02 | 2024 VOLUME 8

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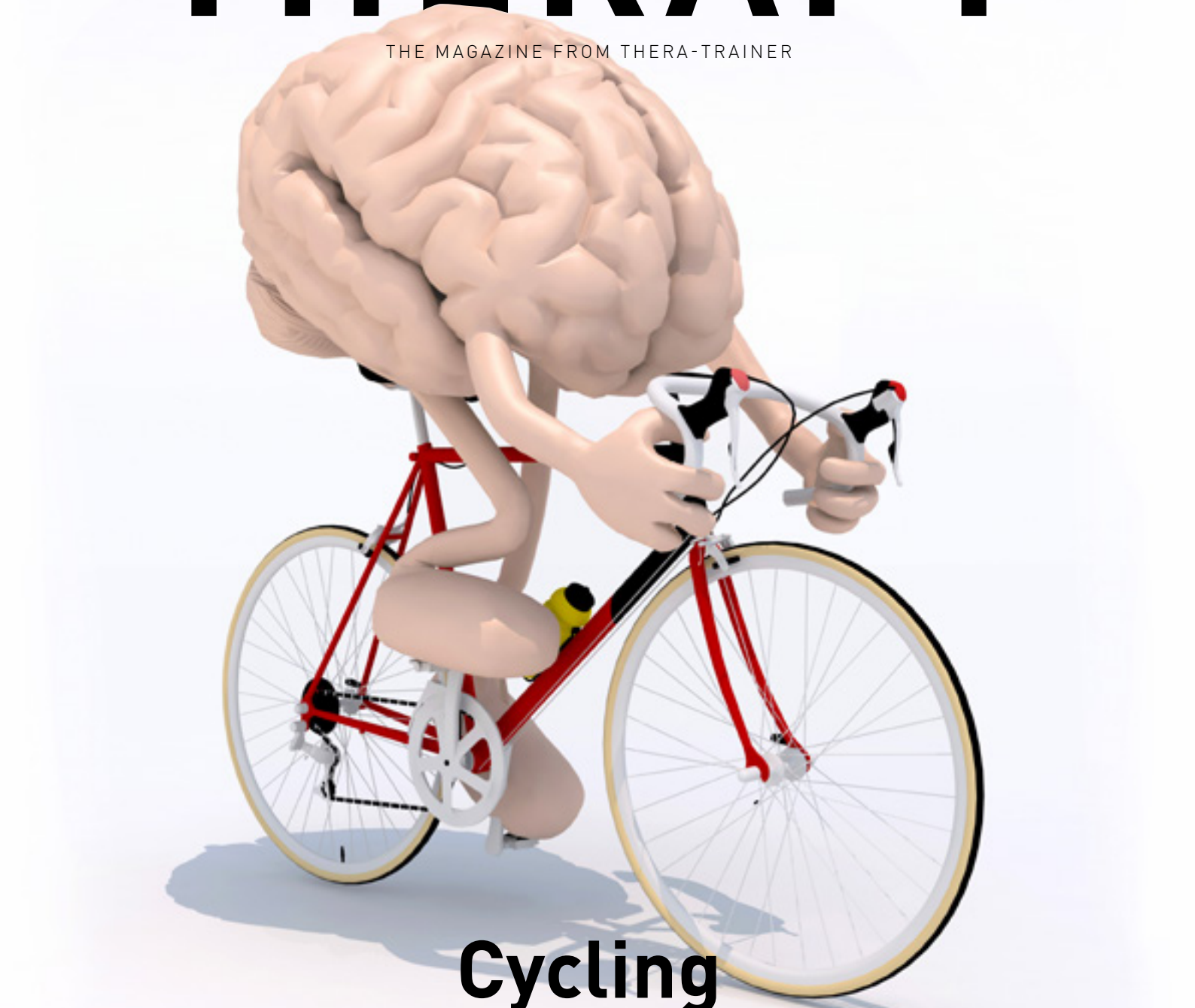

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LIFE IN MOTION

Life is like riding a bicycle. To keep your balance, you must keep moving.

FOREWORD

Keep moving

Dear readers,

It was Albert Einstein who said: "Life is like riding a bicycle. To keep your balance, you must keep moving." This proverb fits perfectly with the focus of this issue: cycling in rehabilitation. Assisted cycling with cyclical movement exercisers in particular offers patients valuable support in regaining their mobility – both in the upper and lower extremities.

The gentle, even movements help to mobilise muscles and joints without putting excessive strain on them. This not only promotes muscle growth, but also helps to improve cardiovascular health. The continuous movement stimulates circulation and strengthens the heart.

But the benefits go beyond the physical. Cycling, especially in combination with cyclical movement exercisers, has been shown to have positive effects on neuroplasticity. The brain can restructure itself through the repeated movement sequences and reactivate connections that have been weakened by an illness or injury.

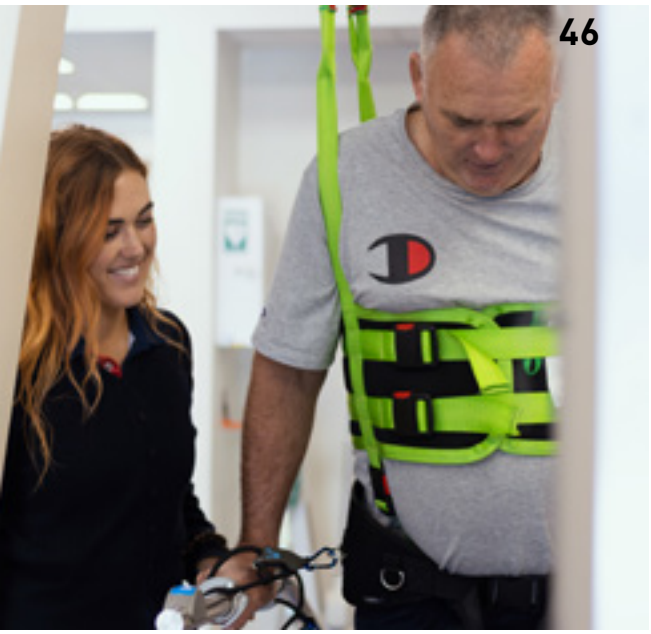
Virtual cycling is also increasingly being used, particularly in the field of geriatrics. Older people can exercise safely in a virtual environment that is easy on the joints, which not only promotes their physical fitness but also boosts their mental activity.

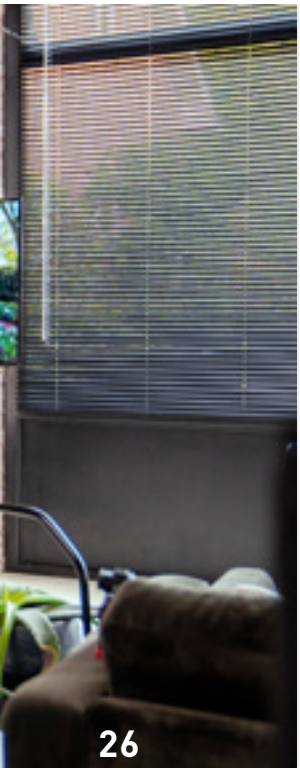
We hope you enjoy reading this issue and that you gain valuable inspiration for your therapeutic work!

With best regards,

Jakob Tiebel

Neuro Alliance





Virtual cycling inspiration

Cover story

Science

Therapy & practice

Technology & development

Sections

EDITORIAL

Results of the 2023 reader survey

What our readers think about THERAPY magazine: insights into wishes and expectations

Leoni Schulz

We are delighted to be able to share the results of our latest reader survey with you. The survey gave us valuable insights into the preferences, interests and expectations of our readers. We would like to take this opportunity to thank the participants who took the time to share their opinions with us.

