02 | 2025 VOLUME 9

THERAPY

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SCIENCE
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LIFE IN MOTION

FOREWORD

Viva la revolución

Dear readers,

Rehabilitation goes well beyond just physiotherapy. It is highly specialised, scientifically validated and technologically supported. Hardly any area of healthcare is developing as rapidly as this one – propelled by innovative insights from research, neuroscience and digitalisation.

Countries worldwide are demonstrating in remarkable ways how rehabilitation can be reimagined: integrative, preventive and closely aligned with daily life. They combine exercise with psychology, social work and innovative technologies – including for the very elderly or those in palliative care. Because movement works. Not as a miracle cure, but as a fundamental resource for participation, quality of life and dignity until the very end.

Innovative therapeutic approaches are increasingly emerging that go beyond traditional one-on-one therapy: structured, evidence-based and systematically integrated into daily care and treatment routines. Digital training equipment, gamified approaches and accessible group offerings make progress more visible and processes more efficient – while reducing the workload of healthcare professionals.

It's time to think outside the box. Rehabilitation starts well before surgery – and continues long after a patient's final appointment. It starts in daily life, operates throughout the system and accompanies people throughout their lives. Other countries are leading the way. Should we learn from others? Absolutely!

With best regards,

Jakob Tiebel

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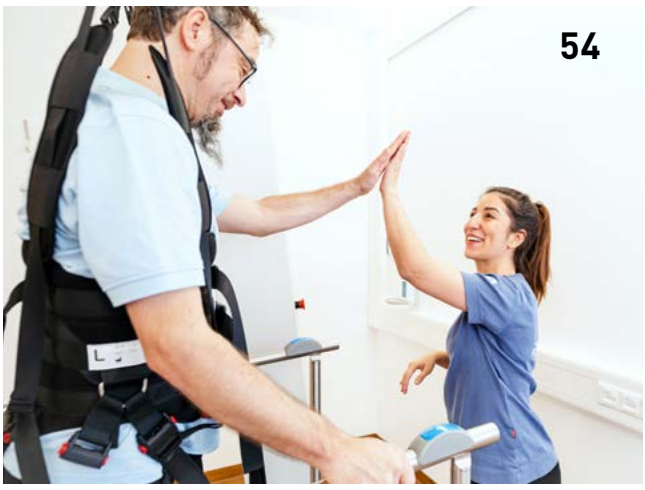
THERA-Trainer toro: the next level of robot-assisted movement training for rehabilitation

Cochrane update: electromechanical gait training



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Waldburg-Zeil Clinic invests in more efficient gait training

Shifting the boundaries

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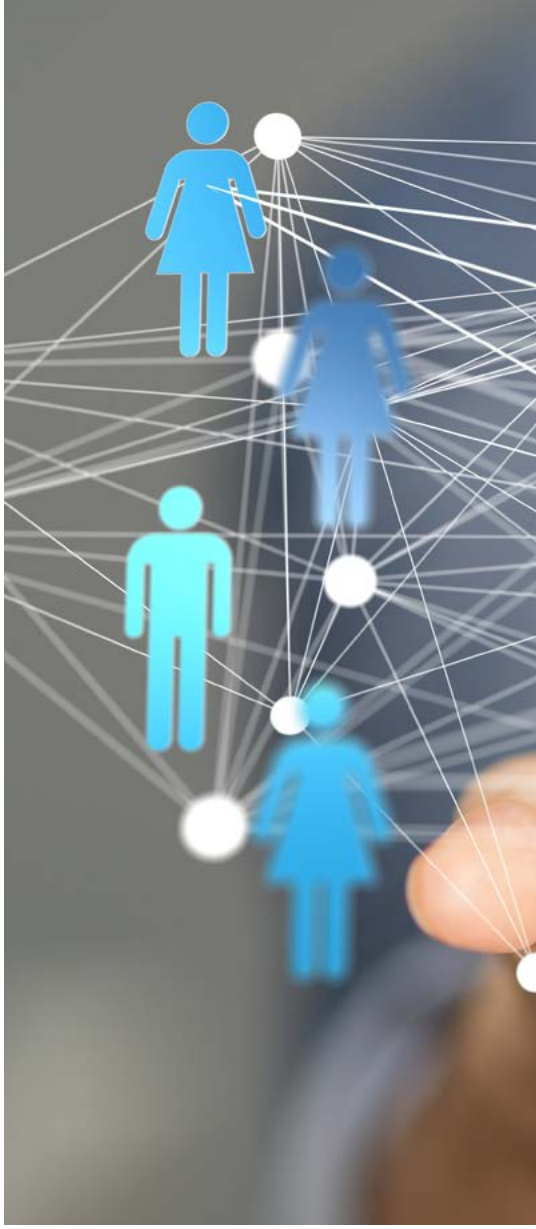
Establishment of the IpNNR



On 3 February 2025, the Interprofessional Network for Neurological Rehabilitation (IpNNR) was launched as an open platform that bridges professionals across therapy, nursing, medicine and other fields. This collaborative network aims to foster knowledge exchange, establish shared standards and enhance the quality of neurological rehabilitation care for the long term

Jakob Tiebel

On 3 February 2025, the Interprofessional Network for Neurological Rehabilitation (IpNNR) was launched at Fachkliniken Wangen. The aim of this network is to systematically enhance collaboration among all professional groups involved in neurological rehabilitation, strengthen interprofessional exchange and ultimately deliver continuously improving, high-quality care to patients. Professionals from therapy, nursing, medicine and related fields were involved in establishing the network, collectively expressing the need for an interprofessional platform for cooperation and knowledge transfer.

The network functions as an open forum for professionals working throughout all rehabilitation phases. It provides space for interprofessional dialogue, the systematic exchange of expertise and the development of shared standards. At its core are issues of care quality, collaboration in multiprofessional teams and the ongoing development of competency profiles within the professions involved. Both existing challenges and best practice examples are incorporated and developed within a structured framework.

Various specialised working groups discuss key questions relating to neurological rehabilitation in greater depth. The working groups are open to interested parties who wish to offer their expertise and perspective. These groups focus on topics that address real-world needs, including standards and

Interprofessionally connected – practical and forward-thinking.

guidelines, digitalisation, patient navigation services, basic and advanced professional training, and strategies for attracting and retaining qualified staff. The aim is to develop practical initiatives that contribute to improving collaboration and care provision.

Professional exchange in the sense of a collegial network is a further cornerstone of the IpNNR. Regular events, meetings and digital exchange formats enable members to find out about current developments, learn from one another and bring fresh perspectives to their institutions or professions.

The IpNNR's long-term vision is to foster neurological rehabilitation while bridging different sectors, prioritising quality and respecting professional expertise. This is based on voluntary participation, transparency and professional openness. The network is independent, non-commercial and focuses on practical benefits for patient care, as well as on the professionalisation of the participating groups.

Source:
For more information, please visit:
l.ead.me/therapy-25-02-6

Sharing knowledge.
Strengthening quality.
Shaping care.

THERA-Trainer toro: the next level of robot-assisted movement training for rehabilitation

Unleashing therapeutic potential

Leoni Schulz

At medica Medizintechnik, our THERA-Trainer toro sets new standards in rehabilitation by combining innovative design with cutting-edge technology. The therapy device enables targeted training of both upper and lower extremities while boosting patient motivation through its interactive programmes. Designed for professional use in neurological and geriatric rehabilitation, it delivers outstanding safety, intuitive handling and user-friendly operation.

For over 35 years, we have been developing, producing and distributing innovative products and robot-assisted solutions for the upper and lower extremities worldwide under the THERA-Trainer brand. With the THERA-Trainer toro, we serve a wide range of patients and healthcare facilities.

Cutting-edge technology meets user-friendly design

The THERA-Trainer toro combines cutting-edge technology, advanced software and impressive performance in an innovative design. This accomplishment earned the device the coveted iF DESIGN AWARD – recognised globally as one of the most important design awards. The product meets the highest

requirements for functionality, user-friendliness and safety, and has been specifically designed for therapeutic use to enable therapists to provide even more efficient and targeted treatment.

Further information about the award is available on the official website of the iF DESIGN AWARD under Winners & iF Ranking:

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At medica Medizintechnik, our THERA-Trainer toro sets new standards in rehabilitation by combining innovative design with cutting-edge technology.

User-friendliness at the forefront

The intelligent design enables users to perform all key functions with a single click. Quick-mounting accessories, effortless height adjustment, intuitive programme selection and immediate therapy start-up. This user-friendly approach boosts patient motivation and engagement while significantly improving treatment adherence and success rates.

The THERA-Trainer toro combines advanced software and impressive performance in an innovative design.

Interactive programmes for greater motivation and engagement

The THERA-Trainer toro enhances rehabilitation through interactive training programmes and video routes that boost patient motivation and drive positive engagement. Visual monitoring indicators allow precise therapy tracking, while the compact drive unit enhances safety and simplifies the disinfection process. The robust design ensures easy transport, making the device versatile for use across different clinical and therapeutic settings.

We at medica Medizintechnik are delighted to present the THERA-Trainer toro, a pioneering innovation for more efficient and patient-centred rehabilitation. In line with our company slogan LIFE IN MOTION, we remain dedicated to our mission of creating innovative solutions for modern rehabilitation.

We at medica Medizintechnik are delighted to present a pioneering innovation for more efficient and patient-centred rehabilitation.

Book a free product demo now:

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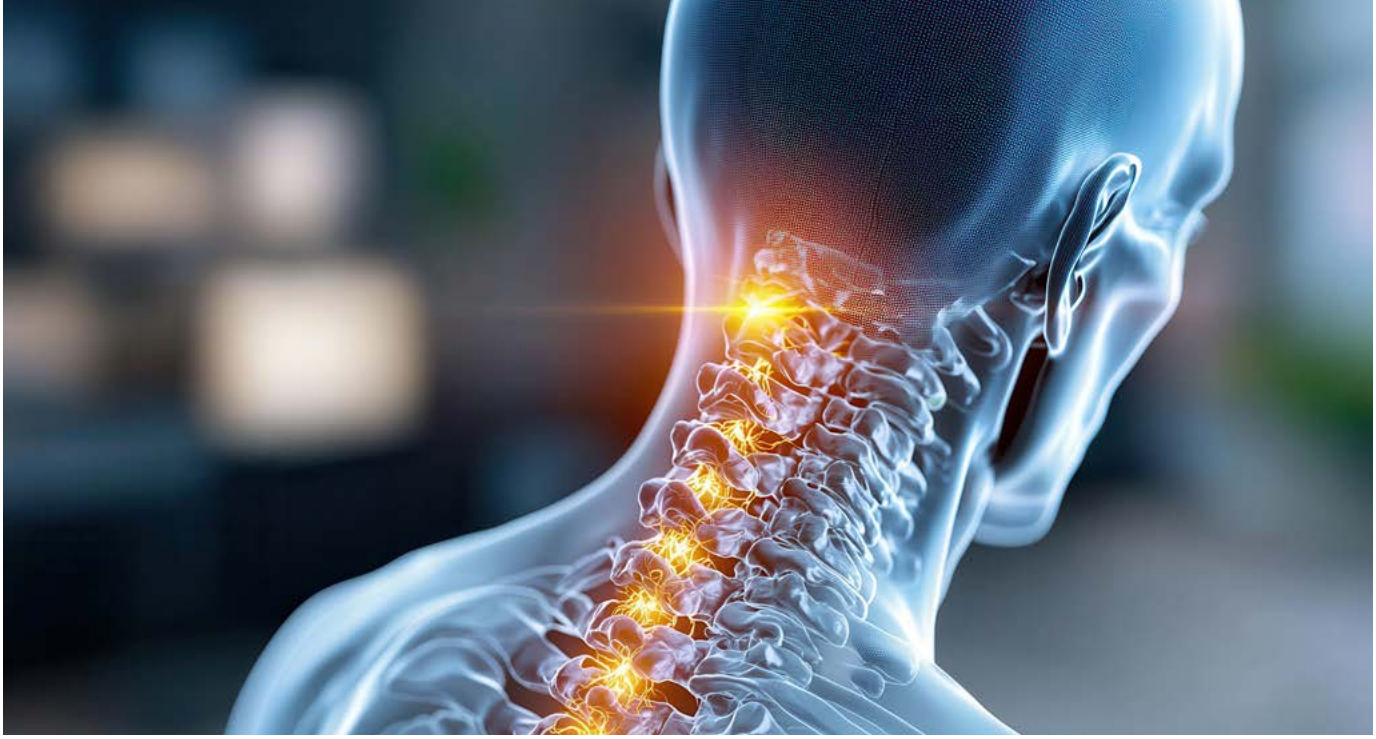

SCIENCE

Balance with system

Technology-assisted verticalisation and postural control following spinal cord injury – a fall-safe environment

Jakob Tiebel

Spinal cord injuries (SCI) are frequently associated with significant motor and sensory impairments below the level of the lesion. Besides the reduced voluntary motor function, disrupted afferent pathways also impair the ability for postural control, i.e. maintaining or restoring balance in various body positions and during everyday activities. However, balance is central to functions such as transfers, dressing or the safe use of the wheelchair.

A reduced ability to react to changes in the body's centre of gravity, increased postural swaying and delayed responses to external influences significantly increase the risk of falls. This presents a major challenge, particularly in early rehabilitation, resulting in the need for targeted, safe balance training – preferably using modern technologies that enable early verticalisation in a protected environment.

Objective

The aim of this work was to present physiotherapeutic approaches for managing balance disorders in persons with SCI, highlighting how innovative

Technology-assisted verticalisation strengthens balance, reaction – and confidence in one's own body.

technologies are used to enhance training. This work also demonstrates how technological equipment can enable targeted, task-oriented interventions and how progress can be systematically recorded.

Methodology

The underlying literature search was conducted systematically via databases such as MEDLINE, PubMed, Scopus and HRČAK. Studies and reviews were considered using the keywords: spinal cord injury, postural control, balance, robotics.

Results

The analysis shows that the use of technological medical equipment in rehabilitation following spinal cord injury depends heavily on the level of the lesion and the extent of the impairments. A variety of devices have been developed that allow intensive and safe training of postural control – both in early and advanced rehabilitation phases.

The authors describe the **THERA-Trainer balo** as an exceptional example. "This innovative device combines an electrically powered lifting system with a specialised safety frame, enabling patients who cannot stand independently to experience secure, upright positioning in a fall-protected environment. The integrated balancing unit allows both static and dynamic standing, whereby the body's centre of gravity can be shifted in the sagittal, frontal or combined plane. During training, the patients follow a visual task on the screen – simultaneously addressing both cognitive and motor processes."

The concept combines therapeutic principles such as task-oriented learning, repetition and feedback with high patient safety. The ability to actively control weight shifts not only trains balance and reaction, but also promotes self-efficacy – a key psychological factor in rehabilitation.

Conclusion

Technology-assisted verticalisation offers great potential in therapy following spinal cord injuries. Initial studies indicate positive effects with regard to postural control, functional balance and subjective feeling of security. These devices also reduce therapist workload while providing objective documentation relating to therapy progress.

To drive further evidence-based development in this field, we need future studies that integrate innovative technologies with clearly defined rehabilitation goals and consistent protocols.

The THERA-Trainer balo enables safe standing and targeted balance training – even without the ability to stand independently.

