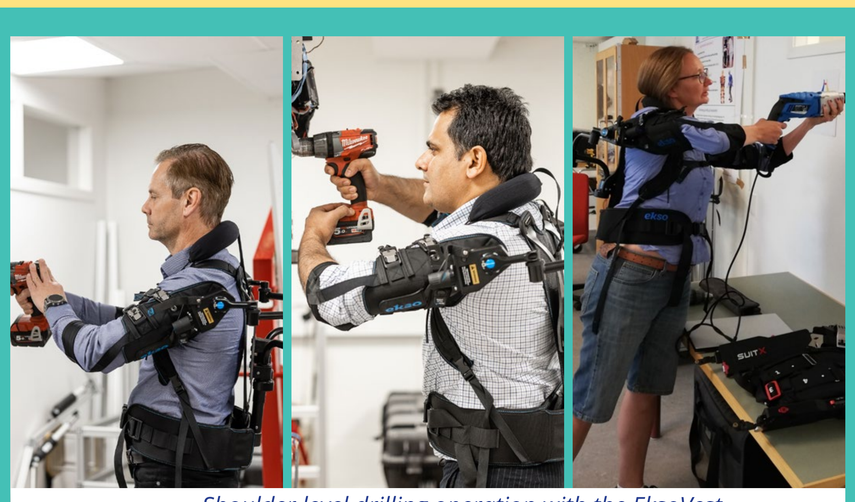
- Overhead work such as roof drilling is a common task for construction workers. It inflicts immense stress on shoulder and elbow joints and is one of the main causes of shoulder and arm injuries.
- The University of Gävle has carried out roof drilling tasks and measured workers' muscle activity with and without wearing the 'EksoVest'.
- It was found that by wearing the EksoVest human effort was reduced by up to 60%.

Overhead drilling operation with the EksoVest at University of Gävle

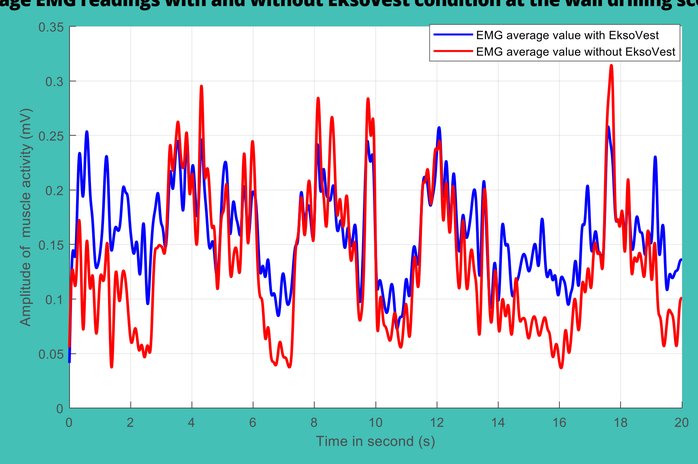


SHOULDER POSITION

- Different tasks were also performed at shoulder level. As shown in the graph on the right, it was found that workers' muscle effort was reduced by up to 62%.
- A 3.5kg power drilling machine was used in overhead and shoulder level drilling experiments to calculate peak muscle activity.



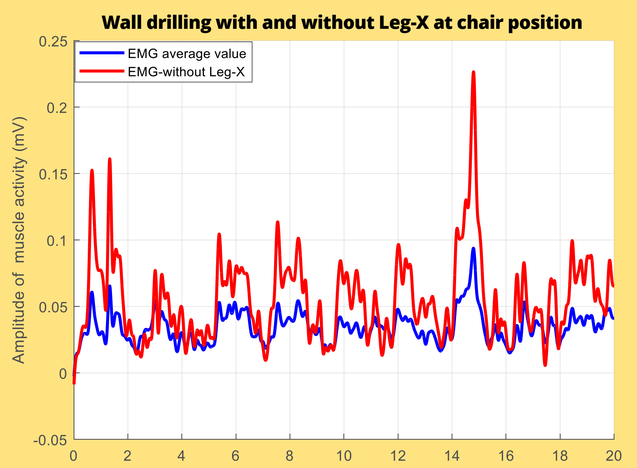
Shoulder level drilling operation with the EksoVest