The most popular sections and topics

The results show that the "Therapy & practice" section is particularly popular. Almost 95% of readers stated that they were most interested in this subject area. Articles that combine theoretical concepts with

practical applications and comprehensively cover new technological developments and their impact on the therapeutic field are particularly in demand.

The "Case studies and success stories" and "Technology & development" sections are also very popular, with around 60% of readers appreciating them.

Satisfaction and suggestions for improvement

Satisfaction with THERAPY magazine is pleasingly high. Around 80% of those surveyed stated that they read each new issue with great interest. The high quality of the articles and the variety of topics were particularly appreciated. All participants also rated the length of the articles as appropriate. Many readers praise the selected content and focus of the magazine as "an all-round success". The positive response from our readership clearly reflects this high level of satisfaction.

The high quality of the articles and the variety of topics were particularly appreciated.

The difficulty already mentioned by individual readers that some articles in the German edition are printed in English is also reflected in the results of the reader survey. We already reported on the associated editorial challenges in issue 03|2023. As THERAPY is an international magazine, it will not always be possible for us to fully retranslate all articles in the future. We ask for your understanding for these circumstances and are constantly working to ensure the best possible quality and comprehensibility for our readers.

Conclusion and outlook

The results of the reader survey are invaluable to us. They help us to customise our magazine to your needs. We will use the evaluation to continue to offer you a high-quality and varied magazine in the future.

Thank you once again for your participation and your trust. We look forward to shaping the future of THERAPY magazine together with you.

Leoni Schulz has been supporting the editorial team of THERAPY magazine since mid-2024. In addition to her responsibilities with 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.

Cycling combined with electrical stimulation at acupuncture points

An effectiveness analysis of the application of cyclical movement training in combination with electrical stimulation at acupuncture points compared to the exclusive application of electroacupuncture in post-stroke hemiplegia.

Jakob Tiebel

Electroacupuncture combined with cyclical movement training could improve the rehabilitation of stroke patients, but the evidence is not yet conclusive. While initial studies show positive effects on muscle power and motor functions, the effectiveness of the combination therapy remains controversial. A recent study from Vietnam suggests that the integration of these methods could bring benefits, but further research is needed to confirm the actual effectiveness and long-term effects.

Electroacupuncture, i.e. the electrical stimulation of acupuncture points, can be used in the treatment of stroke patients to improve motor performance after a stroke. Although the efficacy is not fully understood, there is evidence from animal models and clinical studies that show positive effects.

A systematic review from 2018, which included 19 studies with a total of 1434 participants, reported a superior effectiveness of electroacupuncture when used in combination with conventional therapy with regard to the restoration of motor functions after a stroke [1].

Numerous studies also emphasise that recovery after a stroke can be improved by cyclical movement training, as it has positive effects on motor performance and neuronal networking (see p. 18 “Cycling improves walking performance after stroke” in this issue) [2,3].

In order to achieve the most effective recovery of motor functions after a stroke, electrical stimulation can be applied to acupuncture points in conjunction with rehabilitation measures. Such combination therapies have already been shown to be effective

The authors conclude that the combination of electrical stimulation at acupuncture points with cyclical movement training has a positive influence on the motor recovery of stroke patients.

in improving muscular sensitivity, function and movement coordination [4,5,6].

In this context, a research group from the Department of Senior Specialist National Hospital for Traditional Medicine and Acupuncture in Vietnam recently investigated the effects of cyclical movement training in combination with electroacupuncture compared with the exclusive use of electroacupuncture in patients with hemiplegia following a stroke. The researchers conducted a randomised control study for this purpose.

Methods

The outcome-assessor-blinded randomised controlled study was designed and conducted in the clinics of the Vietnamese institute. A total of 120 patients with post-stroke hemiplegia were randomly divided into two groups: electrical stimulation of acupuncture points in combination with cyclical movement training (IG) and electrical stimulation of acupuncture points alone (CG). Patients were assessed before and after treatment using muscle contraction, modified Rankin score, Barthel index, Orgogozo score and electromyography. Non-parametric statistical evaluation methods were used to analyse the differences between the groups.

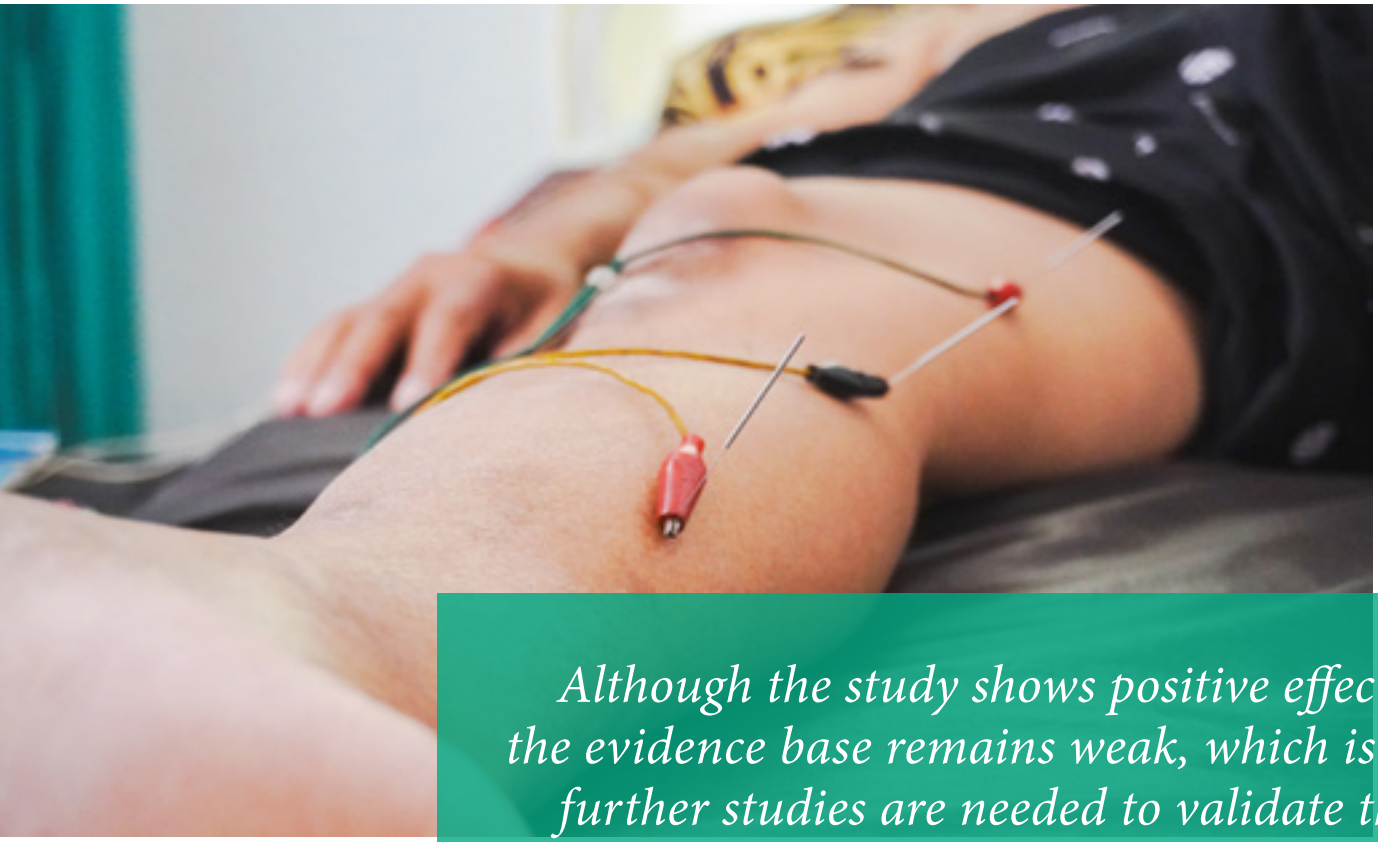
Intervention

In addition to the usual rehabilitation programme, the participants in the IG received 30 minutes of cyclical leg movement training every day, five days a week. The training protocol comprised two training modes, which were carried out and recorded by a qualified physiotherapist.