Original work

Denac, Z., Kuzmić, A., & Zaplatić Degač, N. (2024). Technology-assisted verticalization and postural control after spinal cord injury – fall-safe environment In I. Živoder, N. Zaplatić-Degač & M. Arapović (Eds.), Proceedings of the 1st International Scientific Conference on "Modern Approaches in Physiotherapy" (pp. 53–54). Varaždin: University North. ISSN: 3044-1676.

https://www.croris.hr/crosbi/publikacija/prilog-skup/866484

l.ead.me/therapy-25-02-12

Author information

The original work was authored by **Anica Kuzmić** and **Nikolina Zaplatić Degač**, both academic researchers at University North located in Varaždin, Croatia. The paper was presented as a poster presentation at the 1st International Scientific Conference on "Modern Approaches in Physiotherapy" on 7–8 June 2024 in Varaždin and is published in the conference proceedings of abstracts, pages 53–54, ISSN: 3044-1676, published by University North, Varaždin.

The Silver Gym concept

KÖRPERWERK Südbaden: when therapy takes new paths – and transforms lives

Jakob Tiebel interviews Armin Brucker

With their innovative Silver Gym concept, the KÖRPERWERK Südbaden team is revolutionising physiotherapy in care facilities – creating a more systematic, effective and socially integrated experience. Active movement training takes centre stage, featuring specialised medical training equipment including the THERA-Trainer tigo for endurance training, the THERA-Trainer balo for standing ability, and a cable machine for strength training.

An example of successful implementation can be found at the Max-Josef-Metzger-Haus in Umkirch where seniors regularly exercise on the equipment as part of their prescribed physiotherapy – sometimes training together in pairs. This not only doubles therapy time to up to 40 minutes, but also creates space for social interaction. This solution simultaneously reduces the workload for healthcare staff while enabling targeted everyday mobility – such as maintaining the ability to stand, balance or walk.

"We're seeing a significant improvement in both therapy quality and patients' zest for life – along with optimised staffing levels," says Armin Brucker, the creative mind behind KÖRPERWERK Südbaden.

The service is now available not only at Max-Josef-Metzger-Haus but also at four other care facilities, with plans for further expansion. In our interview with Armin Brucker, we discover the story behind this concept and his plans for the future.

Jakob Tiebel: How did the idea for the Silver Gym come about? Was there a specific problem you wanted to solve?

Armin Brucker: The starting point was purely practical: care facilities contacted our practice because they needed on-site physiotherapy services. I handled their requests in a very traditional way at first. Over time, however, more and more questions began to surface, especially about the quality of care provided. Objectively speaking, the care was solid, but a vision emerged within me: how could we rethink physiotherapy for elderly people in a completely new way – more holistic, more systemic, more sustainable? That was our cue to broaden the scope of the entire project. I wanted to move away from simply "working through things" towards a truly transformative approach – both physically and socially. We know from the evidence that people need significantly more movement than they get in daily

The Silver Gym is revolutionising the approach to physiotherapy in care homes.

care. And that's the key element in the Silver Gym. Crucially, it had to be simple – for the therapists, for the staff, for the residents. It shouldn't add further complexity but should provide relief.

Jakob Tiebel: What was particularly important to you when developing the concept?

Armin Brucker: We aimed to create a concept that maintains and enhances the fundamental abilities of older people. So we carefully selected equipment designed specifically for cardiovascular health, strength and standing ability. And this equipment needs to serve a purpose and form part of a structured concept. In practice, we use THERA-Trainer equipment – movement exercisers to build strength and endurance, plus balance trainers to enhance stability and coordination while standing. These medical training devices are not an end in themselves but are integrated into a holistic therapeutic approach. The various devices are connected to software. This provides targeted control, while incorporating entertainment and motivation through gamification elements. It was also important that the entire system integrates seamlessly into daily life – requiring minimal additional effort while delivering genuine value.

Jakob Tiebel: What sets the Silver Gym apart from traditional one-on-one therapy?

Armin Brucker: The major difference lies in the conceptual approach. The Silver Gym is not simply a training room with equipment, but a clearly defined therapeutic framework. This framework fosters the development of structures, commitment and, above all, a vibrant social platform. In traditional physiotherapy, individual treatment is often isolated. In the Silver Gym, two or sometimes more people train together. This creates interaction and motivation. The social component is a key aspect of the concept. Each patient is individually cared for – at least for the prescribed time of their one-on-one therapy session. But because the residents arrive in groups, they actually stay at least twice as long. And as a result, they are usually active for much longer, because they have the opportunity to move around and actively participate during the whole session. In this way, we often achieve a doubling of the therapy time for individual residents – without any extra effort. A conceptual approach that benefits everyone and achieves more than traditional one-on-one therapy.

Jakob Tiebel: What does a typical training day at the Silver Gym look like? Who is involved and how?

Armin Brucker: Our staff typically work half a day in a care home. The residents benefit from personalised support in small groups – this is our standard setting. The therapist on site always decides which exercises are done. This sometimes depends on daily fitness levels, which need to be checked regularly and adjusted if necessary. But ideally, at least two exercises and training goals are always combined. This might include cardiovascular and strength, or strength and standing ability. It's important to note that not all residents can be supervised in the Silver Gym. We check carefully beforehand to determine whether there are any motor or cognitive contraindications, or if someone is bedridden. Certain inclusion criteria are needed. Once these are met, we can start allocating exercises. We then assess what makes functional sense and what seems achievable on an individual basis. There are no rigid plans, but rather a flexible combination of therapeutic judgement and practical assessment.

Jakob Tiebel: What advantages does the equipment offer from a therapeutic perspective? Are there examples of tangible progress among residents?

Armin Brucker: The equipment helps us to provide clear guidelines, such as targeted leg or arm training. This reduces the workload for therapists because they no longer need to continuously provide manual guidance or safety monitoring. Another often underestimated aspect is that older people find the interactive component enormously motivating. They gladly accept the challenge and automatically train with greater intensity and for longer periods. There are numerous examples of progress. Particularly impressive are the short-term care success stories, where residents returned home fitter after just a few weeks of training. According to one healthcare worker: "You've given a renewed desire for life to one resident who just wanted to die." Whether this success was solely due to our concept is certainly open to debate – but it definitely made a vital contribution to the overall picture, as mobility plays a key role in maintaining independence and autonomy in daily life.

The strength of the Silver Gym lies in its simplicity.

Jakob Tiebel: How do new residents respond? Are there any challenges in terms of acceptance or usability?

Armin Brucker: We don't see any fundamental obstacles – neither in terms of usability nor acceptance. We occasionally encounter resistance, mainly due to a persistent stigma that reinforces the notion that technology and old people don't mix. But that doesn't reflect reality. Equally false is the widespread perception that geriatrics is a deadly boring field – quite literally – where nothing meaningful can be accomplished. That is simply wrong – and it's a shame that this image is so prevalent in the public eye. The ageing patient with multimorbidity is an extremely fascinating subject in therapeutic practice. The objectives may differ from other specialties – here it's more often about maintaining abilities rather than complete recovery. But that doesn't make our work any less meaningful. I recognise first hand how our approach makes a meaningful difference in the lives of older people. I'm completely behind our approach and see how effective it is on a daily basis. Of course, there are moments of uncertainty – for example, when someone stands in the balance trainer for the first time. This anxiety doesn't come from the equipment, but from the unfamiliar situation and the lack of confidence in being able to stand securely for extended periods. In most cases, this anxiety vanishes very quickly.

Jakob Tiebel: How do care staff respond to the collaboration and integration of the movement sessions?

Armin Brucker: Acceptance rates are highest when we provide information early on and actively engage care staff. We present the concept, explain our working method, and then the collaboration works smoothly. Crucially, the facility must understand from the outset that the Silver Gym is not a gimmick, but a clearly structured, therapeutically sound concept. Where this understanding exists and institutions cooperate, everything runs smoothly. The feedback can be non-committal at times. It's often just things like "It works". And that's widely regarded as high praise (laughs). But seriously, if the concept didn't provide added value, the care facilities wouldn't give it their backing.

Jakob Tiebel: Are there measurable effects or qualitative observations that highlight the effectiveness of the concept?

Armin Brucker: Currently, we aren't conducting any comprehensive measurements. Instead, we're working with simple, practical assessments and documenting qualitative changes. It's important to adopt a realistic perspective: not all residents objectively "improve" through training. But the rate of decline is slower – and that is often the real success. This form of stability is difficult to measure, but we can make it visible using straightforward methods. Of course, evaluation is an important topic for the future. At the same time, we must ensure that the concept doesn't lose its practicality by becoming excessively complex. The strength of Silver Gym is its simplicity. If we overcomplicate this approach, it will increase the effort and resources, making the model less attractive and harder to implement. There is a clear balancing act between the legitimate demand for proof of effectiveness and the need to remain practical. We're constantly working to critically assess and strike the right balance.

Jakob Tiebel: What's next on the horizon for Silver Gym? Are there plans for expansion?

Armin Brucker: Yes, we would like to develop and scale up the concept in a targeted way. From a conceptual standpoint, we've established a strong position, and our experience to date validates the direction we've taken. The potential is still great – not to overstate it: almost unlimited. The real limitations aren't therapeutic or conceptual but systemic in nature – particularly in terms of staffing or finances. At the same time, we are operating in an almost crisis-proof growth market. Demographic trends and the gradual transition to an ageing society will see an increasing demand for what we've pioneered today and are now gradually rolling out.

Jakob Tiebel: What advice would you give to colleagues who want to establish a similar concept?

Armin Brucker: Stick with it, be brave, try out your ideas – and then implement them consistently. Find people who believe in the concept, and partners who support it. The most important thing is to get started. I meet so many people with brilliant ideas – but in the end, the world belongs to those brave enough to turn their ideas into reality. This is my advice to anyone who is toying with the idea of implementing a similar concept.

Jakob Tiebel: When you reflect on your most memorable moments at Silver Gym, which one stands out?

Armin Brucker: There are many. But one particularly stands out, not because of its emotionality but because of its authenticity. A blind resident took my hand and kissed it. No words were spoken. Just a spontaneous, heartfelt thank-you. It was a silent, yet powerful moment. For me, it reaffirms what we are doing for people.

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Armin Brucker has been a physiotherapist since 1997. He worked for ten years as a physiotherapist and therapy manager at Moos-waldklinik Freiburg (1997–2007), followed by freelance work (2007–2009). Since 2009, he has been self-employed with his own practice, Körperwerk Freiburg. He expanded his practice network with Körperwerk Emmendingen GmbH (2017), Körperwerk Waldkirch (2018), Körperwerk Rheinhausen (2021) and a second location in Freiburg (2025).

More movement, more progress

Innovative neurorehabilitation at HSH Lamprecht GbR: practice expands THERA-Trainer portfolio

Leoni Schulz

For many years, the HSH Lamprecht GbR practice in Kirchheim unter Teck has provided comprehensive care for severely affected patients in neurorehabilitation through an extensive range of specialised services. The practice team has long embraced THERA-Trainer therapy solutions in their facility – featuring the cutting-edge lyra end-effector gait trainer, the dynamic balo standing frame and the advanced tigo motor-assisted movement exerciser. The THERA-Trainer toro has recently joined the existing line-up: an innovative movement exerciser designed for functional training of both upper and lower extremities.

The initial feedback was consistently positive – the toro is firmly integrated in daily therapy. This innovative movement exerciser has established itself as a useful therapy device and is now an integral part of everyday practice. Its introduction and implementation was overseen by Felix Gaus, physiotherapist and project coordination leader, alongside Patrick Vaz Gomez, physiotherapist and head of the neurology team.

Both actively shape the integration of modern, technology-supported therapy concepts – with a specific focus on innovative systems such as the toro.

Practical and versatile for everyday use

The THERA-Trainer toro enables targeted movement training for the upper and lower extremities. Its functionality and user-friendly operation is a hit with the team. "From a therapeutic standpoint, it's excellent," emphasises Felix Gaus. The toro is used daily with a wide variety of patients. With its high usage frequency, the new therapy device not only pays for itself quickly, but also substantially improves therapy outcomes through repeated use and self-training options – a key benefit in both outpatient care and clinical environments.

Acceptance among patients – and therapists

Patrick Vaz Gomez adds: "Patients respond very well to the training – partly because the software and interactive elements make it very intuitive." Moreover, the patients feel very much at ease with the toro. The toro is also easy for the therapists to use. As Vaz Gomez notes, "Staff training was remarkably simple – we integrated the device into our everyday workflow quickly and seamlessly." The flexible, tool-free adaptation to individual requirements is just as advantageous as the quick and secure positioning of patients.

HSH Lamprecht GbR:
l.ead.me/therapy-25-02-18

Flexible therapy design

Another advantage in day-to-day practice is that the toro can be moved from room to room. "This is a real advantage, especially when the device is in constant use – we can easily transport it to where it's needed," emphasises Felix Gaus. This allows the toro to be optimally integrated into different therapy settings – with minimal logistical effort.

"A device that delivers targeted movement training, optimises staff resources and has become an essential part of our daily therapeutic practice."

Conclusion: innovative and efficient movement training at the next level

The introduction of the THERA-Trainer toro went smoothly. The combination of intuitive operation, therapeutic versatility and robust technology delivers excellence at every level. "It is a device that delivers targeted movement training, optimises staff resources and has become an essential part of our daily therapeutic practice," Patrick Vaz Gomez points out.

The toro brings real value to any facility implementing active, practical therapy concepts – from community-based settings to hospital environments. The toro redefines innovative movement training.

Waldburg-Zeil Clinic invests in more efficient gait training

Integration of the THERA-Trainer lyra into existing therapy concepts – economic and therapeutic advantages

Miriam Keifert & Lorena Aumann

The Waldburg-Zeil Clinic in Bad Wurzach, under the neurological direction of Dr Martin Schorl, has embraced robot-assisted gait therapy and acquired a THERA-Trainer lyra for its facility last year. Since then, the gait trainer has been helping patients recover their walking ability and other bodily functions following strokes or damage to the nervous system. The lyra is now firmly established in the daily therapy routine at the rehabilitation clinic. But what considerations and decisions led to the purchase of this therapeutic device and how can it be seamlessly integrated into the clinic's therapy concept. In an interview conducted by THERA-Trainer, senior physician Dr Martin Schorl and project manager and deputy therapy director Johannes Schuschkewitz share valuable insights about the economic and therapeutic benefits of using the end effector.

Info

The number needed to treat (NNT) in order to prevent permanent walking disability when using robotic gait robotics/ gait trainers is 8 (Mehrholz 2020). This means that only 8 patients need to be treated to prevent permanent walking disability in one patient. This achieves a value ranking just behind mechanical recanalisation for reducing stroke sequelae (NNT approx. 7) (Lenzen-Schulte 2016) and carotid endarterectomy (NNT 6) for symptomatic high-grade carotid stenoses in preventing additional strokes (Eckstein, 2020). Therapies with this type of NNT are recognised as highly effective treatment methods in medicine.

Dr Schorl specifically highlights patients with hemiplegia, for whom the lyra is "the device of choice".

Dr Martin Schorl has extensive experience in gait rehabilitation and has already successfully introduced the lyra to a second clinic in partnership with the Waldburg-Zeil Clinic in Bad Wurzach.

