Clinical Benefits of Add-On Drives and the e-motion

Extend your range of travel and help reduce strain on muscles and joints

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Content

What is a pushrim-activated power assist?

Like a pedelec (e-bike), with a pushrim-activated power assist, electric motors in the wheel hub amplify the drive movement of the wheelchair user.

Special sensors attached to the pushrims measure the pressure of the push during motion and convert it into corresponding power assistance. Integrated lithium-ion batteries provide the required energy.

Pushrim-activated power assist can be attached to almost any manual wheelchair using lightweight and discreet adapters which, generally do not change the characteristics of the wheelchair. In most cases, the manual wheelchair wheels can still be used.

The drive wheels of the e-motion power assist are simply attached to the chair instead of the manual wheelchair wheels. The battery is integrated into the wheel hub.

Why pushrim-activated power assist?

Manage longer distances and slopes

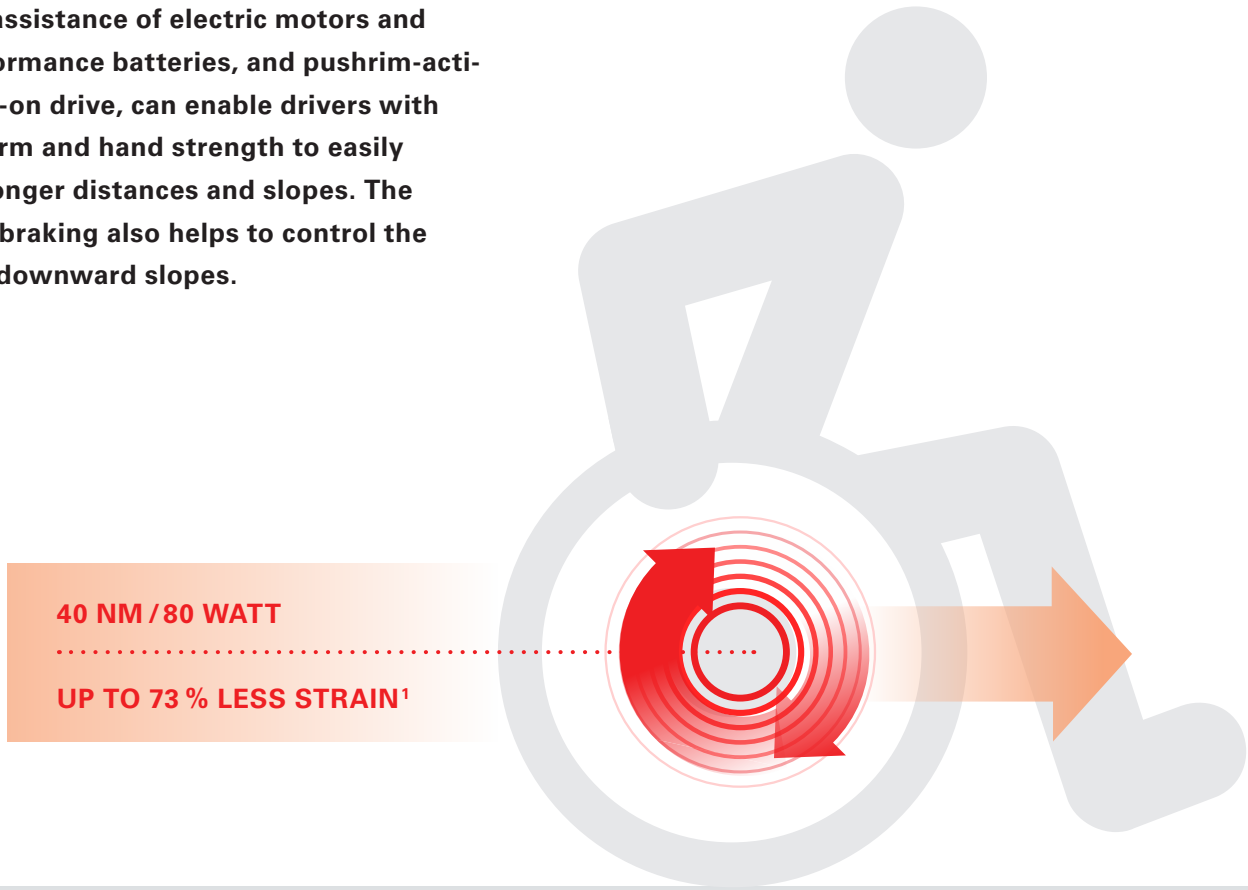
Many wheelchair drivers do not have sufficient strength in their arms and hands to safely propel themselves over longer distances. Even slight slopes can make it much more difficult to move the wheelchair. Braking on downward slopes is another challenge that should not be underestimated and can sometimes even lead to dangerous situations. These challenges often reduce the activity level of wheelchair users, restricting their freedom and making them dependent on the assistance of other people.