1) Passive training: for patients with muscle power 0, 1 or 2, at a speed of 20 revolutions per minute (rpm).
2) Active training with/without resistance: for patients with muscle power 3 – 5, at a speed of 60 rpm, focussing on the best performance of the load symmetry of the lower extremities.

Results

The results showed a statistically significant improvement in motor function in both groups. Patients in the IG achieved better results compared to those in the CG. These included improved muscle contraction (increased frequency and amplitude of electromyography and improved strength values), improved recovery (measured by the Orgogozo score), increased independence (measured by the Barthel index) and reduced disability (measured by the modified Rankin score).



Although the study shows positive effects, the evidence base remains weak, which is why further studies are needed to validate the long-term effects and the specific effect of the combination therapy.

Combination therapy vs combination of individual therapies

The use of combination therapy, where two or more therapeutic approaches are employed synchronously, may produce different effects than the sum of the effects of the individual therapeutic approaches when applied separately. It is crucial to understand that the effects of a combination therapy cannot simply be explained by adding the effects of the individual therapies. Rather, the interactions between the therapy components can produce new, often intensified effects that are not achieved by the separate application of the individual therapies.

Combined individual therapies generally offer efficiency advantages, as they allow several interventions to be carried out simultaneously. However, this type of therapy cannot replicate the specific, potentially synergistic effects of a true combination therapy. A combination therapy can constitute a new form of therapy where the effectiveness is determined by more than just the sum of the individual therapies. The combined interventions can reinforce each other and lead to an improved overall effect.

It is therefore important to clarify in research whether the observed effects of a combination therapy actually go beyond the mere aggregation of the individual therapy effects or whether they are attributable to specific synergetic effects of the combined interventions. This distinction is crucial for understanding and evaluating the efficacy of combination therapies in clinical practice.

Specific scientific methods are required to investigate whether a combination therapy actually goes beyond the effects of individual therapies. This includes conducting randomised controlled trials (RCTs) in which the combination therapy is compared directly with the individual therapies. Such trials should include appropriate control groups to assess the isolated effects of each individual therapy as well as the combined intervention. In addition, mechanism studies and exploratory analyses can be used to understand the biological and physiological interactions between the therapy components. Detailed statistical analyses and interaction models can be used to determine whether the combined effects significantly exceed the sum of the individual therapy effects. Long-term studies to evaluate the sustainability and long-term effects of combination therapy are also important to enable a well-founded assessment of the actual efficacy and possible synergies.

Conclusions

The authors conclude that the combination of electrostimulation at acupuncture points with cyclical movement training has a positive influence on the recovery of stroke patients. The results indicate that the integration of cyclical movement training in the treatment of patients with post-stroke hemiplegia in combination with electroacupuncture is a promising method for improving motor function.

Commentary on the study

In the present study, a statistically significant improvement in certain motor functions was observed in patients with hemiplegia after an ischaemic stroke. Positive effects were seen both in the group that received electroacupuncture alone and in the group that additionally performed 30 minutes of cyclical movement training with moderate exertion.

The effects were stronger in the patients in the intervention group, which is consistent with previous studies. However, the evidence base remains weak. The present study has some limitations. These included an insufficient sample size, a relatively limited intervention duration, possible distortions due to the open study design and weaknesses in the statistical analysis. The authors also recognise this in their publication. Further studies are therefore needed to validate the efficacy and long-term effects of the therapy. In particular, the extent to which the combination of cyclical movement training and electrostimulation at acupuncture points increases the effects must be critically examined. This is because it cannot be ruled out that the effects of the individual therapies merely add up. In the past, both electroacupuncture and cyclical movement training have independently shown positive effects on the endpoints studied.

SOURCES:

Electroacupuncture as an adjunctive therapy for motor dysfunction in acute stroke survivors: a systematic review and Meta-analyses. BMJ Open 2018; 8: e017153.

Klarner T, Barss TS, Sun Y, Kaupp C, Zehr EP. Preservation of common rhythmic locomotor control despite weakened supraspinal regulation after stroke. Front Integr Neurosci 2014; 8: 95.

Tanuma A, Fujiwara T, Yamaguchi T, et al. After-effects of pedaling exercise on spinal excitability and spinal reciprocal inhibition in patients with chronic stroke. Int J Neurosci 2017; 127: 73-9.

Wei NN, Pan JX, Chen YP, Chen Y. Effects of balance acupuncture combined with motor relearning for lower limb motor function of stroke patients with hemiplegia. Zhen Ci Yan Jiu 2018; 43:730-2.

Chen L, Fang J, Ma R, et al. Additional effects of acupuncture on early comprehensive rehabilitation in patients with mild to moderate acute ischemic stroke: a multicenter randomized controlled trial. BMC Complement Altern Med 2016; 16: 226.

Zhao DG, Mu JP. Clinical study on scalp acupuncture combined with sports therapy for rehabilitation of poststroke hemiplegia. Zhong Guo Zhen Jiu 2005; 25: 19-20.

Original work
l.ead.me/therapy-24-02-08

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.

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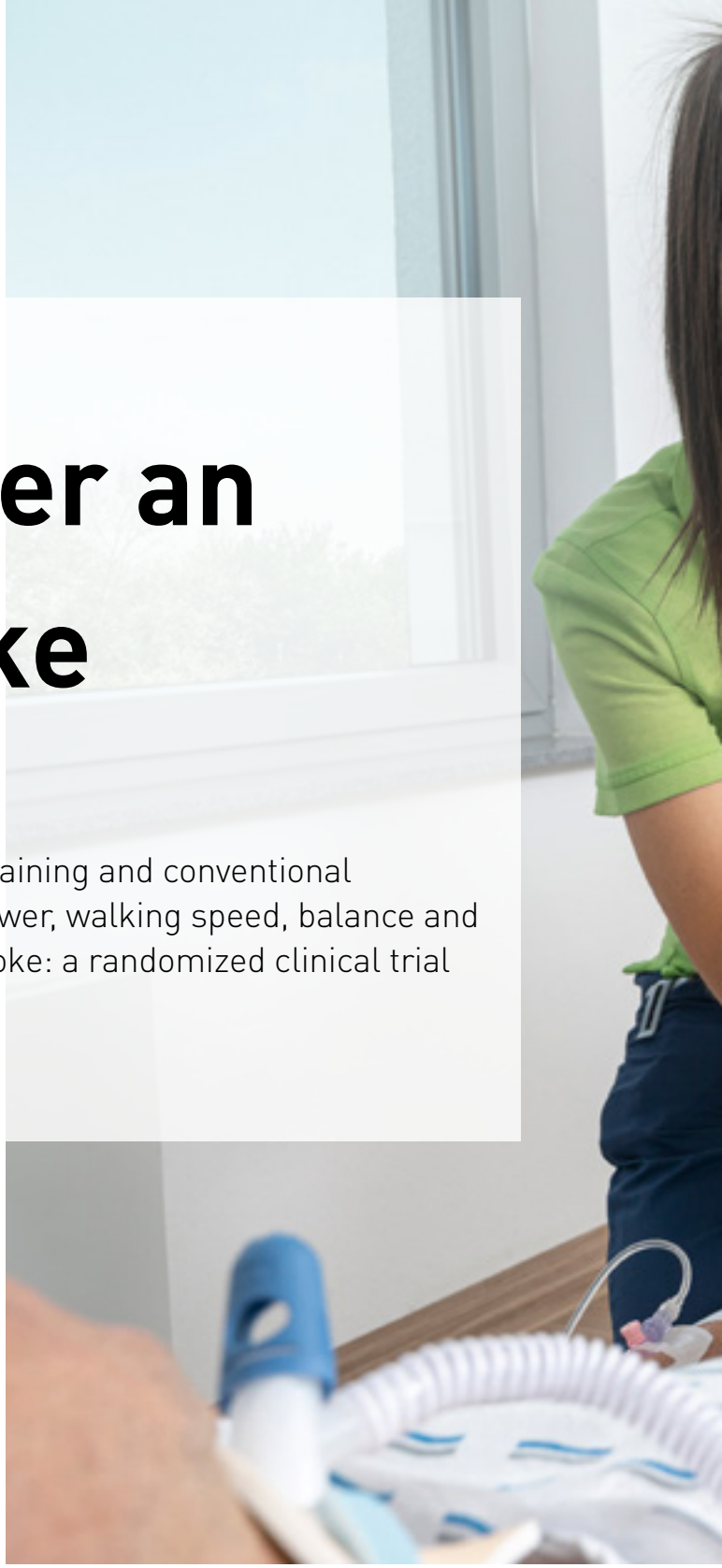
SCIENCE