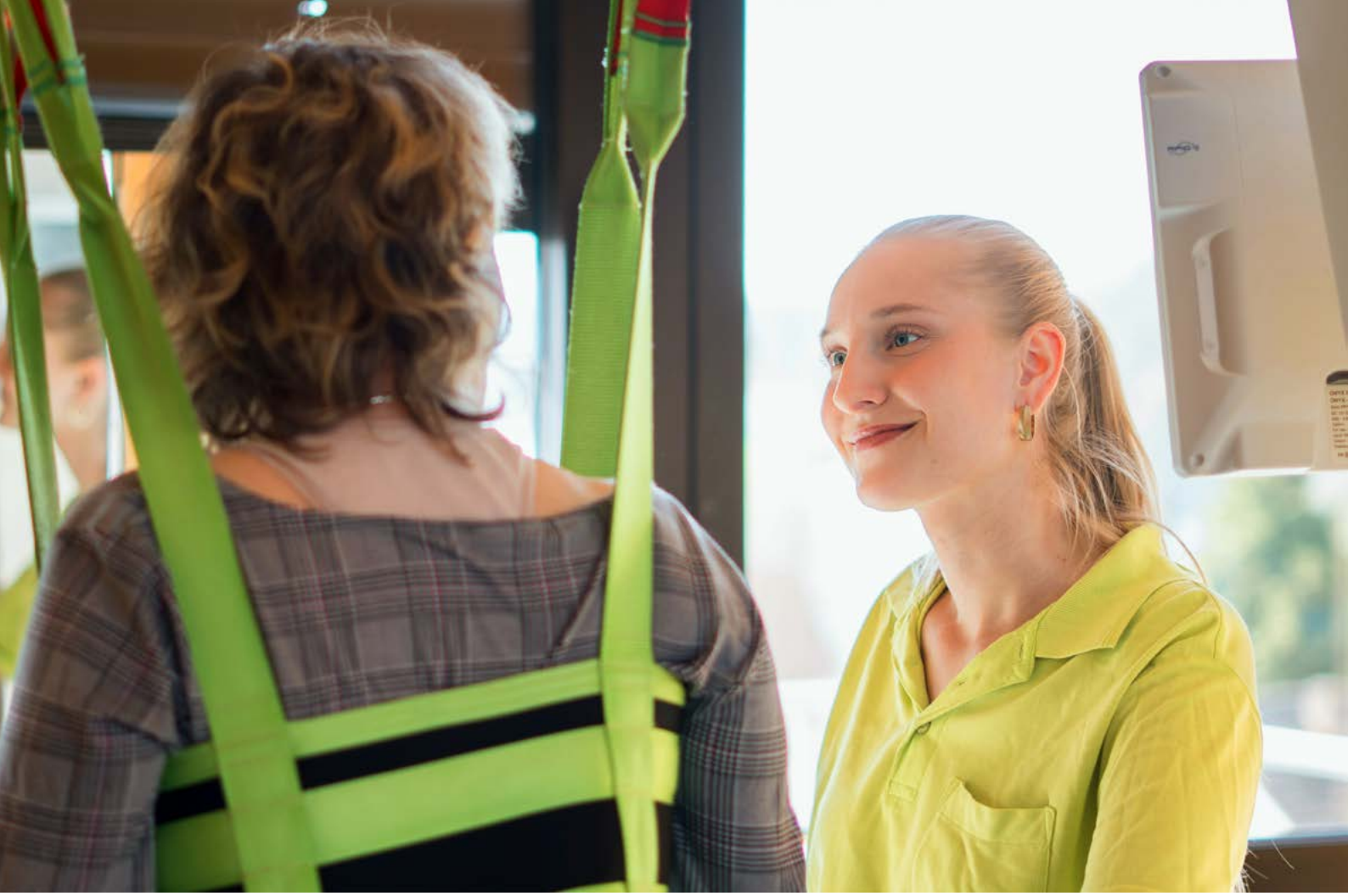
During his extensive research work, he compared various therapy devices for gait rehabilitation. The lyra proved to be particularly suitable for the patients at the rehabilitation clinic in Bad Wurzach. In the specialist clinic, patients are treated in phases C and D. The lyra is particularly suitable for

these individuals, as they are optimally supported and encouraged by the gait trainer in regaining a functional gait pattern and improving their mobility. Dr Schorl specifically highlights patients with hemiplegia, for whom the lyra is "the device of choice". A treadmill with suspension is not a suitable alternative for patients with an FAC of 0 to 2, as it does not provide the necessary therapeutic effectiveness. For these patients, weight relief is an essential therapeutic aspect that the lyra delivers effectively while offering exceptional cost-efficiency.

Beyond its functional benefits for patients, the lyra also stands out through its user-friendly operation. Short setup times are essential in a stressful therapy environment, and this is precisely where the lyra excels. According to Schuschkewitz, it offers fast and hassle-free setup, which saves precious time during therapy sessions and ensures patients can spend their time walking as effectively as possible. Therapists spend considerably less time mastering the functions and application of this gait trainer compared to other robotic gait trainers – a benefit that delivers real value in today's busy clinical settings.

Particularly for large and heavy robotic gait trainers, finding appropriate rooms presents a common challenge – requiring not only ample space but also structures that meet essential load-bearing requirements. Against this backdrop, a key advantage of the lyra was its effortless integration into an existing therapy room at the Bad Wurzach rehabilitation clinic. Project manager Johannes Schuschkewitz pointed out that other robotic gait trainers would necessitate either a new building or modifications to existing ones. Choosing the lyra therefore saves both costs and valuable time when integrating it into hospital workflows.

The lyra has become extremely popular among both therapists and patients, establishing itself as an essential element in everyday therapy.



Choosing the lyra therefore saves both costs and valuable time when integrating it into hospital workflows.

The introduction of the lyra at Waldburg-Zeil Clinic coincided with the launch of a new therapy programme. In addition to one-on-one therapy, a movement circuit is now offered. This consists of three devices: lyra gait trainer, cycling trainer and balance trainer (THERA-Trainer balo). Up to three patients can exercise simultaneously in the dedicated therapy room while receiving support from a therapist and trainee. Patients train on the lyra two to three times per week for 20 to 30 minutes. The movement circuit ensures maximum usage of the lyra. The end effector is used for at least four to five hours per day at the clinic in Bad Wurzach. Schuschkewitz emphasises that therapists gain numerous benefits when working with the training device. The therapists are scheduled for set periods in the movement circuit, allowing them to work with the lyra for longer periods at a time. This allows them to develop routines, which is crucial for the successful implementation of the gait trainer.

Since the rehabilitation clinic in Bad Wurzach acquired the lyra, the effectiveness of gait training has been further increased. Previously, FAC 0–2 patients were supported by two therapists in the corridor, while a

"Walking in the lyra is a joy – it's such a wonderful feeling beyond description. It makes me happy."

third therapist would crawl along the floor to correctly place the patient's feet. According to Schuschkewitz, the 15 to 20 steps that were taken after 20 minutes are hardly comparable to the number of steps achieved during lyra training. Dr Schorl also doubts the learning effect of "shuffling patients 15 steps along a corridor". He also emphasises that training on the lyra is less distracting, allowing patients to focus more effectively on their gait training. Additionally, gait training with the lyra significantly reduces physical strain on therapists. Physically strong therapists who can provide corridor support for patients for extended periods aren't always available. Furthermore, therapists who are no longer needed for gait training are now available to other patients. According to Schuschkewitz, one-on-one therapy can now be offered to a larger group of patients, which was previously impossible due to capacity constraints.

Different objectives are pursued with gait training on the lyra, depending on the patient. Besides the main goal of relearning to walk, secondary aspects such as balance and trunk stability can also be addressed for a better free sitting position or improved head posture control in patients with swallowing disorders. Lyra training is beneficial for patients who spend their day in a wheelchair, helping them to change their posture, while patients with Parkinson's benefit from its rhythmic movements.

During observation of a training session, a patient's enthusiasm and motivation during gait training on the lyra was clearly apparent, as she excitedly commented: "Walking in the lyra is a joy – it's such a wonderful feeling beyond description. It makes me happy." The patient was unable to walk or stand at the beginning of rehabilitation and had not walked for three years.

The introduction of the lyra at Waldburg-Zeil has proven to be a success story from various viewpoints. It streamlines and improves day-to-day therapeutic care and is the perfect addition to the current therapy concept. The lyra has become extremely popular among both therapists and patients, establishing itself as an essential element in everyday therapy.

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Lorena Aumann completed her studies in medical technology and now works in project management at THERA-Trainer

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SCIENCE

When bone fractures refuse to heal

How Extracorporeal Shockwave Therapy combined with movement training can help a patient with a chronic femur fracture achieve complete healing

Jakob Tiebel

Not all bone fractures heal smoothly. Particularly complex are nonunion fractures – bone fractures where healing stops completely and the fracture gap remains open. A recent case report from Indonesia demonstrates impressively how Extracorporeal Shockwave Therapy (ESWT) helped a patient with a chronic femur fracture achieve complete healing – with modern rehabilitation devices like the THERA-Trainer playing a crucial role.

When the bone simply refuses to heal

The 40-year-old patient suffered an open fracture in the lower third of his left thigh bone (femur) in a road traffic accident. First-response treatment followed standard procedure: the fracture was surgically stabilised (known as open reduction and internal fixation), and the patient began a classic rehabilitation treatment. However, even after six months and despite all measures taken, almost no new bone tissue (callus) had formed. A dangerous situation because, if healing does not occur, there is a risk of permanent disability, pain and significant psychological distress.

A new approach: shockwaves instead of repeat surgery

As the classic therapy failed, the treating physicians decided on an innovative approach: Extracorporeal Shockwave Therapy (ESWT). High-energy sound waves are directed at the bone tissue. These stimulate various biological processes. They promote the formation of growth factors such as TGF-β1 and VEGF, activate bone-forming cells (osteoblasts) and improve blood circulation. This reactivates the healing cascade – without any further surgical intervention.

For this particular patient, ESWT therapy was provided once a week for a 23-week period. He also received Low-Intensity Pulsed Ultrasound (LIPUS) – a low-frequency ultrasound treatment that can also support bone healing.

ESWT is a promising adjunct to conservative and surgical procedures in cases of delayed fracture healing.

Therapeutic success when combined with movement training

A crucial factor for success was also the use of targeted exercise training. This included the THERA-Trainer – a specialised training device for medical rehabilitation. Despite the patient's fracture, the THERA-Trainer allowed for early guided movement exercises without compromising the new bone formation. Such active but controlled loads are important as they stimulate bone metabolism, maintain muscle power and promote blood circulation.

After 23 weeks, the success was visible: X-rays showed complete callus formation. The fracture had healed completely, the patient returned to his daily routine.

Benefits of combination therapy with the THERA-Trainer

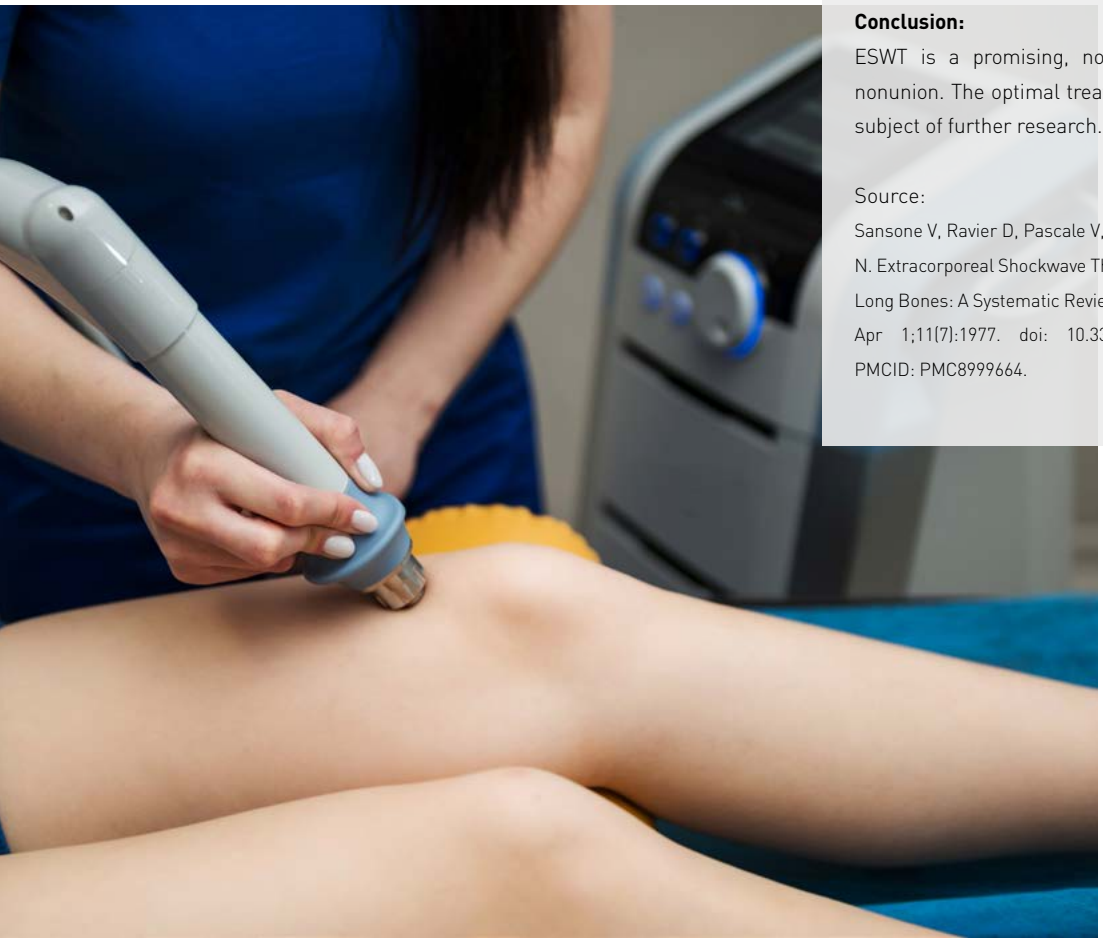
The combination of Extracorporeal Shockwave Therapy (ESWT) with targeted exercise training using the THERA-Trainer delivers multiple synergistic benefits in the treatment of nonunion fractures:

- **Early functional mobilisation**
  Gentle, guided movements promote blood circulation in the affected area, which is essential for stem cell migration and bone regeneration.
- **Stimulation of bone metabolism**
  Mechanical stimuli from active movement enhance the osteogenic effect of shock waves, additionally stimulate bone metabolism and support callus formation.
- **Maintenance of muscle power and joint function**
  Through the early use of the THERA-Trainer, muscle atrophy and joint stiffening are prevented. The patient maintains higher performance levels and enjoys better overall rehabilitation outcomes.
- **Psychological stability**
  Active participation in therapy increases patient motivation and confidence in the healing process. This can have a positive impact on the entire rehabilitation process.
- **Reduced risk of complications**
  The combination therapy may help to avoid invasive follow-up surgery and reduce the overall risk of complications.

A method with potential?

Shockwave therapy for bone healing disorders is being increasingly investigated worldwide. Studies show success rates between 54% and 98% – depending on fracture type, location and timing of treatment. ESWT demonstrates particularly promising results for hypertrophic nonunions, where biological healing potential still exists. In cases of atrophic nonunions, like the one presented here, successful outcomes have historically been rare – which makes this documented healing journey all the more remarkable.

Combination therapies open new pathways in fracture healing.



Effectiveness of shockwave therapy in nonunion

A systematic review by Sansone et al. evaluated 23 studies on the application of Extracorporeal Shockwave Therapy (ESWT) in nonunion of long bones. The most important results were:

Healing rates:

Overall, 73% of the nonunion cases healed after ESWT. Hypertrophic nonunions demonstrated success rates up to three times higher when compared to oligotrophic or atrophic cases.

Success by bone region:

- Metatarsals: 90%
- Tibia: 75.5%
- Femur: 66.9%
- Humerus: 63.9%

Treatment timing decisive:

The shorter the time between injury and commencement of shockwave therapy, the higher the chance of healing ($p < 0.02$).

Long-term therapeutic success:

Six months of follow-up monitoring is often insufficient. In many studies, further healing progress was also shown to occur significantly later ($p < 0.01$).

Conclusion:

ESWT is a promising, non-invasive treatment option for nonunion. The optimal treatment protocols are currently the subject of further research.

Source:

Sansone V, Ravier D, Pascale V, Applefield R, Del Fabbro M, Martinelli N. Extracorporeal Shockwave Therapy in the Treatment of Nonunion in Long Bones: A Systematic Review and Meta-Analysis. J Clin Med. 2022 Apr 1;11(7):1977. doi: 10.3390/jcm11071977. PMID: 35407583; PMCID: PMC8999664.