With the assistance of electric motors and high-performance batteries, and pushrim-activated add-on drive, can enable drivers with reduced arm and hand strength to easily manage longer distances and slopes. The amplified braking also helps to control the speed on downward slopes.

No fatigue throughout the day

Sometimes strength or stamina is not enough to keep the wheelchair driver moving throughout the entire day. Actions that seem easy in the morning can become a burden as the day progresses and lead to premature fatigue.

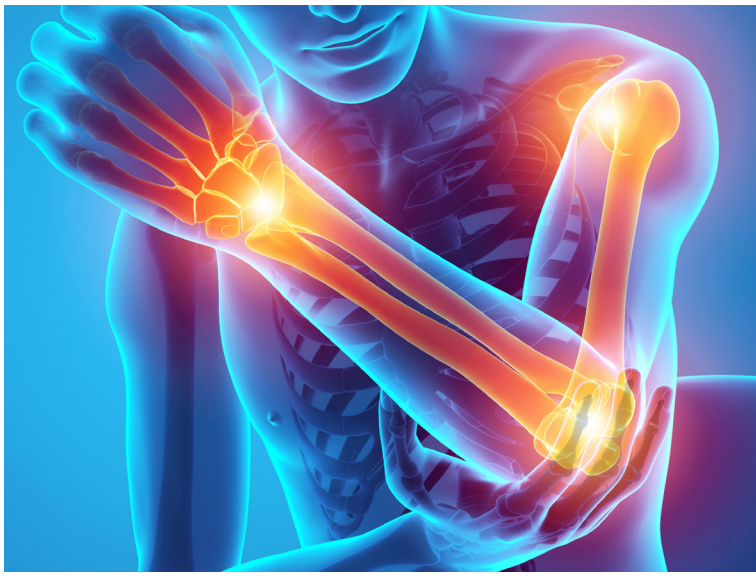
By reducing the effort by up to 73 %[1], a pushrim-activated add-on drive can ensure that even wheelchair users with limited strength and stamina get through their day.



1 J. Arva, S.G. Fitzgerald, R.A. Cooper, M.L. Boninger – *Medical Engineering & Physics*, 2001.

Preventing strain and its consequences

Wheelchair drivers with sufficient strength and stamina often complain about an entirely different problem: The permanent strain on shoulders, elbows and wrists may cause injuries, premature wear and pain. According to a study, 75% of all wheelchair drivers complain of symptoms in their lifetime.[2] The healthcare costs for additional treatments and operations should also be considered. The costs to the healthcare system caused by additional treatments and operations should also not be underestimated.



The reduced effort when driving with a push-rim-activated power assist considerably reduces the strain on the entire musculoskeletal system and therefore protects against wear in the long term.[3]

At the same time, the wheelchair driver stays active and therefore continues to maintain their health and vital functions.