Cycling after an acute stroke

Comparison of cyclical movement training and conventional physiotherapy to improve muscle power, walking speed, balance and mobility in the acute phase after stroke: a randomized clinical trial

Jakob Tiebel



In a randomised clinical trial, 20 stroke patients in the acute phase after the event were divided into a control group (CG) and an intervention group (IG). In addition to conventional physiotherapy, the IG carried out daily sessions with a movement exerciser. The results showed significant improvements in muscle power, walking speed and balance in the IG. These findings underline the effectiveness of the movement exerciser in early mobilisation after a stroke.

Background

Rehabilitation after a stroke plays a crucial role in restoring muscle and movement functions and can significantly reduce the rate of disability. Studies show that the optimal recovery phase is within the first six months after a stroke, whereby early rehabilitation can potentiate the neuroplastic effects. Various interventions, such as highly repetitive robot-assisted therapies, self-management programmes and aerobic exercise, have been shown to be effective in the subacute and chronic phases. In the acute phase in hospital, early mobilisation is of central importance, which includes early sitting up, standing and gait training.

A promising method for supporting early mobilisation is semi-recumbent or seated aerobic training with a movement exerciser. The therapy devices enable

The study shows that aerobic movement training in the acute phase can bring about significant improvements in muscle power, walking speed and balance.

both passive and active movements with or without resistance. Their use in the subacute and chronic phase shows positive effects on muscle power, functional and motor recovery, walking ability, balance, mobility, cardiovascular fitness and cognitive functions. However, studies investigating the effects of this intervention in the acute phase after a stroke have so far been lacking.

A fairly recent study from 2021 aimed to examine the effects of aerobic cycling training on lower limb muscle power, walking speed, balance, mobility and functionality of stroke patients in the acute hospital phase.

The intervention group achieved better results in terms of walking speed and balance than the control group.

Methodology

The randomised clinical trial was approved by the Ethics Committee of the Irmandade Santa Casa de Misericórdia de Porto Alegre Hospital and registered in the Brazilian Clinical Trials Registry. The 20 test subjects were randomised into a control group (CG) and an intervention group (IG). The CG completed two daily sessions of conventional physiotherapy, while the IG completed one daily session of conventional physiotherapy plus one daily session with the bicycle ergometer. Both groups carried out the interventions over five days. Randomisation was carried out in a 1:1 ratio using sealed and consecutively numbered envelopes.

Inclusion criteria were participants who had suffered their first stroke, were older than 40 years, had hemiparesis or hemiplegia due to an ischaemic infarction in the middle cerebral artery territory and were able to respond adequately to instructions. Exclusion criteria were haemodynamic instability, a Glasgow score ≤ 8, bilateral or brainstem lesions, pathological changes in the electrocardiogram that could invalidate the performance of the protocol, clinical signs of a new stroke, and previous cognitive and musculoskeletal dysfunction such as poor communication or joint injuries that could impair mobility.

Original work
l.ead.me/therapy-24-02-14

Results

No reports of instability or discomfort during use of the protocol were found in the evaluations. In the analysis of muscle power of the lower limbs, the primary endpoint of the trial, there was a significant improvement between the pre- and post-test in the IG. The intra-group analysis showed a significant improvement only in the IG, in all muscle groups assessed, both on the paretic and non-paretic side. This was also shown in the effect size analysis.

In the 10-metre walk test (10MWT) and in the Berg Balance Scale (BBS), there was only an intra-group difference in the IG, as well as an inter-group difference with better results for the IG. With regard to the ICU Mobility Scale and the Perme Score, there was an intra-group difference in both evaluated groups with an improvement. The inter-group analysis also showed that the IG achieved better results than the CG.

Discussion

The results show that patients achieved an average walking speed of 0.65 m/s through movement training, which represents a significant clinical improvement. Healthy older people have a walking speed of at least 0.8 m/s, and early rehabilitation with the movement exerciser was able to achieve values close to this and thus higher than expected in stroke patients.

With regard to balance, previous studies have so far shown heterogeneous results, whereas the results of this study show a significant improvement in the Berg Balance Scale, particularly in the intervention group. This also indicates that movement training in the acute rehabilitation phase can improve the outcome compared to conventional physiotherapy.

Outlook

Due to the acute hospital setting, complete blinding could not be guaranteed in the trial. In addition, the trial only included patients with ischaemic stroke, so the results cannot be transferred to patients with haemorrhagic stroke. In addition, a small sample was used. Future research should include both ischaemic and haemorrhagic stroke patients and be conducted as a multicentre trial with a larger sample size to increase its validity.

SOURCES:
da Rosa Pinheiro DR, Cabeleira MEP, da Campo LA, Corrêa PS, Blauth AHEG, Cechetti F. Effects of aerobic cycling training on mobility and functionality of acute stroke subjects: A randomized clinical trial. NeuroRehabilitation. 2021;48(1):39-47. doi: 10.3233/NRE-201585. PMID: 33386826.

Aerobic training performed in a semi-recumbent or seated position with a movement exerciser effectively supports early mobilisation.

Jakob Tiebel studied Applied Psychology with a focus on Health-care 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.

SCIENCE

Cycling improves walking performance after a stroke

A recent review confirms the positive effects of stationary cyclical movement training on walking ability in stroke patients

Jakob Tiebel

Stationary cyclical movement training has been shown to be a safe and effective method of improving the cardiovascular health of stroke patients. Although it is not primarily used to restore the ability to walk, numerous studies have reported positive effects on walking parameters. In a recent review from 2023, Medeeha Khan and colleagues from the Cleveland Clinic investigated the effects of stationary cycling on walking ability in adults after stroke, finding significant improvements in walking speed and walking ability.

Stationary cyclical movement training is a safe and practicable method for implementing aerobic training to improve cardiovascular health in stroke patients. Although cyclical movement training is not typically used as a task-specific exercise approach to restore walking ability, numerous studies have reported improvements in walking parameters as a result of this type of training.

Objective

In a recent literature review from 2023, Medeeha Khan and colleagues from the Department of Physical Medicine and Rehabilitation at the Cleveland Clinic in the USA investigated the effects of stationary cycling on walking ability in adults after a stroke.

Methods

As part of a systematic literature search, the researchers searched relevant databases and registers for studies on the use of movement training in stroke patients. Where gait parameter results were reported in the studies, these were extracted to determine the relationship between the training protocol parameters and changes in gait parameters using calculated correlation coefficients.

The current review from 2023 confirms that stationary cycling achieves significant improvements in walking performance in stroke patients.

Particularly in the early phase of rehabilitation and to increase the therapy dose, structured movement training should be an integral part of every rehabilitation routine.