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At the same time, this case report shows that therapeutic success often depends on the combination of various methods: shock waves, ultrasound, nutritional supplementation and targeted exercise training using equipment such as the THERA-Trainer complement each other ideally.

Opportunities for patients with difficult fractures

This case illustrates that even complicated bone healing disorders can be successfully treated under certain conditions when evidence-based and multimodal therapeutic approaches are utilised. Extracorporeal Shockwave Therapy (ESWT) is a potential alternative or adjunct to surgical procedures, particularly in situations where surgical interventions are associated with increased risk or are not suitable.

Original work

Tandiono T, Mintarjo J, Nugroho N (2025). Successful Treatment of a Nonunion Fracture of the Femur With Extracorporeal Shockwave Therapy: An Evidence-Based Case Report. Cureus 17(5): e84138. DOI: 10.7759/cureus.84138

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THERA-Trainer toro impresses in the USA

Early success at PAM Health Rehabilitation Hospital in Georgetown

Fabian Scheffold

With the market launch of the THERA-Trainer toro in the United States, the success story of the new cycling system is picking up speed – quite literally. PAM Health Rehabilitation Hospital of Georgetown was not only one of the first interested parties worldwide, but also the very first clinic ever to purchase the toro – and that in a remarkably short period of time. Only a few months passed between the first demo and the delivery. This quick decision shows just how much the new high-end trainer impressed the local team.

Present at the demonstration were Jennifer Becker, Director of Rehabilitation, along with five other team members. Together, they thoroughly tested the toro and were impressed by its wide range of applications, intuitive operation, and immediate training effects.

In daily clinical use, the toro has received consistently positive feedback. Patient Laura summed it up enthusiastically: "I love cycling through the different countries. This cycling system is better than a piece of cake – I wish I could take it home!"

The therapy team is also convinced. Milton, Physical Therapist Assistant (PTA), emphasized: "The new toro really motivates our patients. The visual feedback and real-time performance data make all the difference." Katie, PTA, added: "Especially for people who can't walk far, toro is a fantastic option for continuous resistance training. The performance analysis helps us work together on targeted muscle building."

PAM Georgetown already has experience with other THERA-Trainer devices – a tigo and a balo are already in use at the facility. Interestingly, the therapists don't see any overlap between the devices but rather a perfect complement. The tigo is primarily used for a simple warm-up, while the toro takes on a clearly therapeutic role with targeted training modes for strength, endurance, and symmetry. Its biggest advantage: it's mobile and can easily be brought to less mobile patients right at their bedside.

Of particular note is the close collaboration with Jennifer Becker and her team, whose valuable feedback has already contributed to the further development of the product – especially in the area of software. Initial requests for simpler game concepts and targeted symmetry exercises were taken into account and, in some cases, already implemented. PAM Georgetown was also the first clinic worldwide to test and provide feedback on the toro's new software

release, featuring enhanced feedback functions and personalization options.

With this strong foundation, the toro is well-positioned for the U.S. market – and stands as a true ambassador for motivating movement therapy "Made in Germany."

For people with limited mobility, the toro offers a real training opportunity – targeted, effective, and easy to use in various locations.

Images and text references

Jennifer Becker (Director of Rehabilitation, PAM Georgetown)

PAM Health Rehabilitation Hospital of Georgetown:

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SCIENCE

Tried and tested

Why exercise is essential for patients with chronic kidney disease

Isabelle Balge

Reducing cardiovascular morbidity and mortality in chronic kidney disease (CKD) is increasingly becoming a joint priority for both cardiology and nephrology specialists. A recent Clinical Consensus Statement from cardiology and nephrology associations highlights the essential role of exercise training in reducing cardiovascular risk in patients with CKD G3–G5D (cf. Kouidi et al. 2024).

Background

Chronic kidney disease (CKD) affects approximately 10% of the global population. Classification is based on the glomerular filtration rate (GFR), which indicates how well the kidneys filter the blood:

Stage G3: mild to moderate reduction (GFR 30–59 ml/min),
Stage G4: severe reduction (GFR 15–29 ml/min),
Stage G5: kidney failure (GFR below 15 ml/min),
G5D: kidney failure requiring dialysis.

Link between CKD and cardiovascular diseases

There is a close link between CKD and cardiovascular disease (CVD). Contributing factors include chronic volume overload, inflammatory processes and mineral imbalances that can increase arterial stiffness and lead to arteriosclerosis. The prevalence of arteriosclerosis is up to 65% in haemodialysis patients, while approximately 60% of peritoneal dialysis patients and individuals with CKD G3 G4 are affected.

Approximately half of patients with CKD G4–G5 suffer from CVD. They have twice as high a prevalence of cardiovascular diseases compared to the general population (65% vs 32%). Heart failure occurs significantly more frequently in CKD patients over 66 years of age (26% vs 6%), in dialysis patients the prevalence is even as high as 44%. Furthermore, the risk of sudden cardiac death in dialysis patients is markedly increased compared to the general population (59 vs 1 death per 1,000 patient-years).

Exercise as non-pharmacological therapy

The prevention of CVD is an important approach to improving life expectancy in CKD patients. The Clinical Consensus Statement therefore focuses on non-pharmacological therapies, particularly exercise training.

Physical activity and CKD

There is a dose-response relationship between physical activity and CKD risk, as well as overall mortality. Some studies show that physical activity can slow the progression of CKD and reduce albuminuria (protein excretion in the urine). It is estimated that CKD risk can be reduced by 2% per 10 MET-h/week.

MET-h/week describes the energy expenditure through physical activity

An increase in physical activity in CKD patients without renal replacement therapy can also improve risk factors such as hypertension and reduce cardiovascular mortality in dialysis patients. Several studies have shown that patients who are more physically active have a lower mortality rate.

Research evidence on exercise training

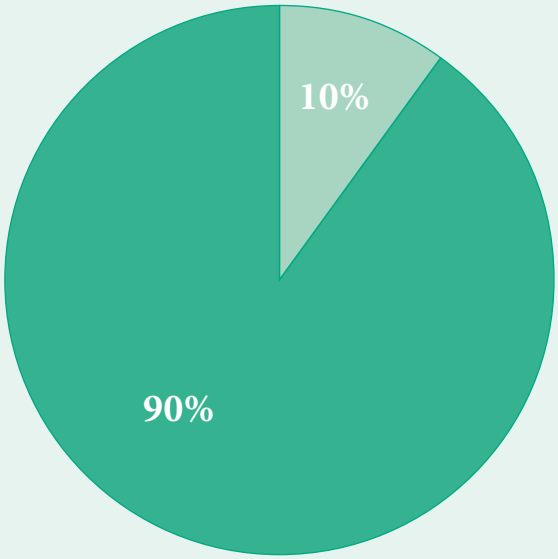
The DiaTT study showed that training during dialysis is safe and brings clinical benefits in patients with different comorbidities and age groups. Physical function improved, the number of hospital admissions was reduced and the hospitalisation rate was halved.

Further studies such as RENEXC and AWARD also showed positive effects on the fitness of patients with CKD G3-G5. The CYCLE-HD study reported improvements in cardiac parameters following six months of intradialytic cycle training.

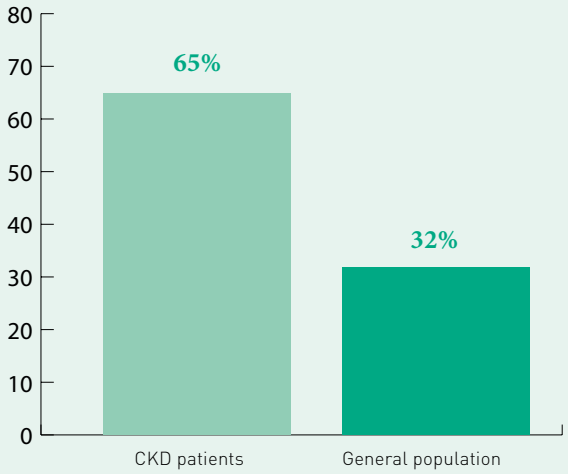
Traditional cardiovascular risk factors in CKD

The development of hypertension and CKD is closely interrelated. Hypertension is one of the main causes of CKD as it damages the small vessels of the kidney.

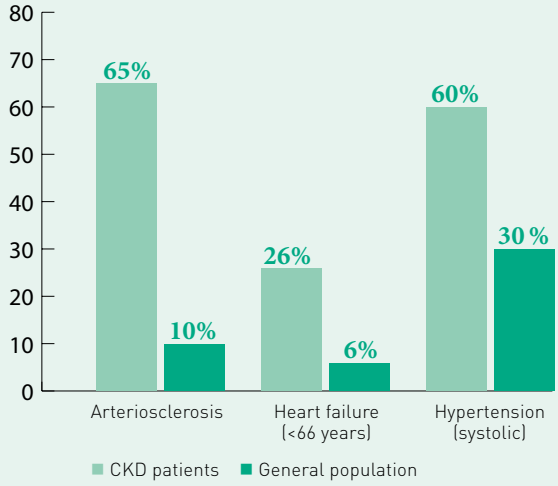
Proportion of CKD patients in the general population



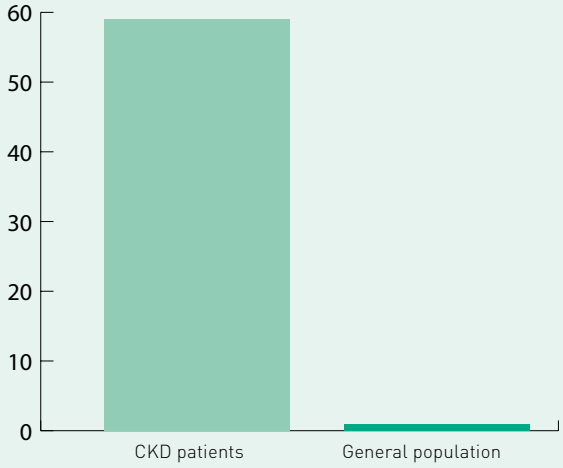
Prevalence of cardiovascular disease



Prevalence of specific cardiovascular diseases



Sudden cardiac death (deaths per 1,000 patient-years)



Conversely, CKD promotes the development of hypertension through increased sympathetic tone and activation of the renin-angiotensin-aldosterone system. The prevalence of hypertension in CKD patients is high: 60% for systolic and 30% for diastolic blood pressure.

CKD and heart failure are closely linked pathophysiologically as cardiorenal syndrome. Both diseases share common underlying mechanisms: systemic inflammation, endothelial dysfunction and oxidative stress.

Dialysis itself poses a risk for sudden cardiac death. Possible mechanisms are insufficient dialysis dose, cardiac arrhythmias as a result of volume overload or depletion, and electrolyte imbalances during and after dialysis.

Fewer heart attacks, fewer hospital stays – better quality of life through exercise training.

Safety of exercise training

Exercise during dialysis is fundamentally safe when it is properly dosed. In the first two hours of dialysis, hardly any side effects occur. In cases of high ultrafiltration volumes and a risk of intradialytic hypotension, training should however be postponed until circulatory values have stabilised.

Recommendations for exercise training and conclusion

The KDIGO guidelines recommend at least 150 minutes of moderate physical activity per week. Ideally, 7,000 to 10,000 steps per day would be optimal – however, most patients do not achieve these levels.

The evidence underscores that targeted exercise training offers CKD patients numerous benefits and can be performed safely. Training should be personalised. The introduction of structured exercise programmes could be crucial in reducing cardiovascular morbidity and mortality in this high-risk group and should therefore be promoted as an integral component of CKD treatment.

Original work

The statements presented in this text are based on the Consensus Paper by Kouidi et al. and refer to the sources cited therein.

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Isabelle Balge has several years of practical experience in the emergency medical services. Following her dual study programme in Business Administration specialising in Health Management, she has been part of THERA-Trainer's New Business Development team since 2023. Her role includes that of Medical Liaison specialising in nephrology and dialysis. She is currently studying on a part-time basis for a master's degree in Health Economics and Management.

Cycling has the edge

A comparison of recumbent step training and cycling in neurological and geriatric rehabilitation – biomechanical, functional and evidence-based evaluation taking into account logistical and economic conditions

Fabian Scheffold

The choice of suitable endurance training modalities influences the start of therapy, the range of applications, functional adaptation, and the overall logistical effort in neurological and geriatric rehabilitation. Two established methods are Recumbent Step Training (RST) and Cycling (CL).

Both forms of training are based on a closed kinetic chain but differ fundamentally in terms of movement control and adaptability. RST generates a linear-axial, alternating extension–flexion of the lower extremities with the feet in a fixed position in a semi-upright sitting position, often combined with arm activity. CL, however, is based on a continuous rotational movement with even load distribution across the entire range of motion and can be applied passively, assistively or actively to the upper and lower extremities.

There is growing evidence in favour of CL, which can be used at an early stage, requires low coordination skills, is gentle on the joints and can be performed with high training density. RST, however, requires higher motor-cognitive skills, is more complex to organise and is less adaptable – especially in patients with severe functional limitations.

CL also offers structural advantages in terms of equipment complexity, space requirements and controllability. Against the backdrop of limited staff resources and infrastructure, the use of RST increasingly raises the question of proportionality in terms of effort and benefit.

This article compares both methods, focusing on biomechanical, functional, practical and evidence-based aspects in neurological and geriatric rehabilitation.

Evidence base for Recumbent Step Training

RST is particularly well established in the North American rehabilitation context, where it is used for both training and diagnostic purposes. A modified test protocol (mTBRS-XT) achieved higher VO_2 peak values in outpatients who had suffered a stroke than a conventional cycle ergometer test, which was attributed to the additional strain on the upper extremities (Billinger et al., 2008). This suggests that RST can cause increased cardiopulmonary stress under certain conditions.

RST is based on the functional coupling of arms and legs, whereby arm movements can support leg movements. One side of the body can also partially compensate for the weakness of the other side, as the movement patterns are linked. However, this method does not focus on differentiated control of residual muscle power or a classic assistance-as-needed principle. Rather, it requires active participation, sufficient core stability and cognitive abilities for movement control.

Functionally, RST is therefore limited to people who can actively participate. In cases of severe paresis, reduced trunk stability or limited cognitive performance, it is often not possible to perform the exercise in a meaningful way, as both the coordinated use of arms and legs and conscious movement control are required to carry out effective training that goes beyond basic mobilisation.

Despite specific advantages in its application, there are currently no randomised controlled studies that prove the functional or everyday relevance of RST compared to CL. In particular, with regard to early mobilisation, adaptability for severely impaired individuals and evidence-based effectiveness, there is currently no clear advantage in favour of RST.

Evidence base for Cycling

CL has a broad evidence base that includes functional, cardiopulmonary and everyday target parameters. A meta-analysis of 28 randomised controlled trials involving a total of 1,115 stroke patients showed significant improvements in walking ability, cardiorespiratory fitness, motor function and balance through ergometer training – mostly in the form of CL (Veldema & Jansen, 2020). Other reviews support these findings (Barclay et al. 2022; Tiebel, 2018).

Further potential arises from combining CL with supportive processes: In a controlled study, co-treatment using functional electrical stimulation (FES) delivered additional improvements in trunk control and walking distance (Aaron et al., 2018). Multimodal approaches like these expand the

Cycling combines early mobilisation with active therapy.

potential applications, especially for patients with severe paralysis or central motor inactivity.

CL is also becoming increasingly established in intensive care settings with a strong evidence base. A recent review showed that in-bed cycling can improve the functional outcome of critically ill patients in intensive care and shorten the length of stay in intensive care units (O'Grady et al. 2024). These findings were incorporated into the updated US guideline on early mobilisation in 2025, which explicitly recommends "enhanced mobilization" – including in-bed cycling after ICU admission (Critical Care Society, 2025).