CHAIR POSITION

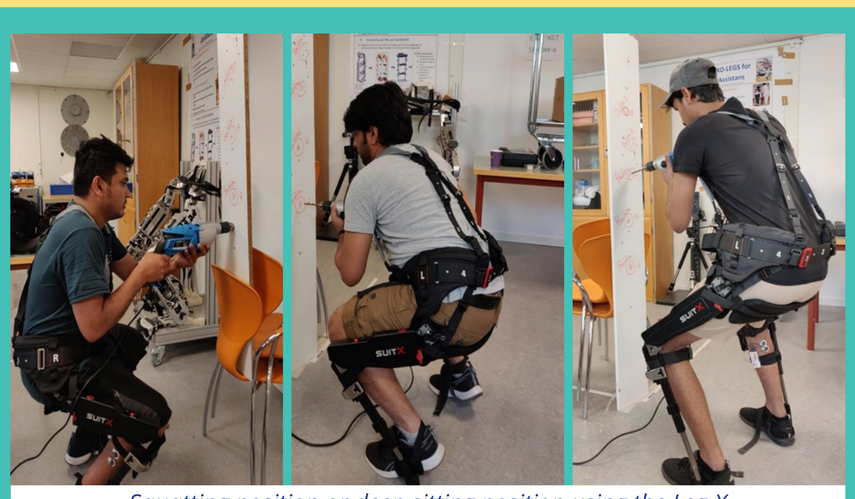
- Knee injuries are one of the most common injuries that workers endure. The University of Gävle has also performed different tests to examine the lower limbs muscle activity.
- It was found that muscle activity and the load on the lower body was reduced by up to 42% when using Leg-X to perform different tasks in the 'virtual chair position'.

Lower body or Chair position Tasks using the Leg-X

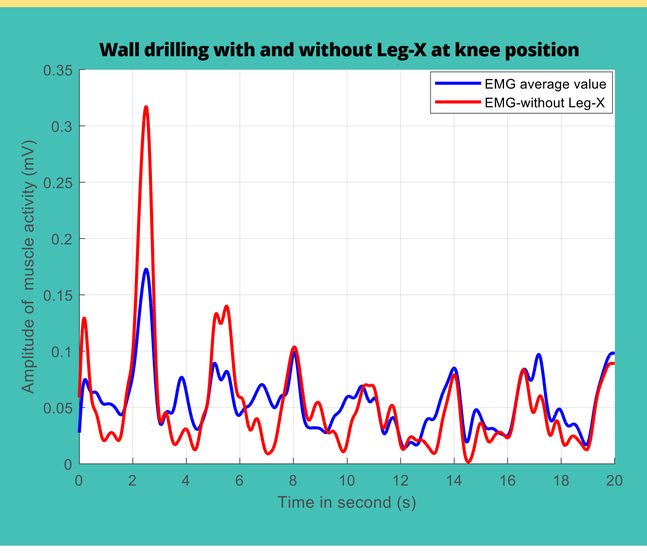


KNEE POSITION

- Knee joints experience extreme stresses while performing certain tasks. The University of Gävle measured the muscle activity of the lower body while performing these tasks with and without the Leg-X.
- Workers' efforts were reduced by 45% when wearing the Leg-X, proving that this exoskeleton effectively reduces the load on the hip & knee joints.



Squatting position or deep sitting position using the Leg-X



RESULTS

S.No	Drilling Position	Muscle activity without Exo (mV)	Muscle activity with Exo (mV)	Efficiency $\eta = \frac{RF - BV}{RF} \times 100\%$
1	Overhead	0.22	0.09	60%
2	Wall	0.28	0.11	62%
3	Chair	0.19	0.11	42%
4	Hip & Knee	0.32	0.17	45%

Peak muscle activity measured by EMG sensor kit from biceps and lower limbs

Questions? Contact:

Dr. Sajid Rafique / Sofi Jonsevall
Faculty of Engineering and Sustainable Development
University of Gävle
Sajid.Rafique@hig.se / sofi.jonsevall@hig.se
026-648251 / 070 755 19 49