Results

A total of 11 articles were included in the analyses. Eight studies representing nine movement training intervention groups reported changes in walking ability, as measured by the six-minute walk test, with improvements ranging from 6.1 to 63.0 metres. Seven studies measured walking speed and reported improvements in the range of 0.01 to 0.21 m/s. Protocols that achieved the greatest improvements in walking ability prescribed aerobic exercise of moderate to high intensity. Significant positive correlations were measured between the change in walking speed and the number of training sessions as well as the total number of training minutes prescribed.

Conclusion

The researchers report that there is considerable heterogeneity in the study protocols in terms of intensity, frequency, training duration and protocol duration. However, none of the studies reported any deterioration in walking ability, and improvements were demonstrated even without the use of specific gait training. Exercise interventions that included moderate to intense aerobic exercise and 24 or more sessions showed the greatest effects in improving walking ability and walking speed.

l.ead.me/therapy-24-02-18

SOURCES:

Khan M, Maag LM, Harnegie MP, Linder SM. The effects of cycling on walking outcomes in adults with stroke: a systematic review. Top Stroke Rehabil. 2024 Apr;31(3):259-271. doi: 10.1080/10749357.2023.2259167. Epub 2023 Sep 21. PMID: 37732513.

Taking into account the current evidence on gait therapy, the results confirm that cyclical movement training is strongly recommended as a complementary therapy.

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.

Comments

This review supports the results of previous studies and shows that stationary cyclical movement training can significantly improve walking ability and walking speed in stroke patients. By repeatedly practising cyclical movements, specific muscle groups are trained and neuromuscular connections that are essential for walking are strengthened.

Previous studies have also shown that cyclical movement training can lead to activation of the central pattern generators (CPG) at spinal cord level. The researchers' correlation analyses confirm that both the duration and the intensity of the training are decisive for the success of the treatment. In particular, studies that included moderate to intensive aerobic training with more than 24 sessions achieved the best results. Despite the heterogeneity of the protocols studied, no deterioration occurred even during intensive training, which emphasises the effectiveness and safety of cycling in stroke rehabilitation. Structured, progressive cyclical movement training cannot and should not replace intensive, task-specific gait training in stroke rehabilitation, although transfer effects have been demonstrated even without specific gait training.

Taking into account the current evidence on gait therapy, the results confirm that cyclical movement training is strongly recommended as a complementary therapy. Particularly in the early phase of rehabilitation and to increase the therapy dose, structured movement training should be an integral part of every rehabilitation routine.

Senior cyclists take the stage: The Road Worlds for Seniors begins

A global cycling championship celebrating seniors' strength, unity, and spirit.

Jan Inge Ebbesvik

Road Worlds for Seniors is the only global indoor championship for seniors and people with dementia. Every year, thousands of cyclists from nursing homes, day care centers and senior centers participate. Motiview's video library is the solution behind the Road Worlds for Seniors championship. With over 2,200 videos, participants can cycle to local videos and reminisce as they pedal, or explore the world with international videos.

With the Olympic Games now behind us, the spotlight shifts to a different set of champions – the senior cyclists competing in the Road Worlds for Seniors.

With 254 teams and 6,986 cyclists from 10 countries, the 2023 Road Worlds for Seniors set a new record as the largest edition to date. The participants collectively covered an astonishing 229,930 kilometres, which is equivalent to more than five laps around the Earth! Leading the charge was Bruyere Village from Canada, followed closely by Dypedalsåsen from Norway and Harbison Moss Vale from Australia.

Not everyone who takes part in the Road Worlds for Seniors remembers being there due to dementia. But imagine being constantly reminded why the medal is hanging there!

229,930
km cycled

6,986
cyclists

10
countries

Road Worlds for Seniors is a unique championship that was first held in 2017. For just over four weeks each year, it gives thousands of seniors and individuals living with dementia the opportunity to participate in a global sports event – a world championship in cycling.

In this championship, there are no qualifications or specific eligibility requirements. Here, everyone can participate – regardless of their level of function or age. The focus is on abilities rather than disabilities, prioritising socialising and a sense of belonging to a

team. Last year the oldest cyclist was a 106 year old woman who actually received her first ever medal in her life- due to her participation in the world's only global cycling championship for residents in care!

Physical benefits

The cyclists tells about improved mobility, better weight management, reduction in physical pain and less need for medications.

Mental and cognitive benefits

Better self-effecancy, increased general contentment and wellbeing. Reports also tells about reduction in anxiety and depression.

Social benefits

Measurements of increased social connectedness and inspiration for residents, staff and relatives. Inspires good conversations.

In our championship, everyone can participate, whatever their functional level. We focus on abilities, not disabilities. It is important that all participants can take part in the joy this competition brings – both in their local area and across international borders.

In all championships, there are winners. Road Worlds for Seniors is no exception and rewards the world's only cycling competition for seniors and individuals living with dementia. Champions for women, men, and teams receive big trophies, honour, and glory. However, in RWS, all participants are rewarded for their efforts - regardless of the distance they have cycled. Physical activity, camaraderie, mastery, and joy are the most important principles. Therefore, all participants receive their own medal and a certificate! The competition engages older people in meaningful social interactions and increases the sense of social connectedness. It has become an annual highlight for seniors and employees both domestically and internationally. In 2022, it brought together over 5,600 cyclists from seven countries.

We love the medals, and our residents are so proud of them, sometimes wearing them for cycling. Some clients expressed they 'never thought they would earn a medal this late in their life.

Jan Inge Ebbesvik took the lead as president of the Road Worlds for Seniors when it started in 2017. Every year since, he's played a key role in making sure seniors globally have a place to come together and compete.

Link to the website
l.ead.me/therapy-24-02-22

Inspiration virtual cycling

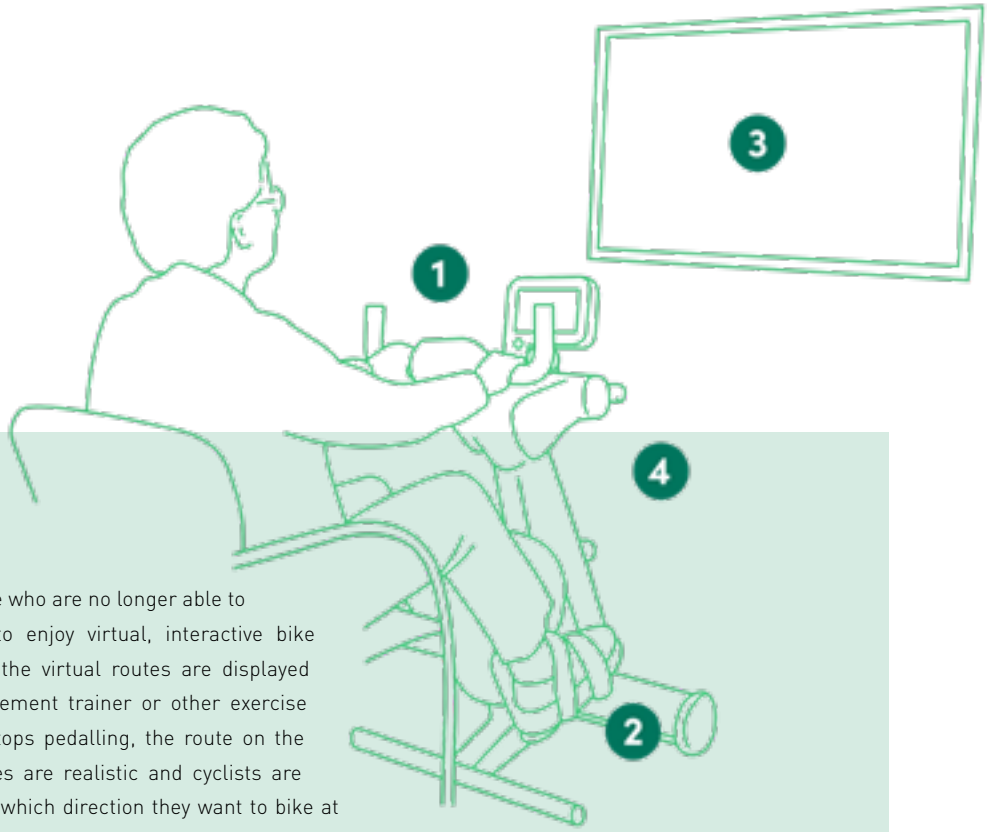
How an Innovative Cycling Experience Enhances Recovery, Sparks Joy, and Connects Residents to Their Past

Ella Keijzer

"When I cycle, it's as if I disappear into a lifelike painting"

What do you do when you can no longer cycle independently and your world becomes increasingly smaller? Care facilities around the world have found a solution: virtual cycling. This is also the case in the Netherlands, at Warande. Albert Westhof (79) cycles every day with Bike Labyrinth through places like Lourdes, Egypt, the Grand Canyon, and the Alps.