CL is an adaptive, evidence-based and versatile training method across the entire care continuum – from intensive care to post-acute rehabilitation.

Biomechanical and neurophysiological principles

Both CL and RST are performed in a seated position, which completely relieves body weight and reduces overall joint stress.

In contrast to the even distribution of force in the rotational cycle during CL, the linear movement during RST can lead to increased stress on individual muscle groups – especially the knee extensors – particularly at higher resistances or with limited joint mechanics. Functional-structural limitations such as arthritis or obesity may potentially reduce movement tolerance under these conditions.

From a neurophysiological perspective, the rhythmic-symmetrical leg movement during CL has an activating effect on spinal central pattern generators

Current findings support the use of CL as the primary endurance device in neurological and geriatric rehabilitation.

(CPGs) and supports the functional reorganisation of cortico-spinal networks through sensorimotor feedback (Klarner et al. 2014). This effect can be further enhanced through forced-rate protocols – deliberately increased pedalling frequencies. A randomised controlled study documented significant improvements in both Fugl-Meyer motor function and VO_2 peak in stroke patients after eight weeks of high-frequency CL training (Linder et al., 2024).

Even with RST, CPG activation is fundamentally possible, provided the movement is rhythmic, bilateral and repetitive. However, corresponding evidence has not yet been comprehensively documented. Overall, the biomechanical and neurophysiological characteristics particularly support the versatile and early possible use of CL in neurological and geriatric rehabilitation.

Logistical and economic aspects

Beyond clinical effectiveness, practical and economic considerations are the primary factors that determine which training equipment is used in day-to-day rehabilitation settings. A clear advantage in favour of CL is evident here.

A typical RST device with dimensions of approximately 1.85 m × 0.76 m requires nearly twice the floor space of a CL system (approx. 0.90 m × 0.57 m) and weighs around 129 kg, which is approximately three times the weight. This not only hampers flexible use across various therapy settings, but also constrains the device's mobility, particularly when space requirements change or therapy units undergo reorganisation. RST systems are exclusively for stationary use; patient transfer to the device seat is necessary and typically requires assistance from one or two caregivers when dealing with higher care needs.

Cycle ergometers, by contrast, are typically wheelchair accessible, mounted on mobile platforms, and specifically designed to be used even by those with severely limited muscle function (grade 0 or 1). Thanks to integrated passive and assistive modes, therapeutic use is possible even when patients cannot yet fully participate actively – such as during early stroke recovery or for severely compromised geriatric patients.

Looking at the economic benefits, the integration of CL systems presents a clear advantage. Modern CL systems typically combine three key functions in a single device: passive mobilisation, assistive training and active ergometer load. This reduces the need for separate individual devices, lowers acquisition and maintenance costs, and simplifies staff training. With its lower technical complexity, reduced space requirements and versatility in day-to-day therapy, CL stands out as a highly efficient training method – not just clinically, but logistically and economically as well.

The consistent integration of cycling in neurorehabilitative and geriatric care standards underscores the clinical significance of this form of training.

Discussion

For cooperative patients with good trunk and limb function, the RST offers infinitely adjustable whole-body training that can produce slightly elevated peak VO_2 values, especially during stress tests. The inclusion of the upper extremities is a potential advantage, provided active participation is ensured. At the same time, the purely active operating principle significantly restricts its application potential: therapeutic access can be limited particularly in early rehabilitation stages, for patients with severe motor impairments or in intensive care settings. Furthermore, the RST movement pattern increases mechanical load on the knee joints due to higher peak moments during concentric extension. This requires careful consideration, especially for those with existing joint conditions (e.g. arthritis, post-traumatic degeneration).

By comparison, CL offers a much wider range of therapeutic applications, ranging from passive early mobilisation on the intensive care unit to

Comparison criterion	Recumbent-Step-Training (RST)	Cycling (CL)	Implication
Movement control	Alternating, linear-axial	Continuous, rotational	Rotational movement reduces joint stress and coordination requirements
Kinetic chain	Closed	Closed	Both closed, but CL uses biomechanically more favourable cycle control
Training modes	Only active	Passive, assistive, active	Greater flexibility with a wide range of functions in all rehabilitation phases
Cardiopulmonary stress	High with active participation	High training density, active, but also usable in an assistive manner	Can also be used effectively with low load capacity
Adaptability (early stage, severe impairment)	Limited – only with active movement control	High – suitable for grade 0–1 and in early phase	Broader applicability in cases of severe limitations
Evidence base	Limited, minimal RCTs, isolated studies	Broadly evidenced (RCTs, meta-analyses, guidelines)	Scientific foundation for clinical application of CL
Neuroplastic potential	Possible in principle, though minimal documentation exists	Well documented (e.g. forced-rate cycling)	Better evidence for targeted enhancement of neuroplastic processes
Mobility and space requirements	Large, stationary, difficult to transport	Compact, mobile, wheelchair accessible	Use possible in confined, dynamic therapy environments
Staffing	High (transfer, min. 1–2 people required for care needs)	Low (can be used without transfer)	Less staffing required, greater everyday efficiency
Combination with other procedures	Little documented	e.g. FES, intensive protocols etc. can be easily combined	Expandability increases therapeutic benefit
Cost-effectiveness	Less favourable in restricted patient group	Highly efficient, versatile	Efficiency with limited resources and broad patient group
Transfer effort	High – seat transfer required	Low – wheelchair accessible or bedside	Enables early deployment without repositioning
Use in intensive care medicine	Not practicable	In-bed cycling evidence-based	Early mobilisation possible in acute phase
Technical integration	Limited (no standardised interface)	Standardised ergometry modules and interfaces	Better data integration and therapy monitoring

assistive-symmetrical motor relearning for severe hemiparesis to active high-intensity training protocols for secondary prevention. This adaptability is greatly enhanced through motor-assisted movement capabilities and standardised ergometry modules that precisely control the training parameters. The evidence base is comprehensive, spanning from mechanistic studies on muscle activation and neuroplastic reorganisation to randomised controlled trials, meta-analyses and current guideline recommendations. In particular, the integration of CL into early mobilisation protocols in intensive care units, alongside neurorehabilitative and geriatric care standards, highlights the significant clinical value of this training approach.

Conclusion

Considering biomechanical stress profiles, neurophysiological mechanisms, evidence-based effectiveness and practical implementation, current findings support CL as the primary endurance equipment for neurological and geriatric rehabilitation. The RST can be a practical addition when patients have adequate leg strength and wish to engage their arms, but it fails to match the versatility, adaptability and early integration options of cycling across the entire rehabilitation journey.

Source

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Fabian Scheffold has been leading the Sport in Dialysis initiative at THERA-Trainer for several years as a project manager in the New Business Development department. His project experience has enabled him to develop extensive expertise and build an exciting professional network. His MBA background gives him valuable insights into the business challenges faced by dialysis centres.

Global rehabilitation revolution: learning from others

What's the key to better rehabilitation? Other countries provide answers

Linda Kaiser

From Japan to Canada, best practice examples demonstrate how physiotherapy, prevention and digitalisation can work seamlessly together. If we take a wider view, we'll see that rehabilitation doesn't end at the practice door – it begins in everyday life. This article inspires us to learn from others.

Rehabilitation is much more than physiotherapy on prescription. It reveals how truly committed a society is to health, personal responsibility and active participation. While rehabilitation in Germany remains trapped in rigid bureaucratic structures, insurance disputes and regulations, other countries demonstrate better approaches – simpler, more flexible, more people-centred. The challenges are similar everywhere: chronic diseases are on the increase, our population is ageing, skilled professionals are in short supply, and waiting times continue to grow. Nevertheless, progress in Germany often fails due to bureaucracy or fear of change (OECD, 2019).

Other countries are leading the way. They integrate physiotherapy with psychology, social work and digital solutions. They bring rehabilitation to where it matters most: in the community, village, workplace or even on a mobile phone. If we take a wider view, we'll see that rehabilitation is not a single appointment with a healthcare professional, but a process that begins well before the first symptom appears and is an effective tool well beyond the last appointment (WHO, 2017).

1. Prevention: rehabilitation begins before rehabilitation

Japan: prevention as a guiding principle for society

Japan has one of the oldest populations in the world. To prevent this demographic change from leading to a crisis in care, prevention has become a national priority (Tsuji et al., 2018). Cities like Matsudo actively promote exercise programmes and neighbourhood groups supervised by physiotherapists. Studies show that these programmes not only enhance physical function, but also decrease social isolation – a key protective factor against depression and care dependency (APA, 2021).

Scandinavia: early intervention instead of endless waiting

In Sweden, for example, the "workplace-based rehabilitation model" has been successfully implemented.

Instead of waiting for reintegration after a six-week sick leave period, rehabilitation begins during the sick leave itself (EU-OSHA, 2021). Ergonomic adjustments and therapeutic support are provided frequently and consistently. This approach is endorsed by the WHO, which highlights the importance of early, community-based interventions in its rehabilitation framework (WHO, 2017).

Scientific background: prevention pays off

International evidence clearly shows that preventive approaches in rehabilitation not only benefit individuals, but also deliver significant economic value at the national level. The WHO emphasises in its global Rehabilitation 2030 initiative: early, accessible local services reduce downstream costs, prevent hospitalisation and create lasting improvements in quality of life.

According to EU-OSHA and ILO, businesses save an average of €2.00 to €2.50 for every euro invested in workplace prevention measures (EU-OSHA 2021; ILO 2019).

What does that mean in practice?

"Prevention" must be more than just a buzzword. Success depends on creating the right structures:

- easy access (no complicated bureaucracy)
- local exercise initiatives with physiotherapists
- early screening to identify at-risk patients
- integration with businesses: rehabilitation alongside sick leave, not after it

Rehabilitation is much more than physiotherapy on prescription.

Germany has some catching up to do here. While prevention is firmly established in guidelines and laws, it often lacks consistent implementation. This is due to funding gaps, sectoral boundaries – and the fact that prevention in physiotherapy often cannot be billed to cover the true costs.

2. Interdisciplinary & connected: eliminating silos, optimising impact

Canada, Australia and Denmark embrace multi-professional teams. In Canada, physiotherapists, occupational therapists, psychologists and nutritional therapists collaborate seamlessly – the biopsychosocial model is a living reality there (Journal of Rehabilitation Medicine, 2020). Studies from Norway, where municipal teams collaborate on planning and share access to digital patient records, demonstrate improved mobility scores and enhanced quality of life (Rønningen et al., 2021).

Rehabilitation is rarely a single discipline. Whether you are dealing with chronic pain, stroke after-effects or psychological challenges, complex health journeys require a coordinated team approach. Countries like Canada, Australia or Denmark show that the closer physiotherapy works with other disciplines, the greater the effectiveness, patient satisfaction and sustainability of treatment. In Canada, interdisciplinary collaboration in rehabilitation centres is part of everyday practice. Patient, physiotherapist, occupational therapist, psychologist, nutritionist – none of these professions see themselves as lone operators, but rather as a closely integrated treatment team. Particularly in cases of musculoskeletal complaints or chronic pain conditions, the psychosocial component is actively treated as well. The biopsychosocial model is not just theory, it is a living reality.

Central approach: the roles are clearly defined – the physiotherapist is the movement expert, the psychologist deals with coping strategies, the social worker helps with adjustments to daily life and the nutritionist assists with weight management. Everyone works together in a coordinated manner.

Community health is also a firmly established concept in Australia. Many physiotherapists work in primary health teams in neighbourhoods – together with general practitioners, midwives, psychologists and community nurses. One example is the concept of shared care: patients with chronic back pain are not simply prescribed six sessions, but rather a coordinated long-term management programme. This includes physiotherapy, psychosocial counselling, digital home workouts and group sessions.

Result: studies from Victoria show that patients in these interdisciplinary programmes are less likely to relapse, return to the workplace more quickly and require fewer painkillers (APA, 2021).

In Norway and Denmark, interdisciplinary care is closely linked to the municipalities. Municipal rehabilitation centres often work with established multi-professional teams. A special feature is that the patient does not have to organise each appointment separately. Instead, planning is done jointly. All data comes together in a digital patient record. This ensures every therapist knows what the other is doing – eliminating redundancies and preventing duplicate patient examinations. Numerous meta-analyses, including those in the Journal of Rehabilitation Medicine, show that interdisciplinary rehabilitation programmes achieve significantly better results – measured in terms of mobility, quality of life and relapse rates.

Particularly for stroke patients, chronic pain sufferers, and those dealing with long COVID, this interdisciplinary approach delivers measurable advantages. The reason is simple: many problems are not purely physical. Without psychosocial support, there is a risk of chronification. Without occupational therapy, barriers in daily life persist.

3. Self-determination & patient autonomy: from patient to active participant

In the Netherlands, patients have direct access to physiotherapy. According to the KNGF (Royal Dutch Society for Physiotherapy), participation in decisions and voluntary co-payments lead to higher therapy adherence (Nivel, 2020). Australia goes even further: self-management programmes actively engage patients in defining their goals and monitoring their progress. Shared Decision Making (SDM) is an established standard there (APA, 2021).

The future of rehabilitation belongs to patients – and not as passive recipients, but as active partners. In Germany, rehabilitation programmes typically operate on a "prescribe and comply" basis, but examples from the Netherlands and Australia demonstrate how genuine patient involvement can

achieve far more than prescriptions and co-payments ever could.

The Netherlands: freedom of choice, greater self-esteem

In the Netherlands, access to physiotherapy has been intentionally streamlined. Patients can go straight to the physiotherapist – without any referral at all. Many practices have adapted to this and now combine traditional therapy with prevention courses, training areas and individual counselling on health issues. An important principle is that patients schedule their own sessions, have a say in deciding which priorities they want to set, and pay privately as well if needed. This requirement for a financial contribution might seem off-putting at first, but it leads to a remarkable side benefit: those who make their own decisions and share the costs typically stay committed for longer. According to a study by the Dutch KNGF, adherence to treatment among patients with chronic back pain significantly exceeds the European average – in part because patients have the flexibility to extend or adjust their therapy as needed (Nivel, 2020).

Australia: patients as co-therapists

Australia is regarded as a pioneer when it comes to patient involvement in decision-making. Many rehabilitation programmes are structured so that patients define their own treatment goals. Physiotherapists are more like coaches: they support patients and provide expertise, but they do not micromanage every exercise. An example of this is the self-management programmes for people with arthritis or chronic back pain. Following an introductory phase, patients largely manage their own training, with digital tools or group meetings. The therapists remain available as points of contact – often via tele-rehabilitation. Outcome: studies by the Australian Physiotherapy Association show that this type of autonomy reduces relapses. Those who understand how their body reacts recognise warning signs earlier – and take appropriate action. The concept of Shared Decision Making (SDM) is now firmly established in many international rehabilitation guidelines. It describes a structured process in which patient and therapist decide on equal terms which goals are realistic and which measures are practical. SDM not only boosts patient satisfaction, but also enhances treatment adherence – a significant advantage for managing chronic conditions. The WHO therefore recommends not only involving patients in treatment plans but actively empowering them with health education, easy-to-understand materials and digital tools.

"Prevention" must be more than just a buzzword. Success depends on creating the right structures.

Obstacles in Germany

In Germany, the issue of patient autonomy often still takes a back seat to statutory requirements. While Shared Decision Making is gaining momentum in hospitals – for example in tumour boards or oncological rehabilitation centres – in the outpatient sector the model often remains wishful thinking. Reason: time pressure, rigid remuneration structures, insufficient scope for individual target planning. Early pilot projects demonstrate that this approach can be successful. Some practices offer hybrid models – face-to-face therapy enhanced by online coaching and digital exercise programmes. Patients are guided to document and assess their own progress.