AREAS PARTICULARLY AFFECTED:

- **Hands and wrists (e.g. carpel tunnel syndrome)**
- **Shoulders (rotator cuff, tendinitis)**
- **Elbows (tendinitis)**

2 R.A. Cooper, D.S. Boehninger, A.M. Koontz – *Investigation of the Performance of an ergonomic handrim*, 2006.
3 M.G. Kloosterman, J.H. Buurke, W. de Vries, L.H. van der Woude, J.S. Rietman – *Medical Engineering & Physics*, 2015.

What are the advantages of the e-motion?

The e-motion M25 is a state-of-the-art pushrim-activated power assist. At 7.8 kg / 17 lbs per wheel, it is one of the lightest systems on the market. The integrated electric motor is silent and high-powered. The system assists a wheelchair driver to propel themselves at up to 8.5 km/h / 5.2 mph.[4]

The wheels can be easily removed from the wheelchair in a single movement and transported in any kind of vehicle. Travelling is also made easy with features that ensure the integrated batteries are safe for air flight.

The e-motion also has additional special features that make life easier.

- The patented rollback delay prevents the wheelchair from rolling back on slopes and therefore ensures a much more relaxed grip and trip.

- The optional cruise mode makes it possible to maintain a permanent speed with just one push. In this mode, the e-motion temporarily mimics an electric wheelchair without brake and joystick. It helps ensure the wheelchair driver can safely reach their destination even when stamina suddenly decreases.

4 Depending on configuration

With the optional cruise mode function, it takes just one push on the pushrim to maintain a permanent speed

The drive wheels of the e-motion can be removed in a single movement and fit in most trunks

BENEFITS AT A GLANCE:

Fits most wheelchairs

Powerful assistance on slopes

Assists when braking downhill

Up to 25 km / 15.5 m range with a single battery charge

Integrated rollback delay on hills

Optional cruise mode

The wheels fit in most trunks (only 7.8 kg / 17 lbs. per wheel)

Who is the e-motion suitable for?

The e-motion fits a wide range of pathologies, even in the geriatric sector

The e-motion can be used by almost any wheelchair driver, meeting a wide range of pediatric and even geriatric needs. In our experience, the e-motion is especially useful for wheelchair drivers with neurodegenerative conditions. It enables them to continue moving independently through-out the day and prevents or at least delays them from having to use an electric wheelchair.[5]

The e-motion is also ideal for paraplegics and quadriplegics.[6] The drive wheels are available with four different pushrim coatings and provide sufficient grip even for users with limited hand function.

5 E.M. Giesbrecht, J.D. Ripat, A.Q. Quanbury, J.E. Cooper – *Disability & Rehabilitation: Assistive Technology*, 2009.
6 S.D. Algood, R.A. Cooper, S.G. Fitzgerald, R. Cooper, M.L. Boninger – *Arch Phys Med Rehabil*, 2004.

It is important to know that the driving behavior of the e-motion can be easily adapted to meet the needs of any wheelchair driver:

- For each drive wheel, the sensitivity of the sensors on the pushrims can be adjusted in seven increments. This makes it easy to balance any strength imbalances between the left and right half of the body and ensures that the wheel-chair user drives straight at all times.

- With the free smartphone app, users can choose from four preset driving profiles. These profiles provide different drive behavior, adjusting the power, speed and responsiveness of the e-motion. A custom profile can be programmed in a password-protected area.

- Each drive profile has two assistance levels for indoor and outdoor use that can be selected with the optional remote control or the smartphone app. A special learning mode is also available, allowing the wheelchair driver to get used to handling their e-motion.