When Gerard Haan, culture and welfare staff member, arrives at work in the morning at Warande's Heerewegen residential location in the Netherlands, he always sees a resident in the hallway, cycling with the Bike Labyrinth under the supervision of a physiotherapist. Gerard: "Our physiotherapists use Bike Labyrinth a lot as a treatment for people who have broken a hip because walking in that case is much more taxing than cycling. There was a lady here in her late eighties who cycled every day with Bike Labyrinth after her hip operation. It really promoted her recovery, she now walks completely pain-free, even without a cane. The bike in the hall is connected to a large screen and a sound system, which makes you completely immersed in the experience. For example, if you cycle over the Wadden Islands with Bike Labyrinth, you hear the cries of the seagulls and the sound of the sea, which enhances the experience. Yes, Bike Labyrinth is worth every penny, and caregivers find it fun too. Residents show, for example, where they used to go on vacation, which leads to nice conversations."



What is Bike Labyrinth?

Bike Labyrinth enables people who are no longer able to go outdoors independently to enjoy virtual, interactive bike tours. The screen on which the virtual routes are displayed is connected to a cyclic movement trainer or other exercise machine. When the cyclist stops pedalling, the route on the screen is paused. The images are realistic and cyclists are given the option to choose in which direction they want to bike at intersections, creating a unique experience. Bike Labyrinth makes it easy to keep moving in a relaxed atmosphere at the user's own pace. Bringing a bit of the outside indoors.

1. The cyclist or supervisor selects a route from the menu and chooses between left and right at intersections, using the yellow and blue buttons.
2. When the cyclist stops pedalling, the route on the screen will pause.
3. The on-screen bike tours trigger memories, provide distraction and promote social interaction. People will be inclined to keep moving and improve their condition in a relaxed manner. As such, Bike Labyrinth improves quality of life while making it easier for people to keep active in a fun setting.
4. Bike Labyrinth can be connected to all hometrainers and exercise machines and it's perfect to use in combination with THERA-Trainer cycling devices.

Grand Canyon, pyramids, Mecca

In the afternoons, Heerewegen residents who can cycle independently are allowed to use Bike Labyrinth, Gerard says enthusiastically. "The rain is hitting the windows now, but I just saw Mr. Westhof happily cycling through Italy in the sun, right, Mr. Westhof?" Mr. Westhof – "just call me Albert" – confirms this and says he cycles daily. "Every day for half an hour after lunch, it helps with digestion. I used to travel a lot, and I enjoy revisiting all those countries. I have been to Portugal often, but now, on the bike, I see much more than when I walked through the cities, haha! While cycling, I have seen many beautiful things pass by. Recently I toured the Grand Canyon, and I recently cycled through Egypt where I saw the pyramids and sphinxes, truly beautiful. And I learn a lot too. For example, I saw many hotels in both Lourdes and Mecca recently – for the pilgrims, of course. I had never thought about that. And funny, when I once cycled through Ankara, I suddenly saw the Dutch ING bank there. Wow, that's far from home, I thought. When I cycle, it's like disappearing into a lifelike painting. Wonderful."

Win-Win

That Mr. Westhof enjoys the bike rides so much automatically ensures that his fitness remains up to par. Gerard: "Mr. Westhof uses a walker, after all, he is almost eighty, but he is very physically strong because of his daily bike rides. Good for his body and his mind. This way, he gets out and he can beautifully tell what he has seen along the way. Actually, all residents should cycle, it's such a great device, really an asset." But not only Mr. Westhof benefits from the bike. Gerard: "In our department, there is an 86-year-old lady who

Virtual Cycling Enhances Quality of Life: *Bike Labyrinth allows elderly residents in care facilities to experience immersive virtual tours of global destinations while cycling, improving both physical health and mental well-being. This technology not only helps with physical rehabilitation but also offers a sense of adventure and relaxation.*

Personalized Therapy and Emotional Benefits: *The system provides personalized experiences, such as cycling through one's hometown, which can evoke happy memories and alleviate feelings of sadness, making it a valuable tool for enhancing emotional well-being and engagement in care settings.*

is sometimes sad because she wants to see her parents. Then I take her to the bike and choose a route through her birthplace Tiel. While cycling, the happy memories come back, and the sad, sorrowful thoughts disappear. A win-win: you make someone happy and get them moving."

The world is open

Mr. Westhof is certainly very happy that Warande has a Bike Labyrinth. "I notice that my condition has really improved through cycling. The system indicates that I cover longer distances in the same amount of time. But that's not why I do it, I do it for relaxation. By getting on that bike, I have a little vacation every day. Soon I will take a look at China. But Israel with Bethlehem and Jerusalem is also still on my list. No, I'm far from done cycling." Bike Labyrinth is already used worldwide.

Are you curious about what virtual cycling can mean for your care facility?

Go to http://www.bikelabyrinth.com and discover the possibilities.

With more than 750 locations around the world, there is a suitable route for everyone.

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Ella Keijzer co-founded Bike Labyrinth in the Netherlands in 2011. During her master study Media Technology at the University of Leiden she made the first version of the virtual cycling product. After an employee of an elderly care facility saw this, she didn't hesitate to ask whether she could use the product for the elderly at her location. And so Bike Labyrinth was born. Ever since Ella has been the CEO and Bike Labyrinth can now be found in over 4000 healthcare institutions in the Netherlands and in over 20 countries worldwide.

Neurorehabilitation Masterclass

Neurorehabilitation Masterclass by THERA-Trainer inspires participants at Medical Park Bad Rodach

Leoni Schulz

The Neurorehabilitation Masterclass 2024 by THERA-Trainer took place at the Medical Park Bad Rodach on 7 and 8 June. The high-calibre specialist symposium was primarily aimed at senior therapists from the inpatient and outpatient rehabilitation sector and offered the opportunity to find out about the latest developments and scientific findings in device-based therapy for the lower extremities.

The symposium focussed on technologies to support the rehabilitation of walking ability. Current scientific studies confirm the high effectiveness of these interventions, particularly in the setting of device-based circuit training. This application option is becoming increasingly important, not least due to the current framework conditions in healthcare.

In his presentation, Jakob Tiebel, an expert in clinical applications in the field of neurorehabilitation, emphasised: "Rehabilitation does not take place on a greenfield site. We must harmonise the current evidence and effective therapies with the real framework conditions and limited resources. In view of rising patient numbers and an increasing shortage of specialists, rehabilitation technologies, when used specifically in a group setting, offer the possibility of effectively and efficiently meeting the growing demand for therapies despite scarce resources."

After an exciting and varied specialist lecture, in which critical questions about patient allocation, billing options and the business aspects of investment projects in modern robot-assisted therapies were discussed, Guter Hölig, host of the event and Head of Therapies at Medical Park Bad Rodach, gave the participants a tour of the clinic building. The tour offered the opportunity to explore the topics discussed in the lecture in greater depth and to view the relevant facilities and technologies on site.