4. Digitalisation: rethinking rehabilitation – even without a waiting room

Norway and Sweden are embracing tele-rehabilitation solutions, such as the E-Rehab programme featuring apps, wearables and weekly video sessions (University of Oslo, 2022). The results demonstrate fewer therapy discontinuations, enhanced flexibility and consistent quality (Meisingset et al., 2021). In Canada and Australia, virtual platforms provide patients in remote areas access to healthcare services – with proven comparable effectiveness (Jirasakulsuk et al., 2022; Cottrell et al., 2017).

Whether in Scandinavia, Canada or Australia, digitalisation in many countries is no longer an emergency stopgap, but an established part of healthcare provision. Rehabilitation becomes more flexible, less dependent on location and more personalised – without losing the quality of personal care.

Scandinavia:
tele-rehabilitation as standard, not as replacement

Tele-rehabilitation has long been part of everyday life in Norway and Sweden. Physiotherapists use video calls, wearables and app-based programmes to support patients even when face-to-face appointments are not possible due to location or scheduling issues or for health reasons. A key element is the principle of blended care: digital units complement face-to-face appointments but do not completely replace them. Especially for patients with chronic conditions or those recovering from surgery, this approach provides continuous care without the wait times associated with face-to-face appointments.

Taking Norway as an example: the E-Rehab programme combines digital back training with weekly live sessions. Patients document their progress via an app. Wearables measure range of movement and provide feedback on posture or load. The physiotherapist receives data automatically and adjusts the plan accordingly.

Result: studies from the University of Oslo demonstrate that tele-rehabilitation in Norway reduces

Rehabilitation doesn't end at the practice door. It begins where people live, work, grow older and take responsibility for their health.

treatment discontinuations by up to 35% – primarily because patients remain more flexible.

Canada: extending access in rural areas

Canada is vast – but sparsely populated. For many patients, it would be impossible to get to a rehabilitation clinic on a weekly basis. Tele-rehabilitation is therefore not just an option but a necessity. Virtual care models are particularly successful because they combine physiotherapy, psychological support and medical consultations. Patients follow digital instructions while training at home, interact in virtual groups and connect via video call whenever they have questions. The Ontario Telemedicine Network Clinics (OTN) connect over 600 rehabilitation therapists with patients in remote areas. In orthopaedic and neurological indications, the results are hardly any different from traditional face-to-face care – patients often feel they receive better care because they have more points of contact.

Australia: digital platforms as a key element

Australia has increasingly focused on national platforms in recent years that connect patients, therapists and doctors.

One example: Healthdirect Australia offers modular programmes alongside information tools, enabling physiotherapists to compile personalised home exercise routines. Key component: digital care is not isolated, but part of holistic healthcare provision. Many practices combine online programmes with face-to-face appointments. This preserves the human touch – while increasing flexibility.

Numbers and evidence: does it work?

Yes – if the quality is right. A meta-analysis from the Journal of Telemedicine and Telecare (2022) shows that tele-rehabilitation for orthopaedic and musculoskeletal indications can be just as effective as face-to-face rehabilitation – when it is conducted in a structured manner.

Key success factors:
- clear objectives and individual adaptation,
- digital competence on both sides,
- regular personal contact to ensure patient bonding,
- seamless integration into existing treatment workflows.

Germany: great potential, significant challenges

Whereas COVID-19 boosted digitalisation in Germany, the structures for sustainable tele-services are largely still lacking in rehabilitation. Many practices lack both the technical infrastructure and time resources needed to sustainably incorporate online support into their operations. Furthermore, billing procedures are often unclear or too bureaucratic. Pilot projects show that the demand is enormous. Patients in rural areas, those with limited mobility or family responsibilities are particularly interested in digital options – whether as a homework programme, a video check-in or a hybrid model. Some rehabilitation centres in Bavaria and Baden-Württemberg are currently testing hybrid models. Patients begin as inpatients, but after discharge continue their treatment plans or breathing therapy using an app – including a chat function with the physiotherapist. Initial evaluations show that relapses and rehabilitation discontinuations fall significantly. Digitalisation does not replace humans – instead, it creates new access points, eliminates unnecessary travel and makes room for greater continuity. Countries like Canada, Norway and Australia demonstrate that modern tele-rehabilitation is not just a temporary solution, but a valuable addition to plug the gaps in healthcare delivery.

For Germany: it is essential that digitalisation does not become a faint echo of the pandemic. Stable platforms, reliable remuneration and ongoing training for therapists are critical. Patients are ready – now it's time for the system to deliver. The intention is clear, but we lack proper structures, secure billing systems and adequate training programmes. The WHO recommends integrating digital elements into existing processes, not as a replacement, but as an extension (WHO, 2021).

Future outlook: rehabilitation 2035 – radically reimagined

Let's imagine a 2035 where rehabilitation functions as a complete health ecosystem rather than just a repair shop. AI-assisted screening tools identify risks before any symptoms appear. Physiotherapists coach and connect rather than just treat. Wearables provide real-time data and digital tools enable hybrid care. The individual is transformed from a passive patient into an active participant – a co-therapist with responsibility and knowledge (cf. WHO 2021; APA 2022).

Instead of regulations there are flexible budgets, instead of waiting lists there are smart interfaces. And the best thing of all: prevention and rehabilitation are merged. Investing in rehabilitation today not only reduces costs, it adds healthy years to people's lives, benefitting both companies and society.

Final thoughts

Rehabilitation doesn't end at the practice door. It begins where people live and take responsibility for their health. Learning from others is a critical step in this process. The future isn't something that just happens – it's something we shape. And this is where we at opta data Zukunfts-Stiftung step in with our optaVita workshops and eLearning formats that address these challenges: strengthening digital competence, changing mindsets and empowering practice teams not only to think about modern rehabilitation but to actively implement it (opta data Zukunfts-Stiftung, 2025).

The future isn't something that just happens – it's something we shape. And ideally by joining forces with those who are already rethinking rehabilitation.

opta data Zukunfts-Stiftung:

l.ead.me/therapy-25-02-42

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Linda Kaiser learned the healthcare profession from the ground up. As a physiotherapist, she worked in neurorehabilitation for over a decade and experienced first-hand the challenges and opportunities involved in caring for patients. In doing so, she recognised that physiotherapy can not only heal, but also sustainably shape the entire healthcare system – provided it has the right framework to do so. To play an active role in shaping this framework, she expanded her knowledge about the healthcare system and, alongside her practical work, completed a bachelor's degree in Health and Social Management followed by a Master of Science in Public Health. This pathway enabled her to link theory with practice even more strongly, and to engage with the structural, political and economic challenges of physiotherapy. She now brings her professional expertise to her role as scientific director, overseeing academic management and future workshops at the opta data Zukunfts-Stiftung foundation. Here she analyses scientific studies, develops future strategies for healthcare and works with interdisciplinary teams to strengthen the future viability of the healthcare professions. In doing so, she employs the future compass, a tool developed by future psychologist Prof. Thomas Druyen, that enables systematic navigation through the challenges of the coming years.

THERA-Trainer supports the SPORTnachSCHLAG project with a € 2,500 donation

Active fundraising campaign at therapie Leipzig 2025: making a difference together

Leoni Schulz

At this year's therapie Leipzig 2025, we at THERA-Trainer showcased not only our innovative rehabilitation technologies but also our commitment to social responsibility. As part of a special interactive activity at our exhibition stand, industry professionals were invited to get hands-on – while supporting a good cause. The new THERA-Trainer toro movement exerciser took centre stage. For every minute that exhibition visitors spent training on the toro, we donated €5 to the SPORTnachSCHLAG project run by the German Stroke Foundation (Stiftung Deutsche Schlaganfall-Hilfe).

The campaign generated tremendous interest among exhibition visitors. Numerous therapists, professionals and interested individuals seized the opportunity to test the toro in person – not only experiencing a novel approach to movement, but also making a meaningful contribution to stroke survivor support.

Thanks to the enthusiastic participation of many visitors, an impressive € 2,500 was raised. This entire sum goes directly to the SPORTnachSCHLAG project, which is dedicated to creating rehabilitation sports groups for stroke survivors. With proceeds

from the campaign, five new groups can now be set up where participants can train together under professional guidance, enhance their mobility and make important social connections.

The donation cheque was presented on 10 May 2025 – stroke awareness day in Germany – at the exhibition centre in Leipzig. A visible demonstration of how trade show presence, product innovation and social responsibility can be successfully integrated.

"We're thrilled with the fantastic response at the trade fair and the opportunity to make a meaningful

Thanks to the enthusiastic participation of many visitors, an impressive €2,500 was raised.

"Progress in rehabilitation encompasses not only technological innovation but also commitment from society as a whole."

impact on stroke patient aftercare with our visitors," says Christine Hohensteiner, our Team Manager for Promotion & Communication. "We're in no doubt that progress in rehabilitation encompasses not only technological innovation but also commitment from society as a whole."

We'd like to thank everyone who participated and supported this initiative – whether through sheer muscle power, motivation or simply spreading the word. Together, we've taken a significant step forwards in improving aftercare and support for stroke survivors – a commitment that not only inspires hope, but demonstrates the remarkable impact of our collective efforts.

More information on the SPORTnachSCHLAG project can be found here:

l.ead.me/therapy-25-02-50

Leoni Schulz has been supporting the editorial team of THERAPY magazine since mid-2024. In addition to her responsibilities for layout and typesetting, she also works as an editor. She writes her own contributions and articles for the editorial. Thanks to her many years of experience in rehabilitation and medical technology, she brings cross-industry knowledge and valuable insights to her articles.

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LIFE IN MOTION

Cochrane update: electromechanical gait training

Do electronic or robot-assisted gait training devices help people walk better after stroke?

Jakob Tiebel

Rationale

Gait disorders are common after a stroke. In rehabilitation, electromechanical and robot-assisted gait training devices can help to improve walking ability. As the evidence base and the certainty of previous findings may have evolved since the last update in 2020, the researchers aimed to update the scientific data on the benefits and acceptance of these technologies in order to reassess their role in stroke rehabilitation.

Objectives of the review

Primary objective
The review investigated whether electromechanical and robot-assisted gait training improves walking ability in adults after stroke compared to physiotherapy (or standard care).

Secondary objectives
An investigation was also conducted to examine whether this therapeutic approach, when compared to physiotherapy (or standard care) after a stroke, influences walking speed, walking distance, treatment acceptance and overall mortality through to the end of the intervention phase.

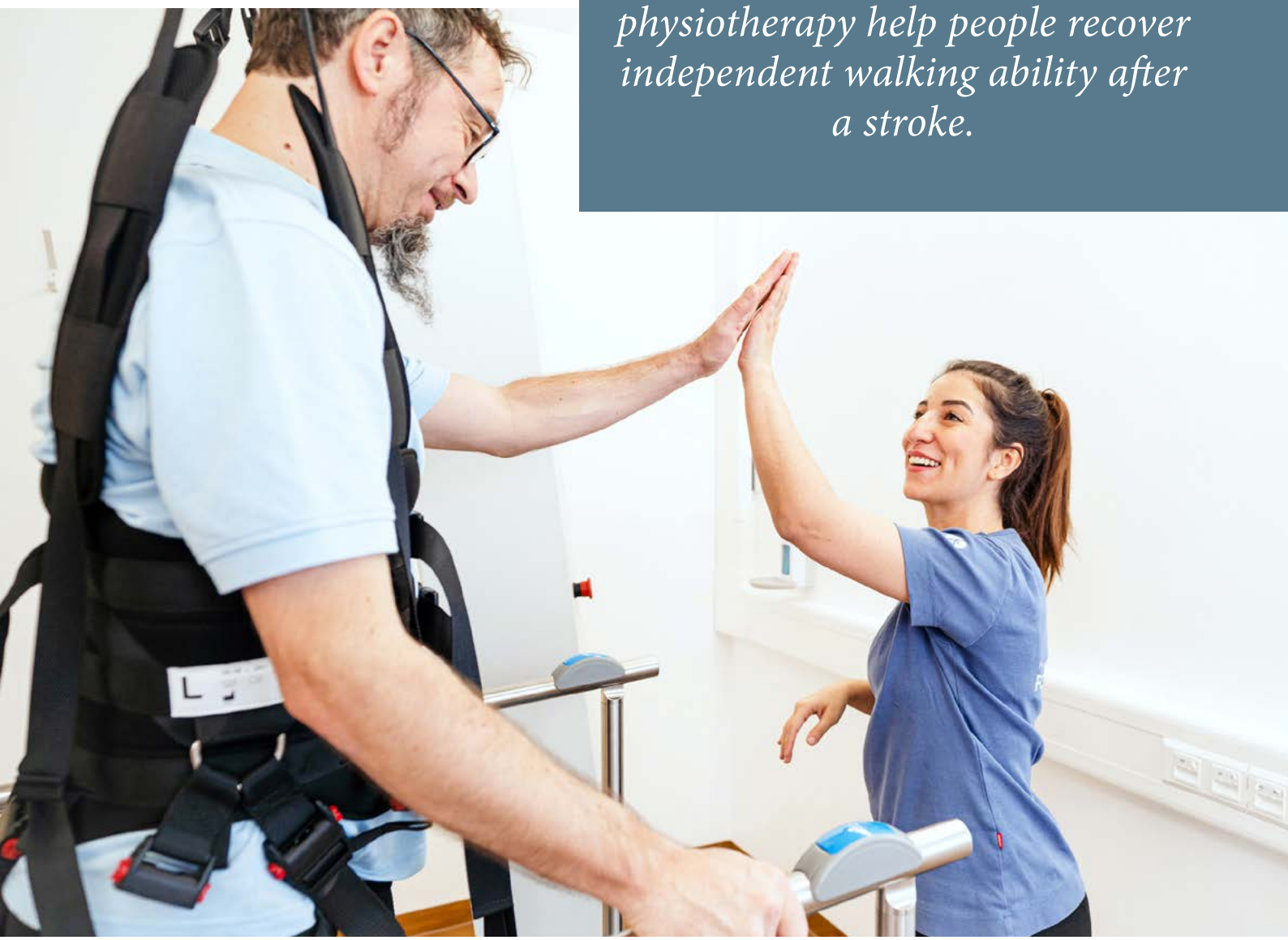
Search methodology

The investigators searched various databases, including CENTRAL, MEDLINE and Embase, as well as seven other databases. In addition, relevant conference proceedings were searched, study and research registers were considered, reference lists were examined, and study authors were contacted to identify further published, unpublished and ongoing studies. The last search date was December 2023.

Inclusion criteria

All randomised controlled trials as well as randomised crossover studies in persons aged 18 years and over with a stroke of any severity and at any stage and care setting were included in the review. The use of electromechanical and robot-assisted gait training devices was compared with physiotherapy (or standard care).

Electronic and robot-assisted devices combined with physiotherapy help people recover independent walking ability after a stroke.



Primary endpoints

The primary endpoint was the ability to walk independently, measured using the Functional Ambulation Category (FAC). An FAC score of 4 or 5 indicated that the affected individuals could walk independently over a distance of 15 metres – using medical aids such as walking sticks. An FAC score below 4 indicated dependence in walking (requiring supervision or assistance when walking).

Additional endpoints included walking speed, walking distance (6-minute walk test) and the number of study discontinuations.

People particularly benefit in the first three months after the stroke – but also afterwards.

Assessment of risk of bias

To assess the risk of bias, the researchers used the Cochrane Risk of Bias Tool version 1 (RoB 1). This tool was developed by the Cochrane Collaboration and is used to systematically assess the quality and trustworthiness of clinical studies. In doing so, it considers various potential sources of bias, such as randomisation, the blinding of participants and study personnel, as well as the handling of incomplete data. Each category is assessed separately to provide the clearest possible picture of how susceptible the examined studies are to bias.