AREAS OF USE

Neurodegenerative pathologies

Paraplegics

Quadriplegics

Geriatrics

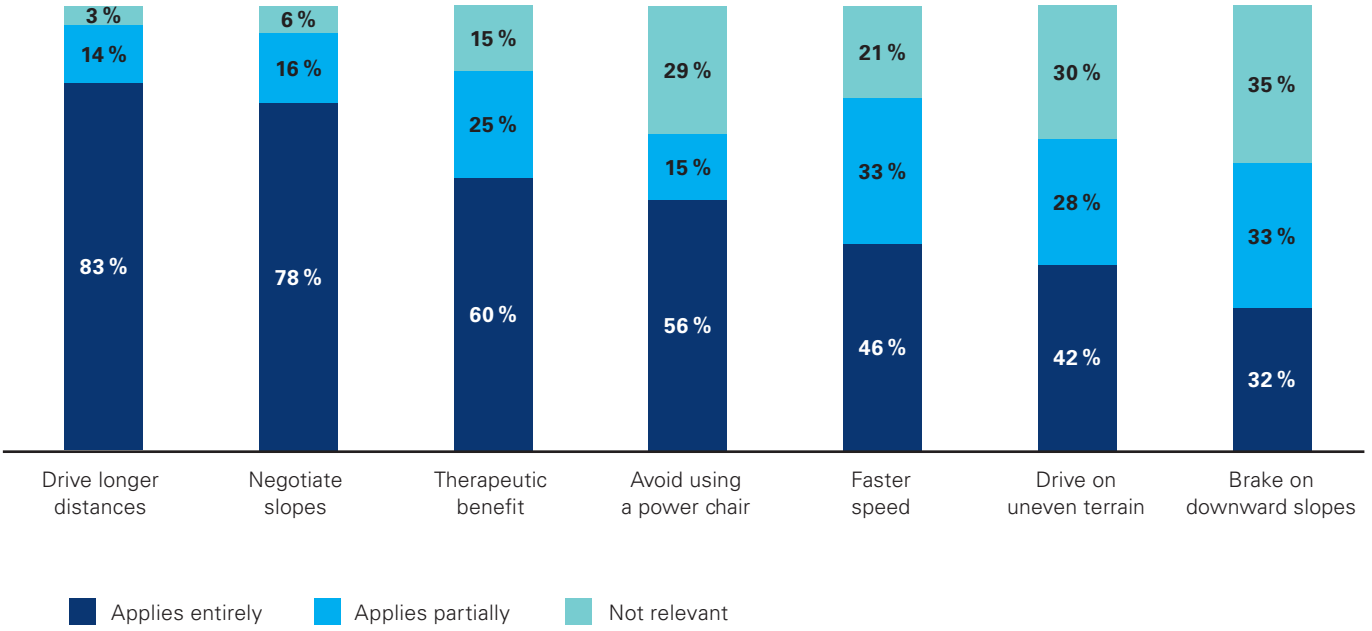
Pediatrics

Adjustable sensitivity of the drive sensor in seven increments

Optional coated pushrim with ergonomic shape for users with limited hand or triceps function (e.g. Quadriplegics)

Has the therapeutic benefit of e-motion been proven?

Reasons for choosing the e-motion



In recent years, Alber has held more than 10 customer polls with a total of more than 1,000 e-motion users. All of whom confirm great satisfaction with the add-on drive: **88 % of all e-motion users would choose it again and recommend it to friends and family.**[7]

Numerous studies on pushrim-activated add-on drives have been published, which suppoery the thera-peutic benefit of e-motion.

7 Alber customer poll, 2001–2011.

The studies referenced on pg 11 in this document, demonstrate the therapeutic benefits of push rim-activated power assist.