***Efficient use of resources:** The targeted use of rehabilitation technologies in group settings can effectively meet the increasing need for therapy despite limited resources.*

In addition to a current evidence update, the following specialist presentations offered further practice-orientated insights. Several experts presented the concepts of their facilities in Germany, including Sarah Ruppert from the DianaKlinik Bad Bevensen, Lena Flöter from the MEDICLIN Fachklinik Rhein/Ruhr in Essen-Kettwig and Özge Demirezen, owner of the Praxis für Physiotherapie Fortschritt in Erlangen.

Sarah Ruppert and Lena Flöter reported on their experiences with a specially developed gait studio that has been used in their clinics for several years. The clinics offer patients intensive therapy that focuses on restoring and improving walking ability over a period of several weeks. The facilities are characterised by their innovative implementation and the use of state-of-the-art THERA-Trainer technologies. Özge Demirezen, representing one of the first outpatient therapy facilities in Germany, presented how she has successfully established a similar setting for outpatient aftercare and emphasised the central role of active patient participation in the rehabilitation process.

The participants also had the opportunity to experience the Bad Rodach therapy world of gait rehabilitation live. This experience was a source of inspiration for many and led to lively discussions about the feasibility of such innovative solutions in their own organisations. Particularly impressive was the insight into the Medical Park's comprehensive gait therapy concept, which has been refined over many years. It offered participants practical insights and the opportunity to try it first-hand.

The interdisciplinary exchange between the experts proved to be extremely enriching, promoting the transfer of knowledge between different specialisms. This was made possible in particular by the close

Innovative therapy concepts: *Successful gait studios and modern aftercare settings show how targeted intensive therapies and active patient participation can improve rehabilitation.*

integration of inpatient and outpatient rehabilitation, which revealed new perspectives and approaches for daily therapeutic practice.

The Neurorehabilitation Masterclass 2024 was a complete success and left a lasting impression on everyone involved. THERA-Trainer would like to thank all participants and organisers for their commitment and is already looking forward to future events.

What is circuit training in neurorehabilitation?

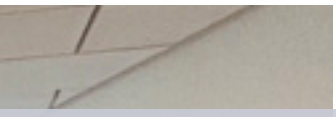
Task-specific circuit training shows significant potential for the rehabilitation of stroke survivors. This training concept includes targeted exercises to improve gait and balance in a structured group setting. Patients with different performance levels train individually on different training equipment and exercise stations, which enables targeted and varied support. Studies have shown that this method achieves clinically relevant improvements in key gait parameters such as endurance, speed, balance and stride length, some of which are superior to conventional therapy approaches. In addition to improved mobility, this specific training method also offers advantages in terms of efficiency and cost-effectiveness, as it represents a structured and at the same time cost-effective training option.

Key benefits include:

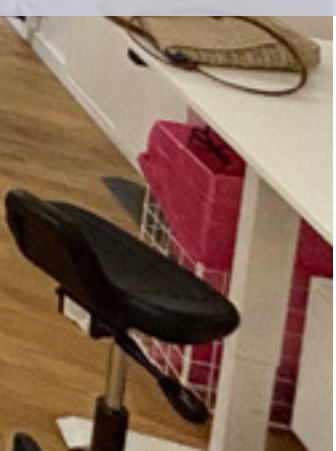
Improved mobility:
Improvements in walking ability and balance contribute to better mobility and stability.

Cost effectiveness:
A lower staff-to-patient ratio and the ability to care for several patients at the same time make this approach more economical and time-saving.

Motivation and support:
Training together with other patients with similar impairments can be motivating and provide additional support.



Practical insights: *The tour of the clinic provided valuable practical insights and new perspectives for therapeutic practice through interdisciplinary dialogue.*



Leoni Schulz has been supporting the editorial team of THERAPY magazine since mid-2024. In addition to her responsibilities in the areas of 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.

Robot-assisted gait rehabilitation update

Update on the effectiveness and practical applicability of robot-assisted procedures for gait rehabilitation of patients after stroke

Jakob Tiebel

Advances in stroke rehabilitation are characterised, among other things, by robot-assisted gait training (RAGT). Studies show that RAGT using end-effector devices significantly improves walking ability. These technologies enable intensive, precise training that promotes neuronal plasticity and motor recovery. Despite the successes, questions remain about the optimal intensity and dosage, which require further research. The article provides an update on the latest developments and their integration into clinical practice.

In recent years, the field of stroke rehabilitation has changed considerably with the advent of robot-assisted therapy, which, in contrast to traditional rehabilitation methods, marks a paradigm shift. In view of the urgent need for more targeted, more intensive task-orientated rehabilitation strategies, robot-assisted gait training (RAGT) has proven to be a particularly effective method and has become established in clinical practice.

The integration of RAGT with traditional physiotherapy promises to improve post-stroke outcome by addressing both the physical and neurological aspects of gait rehabilitation, providing a more comprehensive approach to stroke rehabilitation.

The rationale for integrating RAGT into stroke rehabilitation is based on the scientific principles of neuroplasticity and motor learning. Neuroplasticity describes the brain's remarkable ability to reorganise itself by forming new neuronal connections in response to learning or after injury. In the context of stroke rehabilitation, this plasticity is crucial for the recovery of motor functions that have been lost or impaired by brain injury [1-3].

RAGT utilises this principle by providing consistent and repetitive training, which is essential for stimulating and strengthening these new neural pathways. Such repetitive practice of walking movements using robotic support helps to retrain

Effective methods: *End-effector-assisted gait training and treadmill therapy with partial body weight support are particularly effective in improving walking speed and gait endurance after a stroke.*

the brain and gradually restore the neural circuits for motor function. This is particularly important in stroke rehabilitation, where the aim is to relearn and improve motor skills such as walking [1-3].

RAGT utilises advanced robotic devices and systems specifically designed to support, enhance and guide the lower limbs during walking. These technologies range from end-effector devices and robot-assisted treadmills to innovative wearable exoskeletons that adapt closely to the user's body to support gait training. Exoskeletons provide direct physical support for the legs. They actively help with leg movements to compensate for weaknesses and ensure correct gait patterns. End-effector devices, on the other hand, focus on guiding the feet along a predetermined path and thus offer a more "active" and therefore presumably more effective method of gait rehabilitation [4-8].

The basic aim of RAGT in the field of stroke rehabilitation is to create a training environment characterised by high intensity, repetitive exercises and task-related activities. This approach is based on the principles of motor learning, which state that high-intensity training is crucial to sufficiently challenge the motor system and achieve significant improvements. A high number of repetitions is important for anchoring motor skills, as continuous practice improves execution [9-11].

Another advantage of RAGT over traditional gait rehabilitation methods is the ability to ensure consistent and controlled training. The robotic devices can precisely control movement patterns, speed and resistance, ensuring that patients perform the exercises with the correct form and intensity. This level of control is difficult to achieve with manual therapy alone. In addition, RAGT enables intensive training without physical strain for therapists and with a reduced risk of injury for patients. This is particularly important for patients with severe impairments who require comprehensive support during training [9-12].

Update from network meta-analyses

In everyday clinical practice, the question often arises as to which patients benefit most from which method of improving walking ability after a stroke. A network meta-analysis conducted by Mehrholz and colleagues in 2018 aimed not only to summarise the current evidence on gait rehabilitation after a stroke, but also to statistically compare all approaches to gait rehabilitation for the first time. The evaluation included 95 randomised controlled trials with a total of 4,458 patients. For the primary and secondary endpoints of walking speed and walking distance (endurance), gait training with end-effector-assisted devices and treadmill training with body weight support in particular achieved significant improvements. No difference was identified between the safety of the individual interventions [13].