Evaluation methodology

Two reviewers independently selected the studies for analysis, assessed their methodological quality and risk of bias, and extracted the relevant data.

The authors used random effects models for the meta-analysis. These models take into account that the included studies may differ in terms of their results and general conditions. This assumes that the true effects vary from study to study, allowing for a more realistic estimate of the overall effect when heterogeneity exists between studies.

The certainty in evidence was assessed using GRADE (Grading of Recommendations, Assessment, Development and Evaluation). This internationally recognised system evaluates the trustworthiness of the overall evidence based on several criteria such as study quality, inconsistency of results, indirect evidence, imprecision and publication bias. The result is a classification of the evidence into four levels: high, moderate, low or very low.

Studies included

The updated review included a total of 101 studies (comprising 39 new studies and 62 from previous versions). In total, data from 4,224 people after stroke were analysed.

Results of the analysis

The results of the meta-analysis suggest that electromechanical-assisted gait training in combination with physiotherapy probably improves walking ability after stroke. Studies showed that patients receiving this therapy were more likely to regain independent walking ability than patients without this form of training (odds ratio 1.65).

The 95% confidence interval ranges from 1.21 to 2.25, which means that the true effect is highly likely to lie within this range. The p-value of 0.001 shows a statistically significant superiority of the intervention. The heterogeneity between studies was moderate (I^2 = 31%), indicating relatively good comparability across study results. In total, these results are based on 51 studies with a total of 2,148 participants. The evidence was classified as moderately certain according to GRADE, which means that further research is needed, but the results are overall very reliable.

With regard to walking speed, there was no clinically significant difference between the groups. Although a statistically significant difference was shown with a mean difference (MD) of 0.05 metres per second in favour of electromechanical-assisted gait therapy (95% confidence interval 0.02 to 0.08; $p < 0.001$; I^2 = 58%; 73 studies with a total of 3,043 participants), this increase in speed is rather small and is unlikely to represent a noticeable improvement in walking function in daily life for most patients. The evidence was assessed as moderately certain.

The distance walked in the 6-minute walk test also showed no relevant clinical difference. The mean additional distance covered was 11 metres (MD 11 metres; 95% confidence interval 1.8 to 20.3 metres; $p = 0.02$; I^2 = 43%; 42 studies with 1,966 participants). Although this difference was statistically significant, the actual gain here also remains at a level that will likely mean little or no noticeable improvement in practical daily life of those affected. The evidence for this was classified with high certainty.

Regarding therapy adherence and safety, it was shown that electromechanical-assisted gait therapy neither altered the likelihood of study discontinuation nor the risk of a fatal outcome compared to physiotherapy or standard care. For these endpoints, there was high certainty of evidence.

What does the current body of research show regarding electromechanical gait training?

At first glance, the studies show that electromechanical-assisted gait training in combination with physiotherapy increases the chances of being able to walk independently again after a stroke. In the analysed studies, the intervention was associated with an odds ratio of 1.65 compared to the control group, which suggests a relevant therapeutic advantage.
At second glance, it becomes apparent that in the follow-up examinations some time after the end of therapy, the benefit could no longer be demonstrated with complete certainty. The data continues to suggest a positive effect, but due to the smaller participant numbers and the differences between the studies, the validity is limited.

In the case of other outcomes such as walking speed and walking distance, no statistically significant differences were found, although here too small advantages tending to favour the intervention became apparent.

Implications for practice

The present results support the targeted use of electromechanical-assisted gait training, particularly in the early phase of rehabilitation. Particularly in patients with more severe impairments of walking ability, this form of therapy can help to enable early first steps and promote a physiological gait pattern, which is often difficult to achieve through conventional therapy alone.

For the long-term stabilisation and further development of walking ability, a complementary, personalised therapy concept is recommended, which may logically continue to include electromechanical-assisted gait training – particularly for patients who remain significantly limited in their walking ability even in the long term.

In both inpatient and outpatient settings, the use of these systems is essential because the staffing and organisational resources currently available in both settings do not allow for intensive, task-specific and repetitive gait training without mechanical assistance. Only by adopting this approach can we respect motor learning principles while actively enhancing functional improvement.

Long-term effects following completion of the intervention

In the follow-up examinations after study completion, it was shown that electromechanical-assisted gait training in combination with physiotherapy possibly does not increase the chance of independent walking (OR 1.64; 95% CI 0.77 to 3.48; p = 0.20; I^2 = 69%; 8 studies; 569 participants; low certainty of evidence).

No significant differences were found for walking speed (MD 0.05 m/s; 95% CI −0.03 to 0.13; p = 0.22; I^2 = 66%; 17 studies; 857 participants; moderate certainty of evidence) and walking distance (MD 9.6 metres; 95% CI −14.6 to 33.7; p = 0.44; I^2 = 53%; 15 studies; 736 participants; moderate-certainty evidence).

The researchers point out that the results should be interpreted with caution. On the one hand, some studies also included people who were already able to walk independently at the start of the study. On the other hand, there were differences between the studies regarding the equipment used, the duration of treatment and the frequency of therapy.

Authors' conclusions

The review concludes that electromechanical-assisted gait training in combination with physiotherapy following stroke may, with moderate certainty of evidence, help to restore independent walking ability. Based on the available data, it is estimated that approximately nine patients need to be treated in order to prevent

Further research is needed to determine how often and for how long these devices should be used.

sustained walking dependency in one patient (Number Needed to Treat = 9).

For future research, the authors recommend large-scale, practice-oriented Phase 3 studies to enable more targeted investigation of questions regarding optimal treatment frequency, therapy duration and the sustainability of the achieved effects. Furthermore, the timing of the intervention following the stroke should be given greater consideration in future studies.

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Jakob Tiebel studied Applied Psychology with a focus on Healthcare Management and has clinical expertise through previous therapeutic work in neurorehabilitation. He researches and publishes on theory-practice transfer in neurorehabilitation and is the owner of Native.Health, a digital health marketing agency.

History and significance of the systematic review

This systematic review is one of the most clinically significant and long-established Cochrane reviews in the field of neurological rehabilitation. As early as 2006, the first protocol on this topic was published by Jan Mehrholz and his team of authors. Since then, the work has been updated several times and systematically developed:

2006: Protocol published (Mehrholz et al.)
2007: first complete review publication
2013: update with expanded data
2017: further update including additional studies
2020: comprehensive reappraisal of the evidence base
2025: latest update featuring a significantly expanded range of studies (101 studies in total, 4,224 participants)

Over nearly two decades, the authors have continuously compiled and evaluated the evidence base for electromechanical assisted gait training after stroke with great scientific rigour, methodological precision and remarkable continuity. Their work has substantially contributed to establishing the status of these rehabilitation procedures on a sound scientific footing, clearly identifying open questions and supporting clinical decision-makers as well as researchers worldwide with robust data.

Particularly in a complex and dynamic research area like post-stroke neurorehabilitation, where technologies, therapeutic approaches and study quality vary significantly, this comprehensive long-term review stands out as an exceptional example of evidence-based synthesis. These results provide an essential foundation for advancing rehabilitation approaches and delivering personalised care to stroke patients facing mobility challenges.

Original work

Mehrholz J, Kugler J, Pohl M, Elsner B. Electromechanical-assisted training for walking after stroke. Cochrane Database of Systematic Reviews 2025, Issue 5. Art. no.: CD006185. DOI: 10.1002/14651858.CD006185.pub6.
https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD006185.pub6/full

Nurturing young talent in medical technology

THERA-Trainer supports the Ulm MedTech Scholarship programme

Leoni Schulz

The medical technology industry faces significant challenges. Innovative products, technical know-how and practical training are crucial to meet the increasing demand for qualified specialists. That's why THERA-Trainer is proud to be a partner in the new Ulm MedTech Scholarship at Ulm University of Applied Sciences (THU) – a funding programme that prepares students in the "Medical Devices – Research and Development" master's programme for successful careers in the industry.

Scholarship with added value: practical experience, career development and future prospects

The Ulm MedTech Scholarship programme combines financial support with valuable insights into everyday professional life. THERA-Trainer is one of five regional companies – alongside Beurer, SpineServ, ulrich medical and Zimmer MedizinSysteme – that supports emerging talent with €300 monthly funding while providing hands-on projects, networking opportunities and the option to complete their master's thesis within the company.

"At THERA-Trainer, introducing young talent to hands-on experience at an early stage is top priority," says Petra Bonin, Head of Human Resources. "This allows us not only to share our experiences and expertise, but also to ensure students are perfectly equipped to meet the demands of the medical technology industry."

Bridging the gap between university and industry

Ulm University of Applied Sciences offers a unique blend of medical expertise and technical implementation through its "Medical Devices – Research and Development" programme. The scholarship transforms theoretical knowledge into

"At THERA-Trainer, introducing young talent to hands-on experience at an early stage is top priority."

More information on the MedTech Scholarship can be found here:

l.ead.me/therapy-25-02-60

With support from THERA-Trainer and other regional medical technology companies, the first six recipients of the Ulm MedTech Scholarship are eagerly embarking on their master's programme in "Medical Devices – Research and Development" at Ulm University of Applied Sciences.

real-world applications through collaborations with companies such as THERA-Trainer.

"The Ulm MedTech Scholarship provides students with both financial backing and real-world exposure to their future career environment from day one," explains Prof. Dr Felix Capanni, programme director who launched this initiative. "The partner companies also benefit from the programme: companies can win over the skilled professionals and future leaders early on."

Our offer: innovation and support for aspiring medical technicians

At THERA-Trainer, we go beyond our scholarship programme partnership by offering students and young professionals multiple pathways to enhance their practical knowledge – from internships and student positions to exciting collaborative research projects. We bridge the gap between university and real-world medical technology.

Anyone interested in a hands-on education with future career prospects will find an excellent opportunity to fulfil their ambitions with the Ulm MedTech Scholarship programme.

"The Ulm MedTech Scholarship provides students with both financial backing and real-world exposure to their future career environment from day one."

Leoni Schulz has been supporting the editorial team of THERAPY magazine since mid-2024. In addition to her responsibilities for layout and typesetting, she also works as an editor. She writes her own contributions and articles for the editorial. Thanks to her many years of experience in rehabilitation and medical technology, she brings cross-industry knowledge and valuable insights to her articles.

Early mobilisation, tech-support and research in the ICU

An interview with Barbara Tempert-de Haan, a clinical physiotherapist at MST Enschede

Lars Timm

Barbara Tempert-de Haan is a clinical physiotherapist specialized in intensive care and has been working in the ICU of the Medisch Spectrum Twente (MST) in Enschede, Netherlands, for more than 15 years. With her strong focus on early mobilisation, neuromuscular electrostimulation (NMES) and respiratory muscle training, she contributes to advancing physical therapy in one of Europe's most modern non-university hospitals. In this interview, she provides insight into her daily work, technological developments, and her ongoing research projects.

Lars Timm: Dear Barbara, thank you very much for taking the time for this interview. Let's begin with a brief introduction: Could you briefly introduce yourself to our readers? What is your profession, where do you work, and how long have you been working there?

Barbara Tempert-de Haan: I am a clinical physical therapist with a specialization in intensive care. I have been working for over 15 years in a regional hospital with both general and thoracic intensive care units. My main interests are early mobilisation of ICU patients, neuromuscular electrostimulation (NMES), and respiratory muscle training.

The ICU is a special and inspiring environment due to the complexity of the patients, the intensive teamwork, and the use of advanced technology. In recent years, I have increasingly been involved in developing physical therapy in the ICU, both in terms of content and technology. By pursuing a master's degree and implementing various technical tools, we strive to continuously improve the care we provide.

Private rooms promote mobilisation right at the bedside.

A photo of Barbara Tempert-de Haan applying NMES at the Covid time.

About Medisch Spectrum Twente (MST) in Enschede, Netherlands

Medisch Spectrum Twente (MST) is one of the largest top-clinical teaching hospitals in the Netherlands, located in Enschede near the German border. With around 3,800 employees and over 1,000 beds, MST provides advanced medical care to the Twente region and beyond. As one of the country's 11 trauma centres, MST also coordinates cross-border emergency care in the Euregio.

The modern main hospital, opened in 2016, was designed as a "Healing Environment" that promotes patient recovery through privacy, space, and comfort. Outpatient services are available in Oldenzaal and Haaksbergen.

MST combines human-centred care with cutting-edge technology and works closely with regional partners and universities such as the University of Twente. As part of the Santeon hospital network, MST is committed to value-based care and continuous improvement through collaboration, innovation, and education.

Lars Timm: MST is considered one of the most modern non-academic hospitals in Europe. With over 1000 beds and more than 3800 employees, do you feel that the architecture and design have an impact on patient recovery?

Barbara Tempert-de Haan: Medisch Spectrum Twente in Enschede has been operating a newly designed hospital since January 2016, created as a "Healing Environment." Elements such as light, spaciousness, colors, and furnishings are designed to support patients and their families. Each patient has their own room and bathroom, which offers a high level of privacy and comfort. This also makes it easier to encourage patient movement and carry out therapy sessions directly in the room.

Lars Timm: What does a typical workday look like in such a modern hospital? And what are the biggest differences compared to your previous workplaces?

Barbara Tempert-de Haan: We start the day by dividing patients among our team, followed by reviewing the files and planning the therapy. ICU work is highly unpredictable, so we coordinate each session closely with the responsible nurse. One of the most noticeable changes over the years has been the increasing complexity of patients and the digitization of processes. More medically complex cases require specialized treatment approaches. Where patients used to be kept sedated, they are now awake when possible, and early mobilisation begins right away. This reduces muscle loss during their hospital stay. We use a variety of tools, including NMES, bed bikes, special chairs, and transfer aids. We follow national guidelines from the KNGF/NVZF, supported by MST's own protocols for consistency across the team.

Lars Timm: Your clinic is located close to the German border. Do you have cross-border patient care programs, and are there any synergies with Germany?

Barbara Tempert-de Haan: As a trauma centre, we admit complex trauma patients from the entire border region, including Germany. This requires not only medical knowledge but also language and intercultural skills, especially among doctors and nurses. Generally, cross-border cooperation works well, although arranging rehabilitation after ICU discharge can be challenging. Additionally, we cooperate with a German trauma helicopter, which is stationed near the border and used in critical cases.

NMES reduces muscle loss in COVID-19 patients.

Lars Timm: How do you perceive the general healthcare situation in the Netherlands, particularly regarding rehabilitation? Do you face similar staffing challenges as in other European countries?

Barbara Tempert-de Haan: While healthcare has improved with more investments in training and technology, there is still a significant shortage of specialized staff, especially in the ICU. Few physiotherapists specifically choose intensive care as a specialty, which unfortunately limits the development of our profession. In general, physical therapists in the Netherlands face low salaries, high workloads, and limited career perspectives — especially in outpatient settings. However, conditions in hospitals are better, with more opportunities for training and development, which currently helps maintain staffing levels in intramural care.

Lars Timm: Would you say that Dutch rehabilitation makes strong use of technology? What are the current challenges in your view?

Barbara Tempert-de Haan: The level of hospital-based physical therapy is reasonably high, but implementing new evidence-based practices remains time-consuming and costly. Convincing decision-makers of the importance of physical therapy can be challenging. Nevertheless, movement is increasingly seen as essential to health, and some Dutch hospitals are becoming "exercise hospitals," where all staff support patients in moving more during their stay. Technological aids like activity monitors, bed bikes, and treadmills play an important role. The biggest challenge, however, will be coping with increasing patient complexity and the growing number of individuals with low health and digital literacy. Therapy and information delivery must be adapted accordingly.