Overview of studies on pushrim-activated add-on drives

AUTHORS	RELEASED TITLE / DATE	SUMMARY OF THE OUTCOME
M.G. Kloosterman, J.H. Buurke, W. de Vries, L.H.V. van der Woude, J.S. Rietman	*Medical Engineering & Physics* October 2015	In conclusion, compared to hand-rim propulsion power-assisted propulsion seems effective in reducing potential risk factors of overuse injuries with the highest gain on decreased range of motion of the shoulder joint, lower peak propulsion force on the rim and reduced muscle activity.
M.G. Kloosterman, G.J. Snoek, L.H. van der Woude, J.H. Buurke, J.S. Rietman	*Clinical Rehabilitation* Issue 27 September 2012	Power-assisted propulsion might be beneficial for subjects in whom independent hand-rim wheelchair propulsion is endangered by arm injury, insufficient arm strength or low cardiopulmonary reserves. Also, subjects who have difficulty propelling a wheelchair in a challenging environment can benefit from power-assisted wheelchair use.
E.M. Giesbrecht, J.D. Ripat, A.O. Quanbury, J.E. Cooper	*Disability & Rehabilitation: Assistive Technology* Issue 4 September 2009	Additional knowledge was gained about the benefits pushrim-activated add-on drive technology. Participants were able to continue participating independently in their self-identified community activities using the pushrim-activated add-on drives, and identified comparable ratings of satisfaction and performance with the pushrim-activated add-on drives and the power wheelchair. For some individuals requiring power mobility, the pushrim-activated add-on drives may provide an alternative to the power wheelchair.
S.D. Algood, R.A. Cooper, S.G. Fitzgerald, R. Cooper, M.L. Boninger	*Arch Phys Med Rehabil* January 2005	For subjects with tetraplegia, pushrim-activated add-on drives have the potential to improve functional capabilities during certain ADLs, especially when propelling up ramps, over uneven surfaces, and over thick carpet.
S.D. Algood, R.A. Cooper, S.G. Fitzgerald, R. Cooper, M.L. Boninger	*Arch Phys Med Rehabil* November 2004	For subjects with tetraplegia, pushrim-activated add-on drives reduce the energy demands, stroke frequency, and overall joint range of motion when compared with traditional manual wheelchair propulsion.
R.A. Cooper, S.G. Fitzgerald, M.L. Boninger, K. Prins, A.J. Rentschler, J. Arva, T.J. O'Connor	*Arch Phys Med Rehabil* May 2001	With the pushrim-activated add-on drive, the user had a significantly lower oxygen consumption. Pushrim-activated add-on drives may provide manual wheelchairs with a less physiologically stressful means of mobility with few adaptations to the vehicle or home environment.
J. Arva, S.G. Fitzgerald, R.A. Cooper, M.L. Boninger	*Medical Engineering & Physics* January 2001	Pushrim-activated add-on drives provide on average 73% of the total power when subjects propel with power assistance. Significantly increased efficiency and reduced requirement of user power is achieved using pushrim-activated add-on drives. With use, the pushrim- activated add-on drives may contribute to delaying secondary injuries of manual wheelchair users. In addition, it may be suitable for people who have (or at risk for) upper extremity joint degeneration, reduced exercise capacity, low strength or endurance who currently use electric powered wheelchairs.
T. Corfman, R.A. Cooper, S.G. Fitzgerald, J. Arva, D. Spaeth, M.L. Boninger	*Proceedings RESNA Annual Conference* January 2000	These findings provide the foundation for studying the utility of the pushrim-activated add-on drives in reducing the risk of upper limb injury and neuropathy in the manual wheelchair user population.

The e-motion is produced by Alber in Germany, the specialist for portable and user friendly mobility aids.

e-motion is CE-compliant according to the European Medical Devices Directive (MDR) 2017/745 and is tested and certified on a voluntary basis by the TÜV Süd, in line with the currently valid edition of the product standard EN 12184.

About Alber

Our company is certified to the latest quality management standard (including the respective latest amendments) set out in ISO 13485 for medical devices. With our environmental management system, certified to ISO 14001, we ensure the environmentally compatible manufacture of our products.

Please refer to the Alber and wheelchair users manuals for additional safety information and instructions.

CONTACT YOUR INVACARE SALES REPRESENTATIVE TO LEARN MORE OR SCHEDULE A DEMO.

888.426.8581 | info@alber-usa.com | alber-usa.com

Alber USA LLC | 1005 International Drive | Oakdale, PA 15071

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