Lars Timm: In addition to your clinical work, you are also involved in research. Could you share some insight into your current and recent projects?

Barbara Tempert-de Haan: Over the past few years, I have been researching NMES in patients with ICU-acquired weakness. During the Covid

Movement is therapy – hospitals are becoming movement-focused facilities.

Barbara Tempert-de Haan: Initiating paramedical research in a non-academic hospital is complex and requires pioneering work. Our hospital board recently decided to support such efforts through a science fund, which provided a €10,000 voucher — a good start, though insufficient for a randomized controlled trial. That's why we partnered with Amsterdam UMC and Erasmus MC for scientific and logistical support. Their expertise has been invaluable, and I've learned a great deal in the process.

pandemic, we conducted a study on the effect of NMES on the quadriceps muscle in ventilated Covid-19 patients. We applied mid-frequency stimulation for 55 minutes a day, five times a week. The results showed significantly less muscle atrophy and confirmed the method's safety. The manuscript is currently under review.

My current research focuses on inspiratory muscle training (IMT) in long-term ventilated ICU patients. We are studying the effects of a 6-week IMT program on post-ICU physical function. While skeletal muscle training is well established, respiratory muscle rehabilitation remains underexplored — despite the diaphragm being significantly weakened during ventilation.

Lars Timm: Can you share any early findings from this IMT study?

Barbara Tempert-de Haan: It's still too early for definitive results, but preliminary observations suggest that patients benefit from focused inspiratory training. More detailed outcomes will follow once data collection and analysis are complete.

Lars Timm: As you are not affiliated with a university hospital, how do you manage to conduct such research projects?

Medisch Spectrum Twente
Top Clinical Hospital

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Lars Timm studied Sports Science with a focus on rehabilitation in Freiburg i.Br. and M.Sc. Sports Engineering at KIT Karlsruhe.

SCIENCE

Combination therapies – harnessing synergies through exercise training

Understanding and implementing multimodal therapy concepts: how coordinated combination therapies with integrated exercise training can sustainably improve rehabilitation and healthcare

Jakob Tiebel

In modern medicine, combination therapies are playing an increasingly important role. They combine different therapeutic modalities in a targeted manner to achieve additive and synergistic effects. Across many medical specialties, exercise training delivers powerful systemic effects that perfectly complement pharmacological, device-based and psychosocial treatment approaches. This article outlines the scientific foundations, advantages and methodological challenges of these concepts. What becomes clear is that combination therapies often represent complex interventions where success hinges on the seamless coordination of all elements.

Introduction: more than the sum of its parts

In modern medicine, integrative treatment approaches are increasingly taking centre stage, as isolated single interventions give way to comprehensive, interdisciplinary treatment approaches. Combination therapy is a key principle in this field. It combines various therapeutic approaches in a targeted manner to achieve additive and synergistic effects that can exceed the efficacy of individual measures. Exercise training in particular plays a significant role in this context, as it acts systemically on numerous pathomechanisms and – also due to technological advances – can now be integrated into virtually all specialist disciplines (cf. Issue X).

What is meant by combination therapy?

Combination therapy does not simply mean applying several therapies alongside one another. While individual interventions target specific pathomechanisms in isolation and parallel prescriptions often proceed without proper coordination, combination therapy delivers a strategically coordinated interaction between different therapeutic measures. With this approach, various therapeutic modalities are coordinated with regard to their timing, mechanisms of action, dosage and objectives, so that they reinforce each other both functionally and biologically.

Exercise training plays a key role in these concepts, as it works both systemically and specifically: it influences muscle power, cardiovascular performance, neuroplastic processes, immune functions, psychological stability, as well as numerous cellular and molecular regulatory systems.

Combination therapies are complex interventions

Combination therapies are in many cases complex interventions in the strict scientific sense. According to the UK Medical Research Council (MRC) frameworks, complex interventions are characterised by several interacting components. These include not only the therapeutic procedures themselves, but also contextual factors such as the professional groups involved, organisational

processes, patient participation, adherence and setting conditions. The effectiveness of these interventions comes not simply from their individual components, but critically from how these components interact (Craig et al., 2008; Skivington et al., 2021).

Complex interventions present unique methodological challenges when it comes to their development, evaluation and implementation. Traditional randomised controlled trials (RCTs) are often insufficient to fully capture the complex causal relationships. In addition, Process Evaluations, Realist Evaluations, Cluster-RCTs and Mixed-Methods approaches are increasingly being employed to systematically examine both effectiveness and mechanisms of action, context dependencies and implementation factors (Hawe et al., 2004; Peters et al., 2013). Exercise as a component of such complex combination therapies cannot therefore be considered in isolation, but must always be embedded within the overall therapeutic process and tailored to the context and patient needs.

Application of complex combination therapies in practice

Intradialytic training: exercise during haemodialysis

CKD patients undergoing haemodialysis frequently suffer from cardiovascular deconditioning, sarcopenia and fatigue. Intradialytic training (IDT) utilises dialysis time for therapeutic exercise sessions at the dialysis station, frequently using cycle ergometers or motor-assisted movement exercisers, such as the THERA-Trainer bemo.

Meta-analyses show significant improvements in maximal oxygen uptake, reduction of inflammatory markers (e.g. CRP, TNF-α), vascular elasticity as well as quality of life (Zhang et al., 2019; Heiwe & Jacobson, 2011). IDT is a complex intervention, requiring both medical-technical implementation and interprofessional coordination between nephrologists, nursing staff and physiotherapy. At the same time, the therapy must be adapted to the individual health condition of the patient.

An outstanding example of Dialysis Training Therapy (DiaTT) is documented in the study of the same name, DiaTT (cf. Issue X). A large-scale, multicentre, cluster-randomised randomised trial on the effect of exercise during dialysis.

Orthopaedics: bone healing with shockwave therapy and training

In pseudarthrosis, the effectiveness of combined Extracorporeal Shockwave Therapy (ESWT) with functional movement training is particularly evident. Whilst ESWT stimulates angiogenic and osteogenic healing processes (e.g. VEGF, BMP-2), mechanical loading activates bone-adapting signalling pathways via mechanotransduction. Studies show higher healing rates and shorter consolidation times with a combined approach (Schaden et al., 2015; Wang et al., 2020).

This too is a complex intervention, as the treatment must be dosed individually for each patient, continuously adjusted throughout the healing process, and coordinated in an interdisciplinary manner. (See also Article X in this issue)

Neurological rehabilitation: electrostimulation combined with exercise

In neurorehabilitation – for example following stroke – functional electrical stimulation (FES) and active movement training are mutually beneficial. Electrostimulation activates peripheral nerves and muscles, while exercise promotes neuroplastic reorganisation. Numerous studies demonstrate improved mobility, muscle power and functional independence with combined application (Howlett et al., 2015; de Sousa et al., 2016).

Since neurological deficits, motivation and cognitive resources vary greatly, adaptive therapy plans are essential, which further increase the complexity of the intervention.

Cardiology: exercise as an integrative component of heart failure therapy

The treatment of heart failure also follows a clear multimodal principle today. Medications such as ACE inhibitors, beta-blockers and SGLT2 inhibitors improve cardiac functions, whilst movement training optimises peripheral perfusion, muscle metabolism and exercise tolerance (McDonagh et al., 2021; Taylor et al., 2019). Exercise is firmly established as part of standard therapy in the current ESC guidelines.

The interdisciplinary coordination of medication dosages, training intensity, monitoring and patient education clearly illustrates the complex nature of this intervention.

Oncological rehabilitation:
exercise complements systemic tumour therapies
Exercise reduces therapy-related side effects such as fatigue, polyneuropathies and depressive symptoms, but may also directly influence tumour progression through immunological and inflammatory effects (Campbell et al., 2019; Koelwyn et al., 2017). Many oncological guidelines therefore recommend the structured integration of exercise training during active tumour treatment.

Here, too, the challenge lies in dynamically tailoring exercise to treatment phases, side effects and each patient's individual resources – a classic example of a complex therapeutic intervention.

Intensive care:
early mobilisation under ventilation
In intensive care medicine, early mobilisation of ventilated patients has proven to be an effective strategy for reducing immobilisation complications such as ICU-acquired weakness, delirium and prolonged ventilation times (Schweickert et al., 2009). The implementation of such programmes requires interdisciplinary coordination among intensive care specialists, physiotherapists, nursing staff, occupational therapists and family members – demonstrating, once again, the complex interplay of multiple components.

Conclusion: understanding complexity, harnessing synergies

Combination therapies are not merely a sequence of individual measures, but highly complex interventions in which therapeutic elements, patient factors and contextual conditions interact dynamically. In particular, exercise therapy plays a key role in these multimodal concepts – as a systemic, functional and psychological efficacy enhancer with proven additional benefit.

The development and successful implementation of such complex therapy concepts requires precise planning, interdisciplinary collaboration, high therapy adherence, patient-centred individualisation and continuous monitoring.

Innovative care centres are increasingly integrating these principles into their core structure, creating healing environments – spaces thoughtfully designed both architecturally and organisationally to enhance healing processes and seamlessly integrate complex interventions into everyday clinical practice.

A key component in this approach is the use of cutting-edge medical technology: Technological assistance systems and smart movement exercisers are increasingly being used to support individual therapy goals safely, in measured doses and in an appropriate context – from acute care settings and early rehabilitation to aftercare. These solutions deliver precise control, progress tracking and adaptation within the overall framework, creating new opportunities for the practical delivery of evidence-based combination therapies.

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Shifting the boundaries

How active movement with the THERA-Trainer extends body awareness – new insights into the dynamics of our peripersonal space

Jakob Tiebel

How close does something need to get before we react? This deceptively simple question relates to a highly complex area of human perception – our peripersonal space (PPS). This space immediately surrounding our body plays a vital role in how we interact with the world – and, as a new study reveals, it can be specifically shaped through movement. What's particularly exciting is that the researchers used the THERA-Trainer mobi as a rehabilitation training device to investigate this phenomenon.

The study: cycling in virtual reality

A Japanese research team led by Naoki Kuroda used the THERA-Trainer mobi in combination with virtual reality. The participants sat on the therapy device, wore VR goggles and experienced a computer-generated forward movement in a virtual tunnel Meanwhile, their reaction to tactile stimuli on the upper body was measured.

Three conditions were tested:
Active pedalling: the participants pedalled themselves.
Passive pedalling: the THERA-Trainer moved the legs.
No movement: the participants sat still.

The results: movement expands our perceptual space

The reaction times showed clearly that when people are actively moving, the boundaries of their peripersonal space expand. The visual approach of an object enhanced the perception of a tactile stimulus more strongly during active pedalling than in the control conditions. Even passive movement showed a certain effect – albeit less pronounced.

These results show that one's own movement – and possibly the associated feeling of control (sense of agency) – influences our perception of our own body in space. The body seems to dynamically expand the space around it when moving actively through it.

What does this mean for use of the THERA-Trainer?

These findings confirm what is frequently observed in neurological rehabilitation. Active mobilisation – even when seated and with support – can have profound effects on body awareness and thus on orientation and safety in space. The THERA-Trainer mobi is a valuable tool in this study for providing targeted movement stimuli that go beyond purely muscular effects.

The THERA-Trainer not only promotes mobility, but also activates core processes of spatial and self-perception.

Practical advantages:

Promoting body awareness: Particularly in patients with neurological impairments, the targeted use of the THERA-Trainer can help to improve spatial awareness and reaction capability.

Motivation through active engagement: The study shows that even minimal active movements (e.g. with low pedal resistance) can have positive effects – an important argument for their use in early rehabilitation phases.

Integration into virtual therapy approaches: In combination with VR, an innovative field of multisensory-based therapy emerges.

Conclusion

More than just a training device for arms and legs, the THERA-Trainer mobi is an effective tool for improving body awareness and sensorimotor integration. Current research suggests that active movement – even when seated and with support – has a positive effect on core perceptual processes. The study reinforces the value of such devices in modern rehabilitation – and illustrates how targeted movement can sharpen the connection between body and surroundings.

Original work

Kuroda, N., Teramoto, W. Motor information contributes to visuotactile interaction in trunk-centered peripersonal space during a pedaling situation. Exp Brain Res 243, 25 (2025). https://doi.org/10.1007/s00221-024-06975-9

https://doi.org/10.1007/s00221-024-06975-9

l.ead.me/therapy-25-02-70

TECHNOLOGY & DEVELOPMENT

Measuring muscle mechanics

How a movement exerciser helps us to better understand muscle behaviour

Jakob Tiebel

What happens to our muscles when they move – without us consciously contracting them? A new study shows how passive training can help to objectively capture muscular changes. In neurological rehabilitation – such as after a stroke or with multiple sclerosis – muscle tone often changes. Spasticity, increased muscle stiffness or passive movement restrictions may be the outcome. But how can these changes be reliably tracked? And how can we tell if a therapy – such as physical treatments or passive movement training – is working effectively?

Differentiated assessment of muscle behaviour in spasticity, immobility or increased tone

A research team at Kawasaki University of Medical Welfare tested an innovative and promising approach: passive leg movement with the THERA-Trainer mobi 540, combined with special sensor technology to detect muscle movement – a technique known as Displacement Mechanomyography (DMMG).

What was investigated?

In the study, healthy adults were passively moved on the THERA-Trainer movement exerciser – the device powered the pedals with its motor while the participants passively followed the cyclical movement. Sensors measured the slightest deformations of the thigh muscles. These arise solely through external movement – similar to a patient with severe paralysis or spasticity.

Particularly interesting was the time delay between the actual joint movement (pedal rotation) and the muscle reaction (visible in the DMMG signals). This phase behaviour can indicate the tissue properties of muscles – such as increased muscle stiffness, which may be caused by spasticity, immobility or inflammatory processes.

What did the study reveal?

During faster passive movement, the phase behaviour of the musculature changed markedly. The muscle reacted to the movement with a delay – a possible sign of increased intramuscular inertia.

If the muscle was treated with heat before training, the delay was reduced. This suggests that thermal applications reduce passive resistance in the muscle – allowing for a short-term decrease in tone or improved extensibility.

The magnitude of the muscle movement itself remained constant. The "quality" of the reaction, i.e. its timing, provided more revealing insights than the extent of the movement.

Why is this relevant for clinical practice?

In neurological rehabilitation, it is often difficult to distinguish between active spasticity, structural tissue changes and adaptively increased muscle tone. This study shows that valuable information can be obtained through passive training with the THERA-Trainer and accompanying measurement of phase behaviour:

- Objective assessment of passive muscle resistance
- Differentiation between tonic reactions and structural shortenings
- Progress assessment following heat application or passive training

Of particular interest is the fact that since measurements are taken during passive movement, this method is effective even for individuals who cannot actively participate – offering a distinct advantage particularly for early rehabilitation applications or when working with severely affected patients.

Conclusion

The THERA-Trainer was not used as a training device in the traditional sense in this study, but rather as a measuring instrument for muscular reactions. In combination with DMMG sensors, this creates a new pathway to understand and precisely target adaptive muscle behaviour, spasticity and passive resistance with greater precision – using simple technology that integrates seamlessly into daily clinical practice.

Original work

Fukuhara, S., Oka, H. Displacement MMG-based estimation of dynamic muscle viscoelasticity in the quadriceps during passive pedaling. Sci Rep 15, 3538 (2025).
https://doi.org/10.1038/s41598-025-87842-7

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Issue No. 02/2025 | 17th Edition | Volume 9

Publisher & media owner: THERA-Trainer by medica Medizintechnik GmbH | Blumenweg 8 | 88454 Hochdorf

Photo credits: Adobe Stock, MST Enschede, PAM Georgetown, Waldburg-Zeil Klinik Bad Wurzach, HSH Lamprecht GbR, Silver Gym, THU

Sales: The magazine is published twice a year and is free