The analyses suggest that, compared to conventional gait rehabilitation, end-effector-assisted gait training and treadmill therapy with partial body weight support in particular can bring about significant and clinically meaningful improvements in walking speed and gait endurance after a stroke. For severely affected non-ambulatory patients, the use of end-effector-assisted gait training is particularly recommended. For less severely affected patients who are able to walk, on the other hand, treadmill therapy with partial body weight support is recommended. The key feature for clinical decision-making is whether the patient is already able to perform repeated stepping movements independently or to what extent guiding the distal tips of the limbs along the movement trajectory of the gait trainer offers an advantage for the therapy (e.g. forcing higher walking speed, greater step length, etc.).

Update on intensity and dose-response relationship

High-intensity gait training is recommended in stroke rehabilitation to improve walking speed, walking distance and balance. However, identifying effective and efficient implementation methods still remains somewhat of a challenge in practice.

In stroke rehabilitation, research continues to identify gaps between scientific knowledge and clinical practice. Studies and meta-analyses on gait rehabilitation describe the significantly positive effects and impacts of gait rehabilitation interventions characterised by a high number of steps and high aerobic (i.e. cardiovascular) intensities. Studies on these interventions show significantly improved walking speed, endurance and walking economy in people who have had a stroke. In particular, gait training performed at 60% to 80% of the predicted heart rate (HR) reserve can result in 2000 to 6000 steps per physiotherapy session. Previous studies and guidelines have already pointed to the correlation between this "dose" of step exercises and improvements in therapy outcomes. A recent clinical practice guideline on locomotor strategies strongly recommends the use of moderate to high-intensity gait training for patients with diagnoses affecting the central nervous system [14-21].

A high-quality study by Hornby et al. (2019, 2022) shows that high-intensity gait training at 70-80% of heart rate reserve results in significant improvements in walking speed and gait endurance, regardless of the exercise variation. At least 70 steps per minute are necessary to achieve significant progress. The PHYS-STROKE study (Nave et al. 2019) supports these findings by showing that low-intensity gait training did not lead to significant improvements. This emphasises the importance of higher training intensities and a minimum number of steps in neurological gait therapy [19-21].

Intensity is crucial: *High-intensity gait training, performed at 60% to 80% of the heart rate reserve, shows significant improvements in walking speed and endurance, while low-intensity training is less effective.*

High-intensity gait training can be recommended. This means walking exercises with a high number of repetitions and an intensity that increases the heart rate above a target level. The intensity should be between 60% and 80% of the patient's maximum heart rate. It is important to note that high-intensity gait training is not only suitable for patients who can already walk. Many therapists may not realise that even patients with low functional capacity can handle increased intensity under controlled conditions and thus achieve greater progress in therapy. A consistent focus on high-intensity gait training using an end-effector gait trainer or a treadmill with partial weight support can help to use the limited time with the patient effectively and efficiently. When high-intensity gait training is at the centre of therapy, patients in current studies show significant improvements compared to control groups. An additional benefit of high-intensity exercise is the improvement in cardiovascular fitness and endurance, which can reduce the risk of another stroke.

Exoskeletons in comparison: *Wearable exoskeletons offer some benefits for improving mobility, but are not superior to other gait rehabilitation methods and require further research for optimisation and clinical application.*

The question of the optimal intensity and the correct determination of a dose-response relationship in gait rehabilitation will remain a key issue that requires further research. Determining the optimal therapy dose will be of central importance for the further development of modern gait rehabilitation in order to further optimise active treatment interventions and improve motor outcomes. Randomised controlled trials have so far reported insufficiently on relevant aspects for determining the intensity and dose of the interventions. To date, there are neither clear recommendations nor a universal measurement method for the precise quantification of therapy intensity [22].

Update on mobile exoskeletons

Media and marketing often convey an image in which robotic exoskeletons enable people with brain damage or spinal cord injuries to resume everyday activities. However, these representations may not correspond to the actual technological or clinical reality. A detailed look at the current use of exoskeletons in rehabilitation shows both their advantages and their limitations. Despite the publication of 17 reviews in 2021 dealing with exoskeletons, the methodological quality of the studies was mostly inadequate, especially with regard to the description of patients and interventions. Most of the studies focussed on patients with spinal cord injury who were already able to walk and considered exoskeletons primarily as an aid in everyday life or as part of gait training in rehabilitation. While some studies suggest that exoskeletons may be particularly useful as a mobility aid at home, others show that current devices are limited for home use due to their weight, the need for support devices and the restricted range of motion. Studies on improving walking ability after stroke are still scarce and there is a lack of evidence of relevant clinical improvements. Individual studies show that although significant improvements in walking speed, step length and cadence were observed within the groups, there were often no significant differences between the groups. This suggests that although wearable exoskeletons can improve specific aspects of gait in individuals, their superiority over other forms of rehabilitation is not clear. Future developments must strive for close collaboration between engineers, clinicians and patients to improve the practicality of exoskeletons, while a sound cost-benefit analysis remains essential [23-27].

It is recommended that the performance of mobile exoskeletons be critically evaluated in clinical practice, particularly in the context of neurorehabilitation. Close cooperation between developers, researchers and practitioners is essential in order to continuously improve the devices and optimise their suitability for practical use. Clinical use should be based on sound evidence to ensure that exoskeletons meet the actual needs of patients and provide the desired rehabilitative benefits. Practical experience to date strongly suggests that the technologies still need to be significantly improved in order to have a corresponding benefit in application.

Summary

Current studies show that end-effector robots achieve significant progress in gait function and balance by simulating walking movements in non-ambulatory patients in a repetitive and energy-efficient manner, thereby improving endurance, gait speed and stability. These stationary gait training systems effectively promote cortical activation and the recovery of motor functions through intensive, targeted rehabilitation that supports neuroplasticity and muscle training. In later rehabilitation phases, therapy should ideally transition seamlessly to treadmill training with or without partial body weight support and targeted everyday gait training.

However, the success of the therapy depends not only on the selection of the appropriate intervention, but also to a large extent on ensuring sufficient intensity and dose. Current research findings show that modern neurorehabilitation may require higher intensities, more progressive training protocols and a more targeted focus on minimum step counts and biological markers such as heart rate for adequate load control.

Although wearable exoskeletons improve mobility and provide realistic exercise opportunities, they do not currently demonstrate superior efficacy compared to other gait rehabilitation methods. This emphasises the need for further comparative studies to assess their relative effectiveness. Some studies suggest that an integrated approach combining proven and new therapies could potentially optimise rehabilitation outcomes.

Despite the robust evidence for the effectiveness of individual interventions, there are limitations such as small sample sizes and sometimes contradictory results. Future research should focus on larger, diverse patient groups, detailed subgroup analyses and long-term effects, and include direct comparisons between robotic systems and traditional therapies. Clarifying open questions on intensity and dose-response relationships is also crucial in order to refine robot-assisted gait training protocols and optimise their integration into clinical practice, which could ultimately lead to improved recovery outcomes for stroke survivors.

SOURCES:

El Naamani K., Abbas R., Sioutas G.S., Tjoumakaris S.I., Gooch M.R., Herial N.A., Rosenwasser R.H., Jabbour P.M. Endovascular Robotic Interventions. Neurosurg. Clin. N. Am. 2022;33:225–231.

Kim H., Park G., Shin J.-H., You J.H. Neuroplastic Effects of End-Effector Robotic Gait Training for Hemiparetic Stroke: A Randomised Controlled Trial. Sci. Rep. 2020;10:12461.

Swinnen E., Beckwée D., Meeusen R., Baeyens J.-P., Kerckhofs E. Does Robot-Assisted Gait Rehabilitation Improve Balance in Stroke Patients? A Systematic Review. Top. Stroke Rehabil. 2014;21:87–100.

Chang W.H., Kim Y.-H. Robot-Assisted Therapy in Stroke Rehabilitation. J. Stroke. 2013;15:174–181.

Loro A., Borg M.B., Battaglia M., Amico A.P., Antenucci R., Benanti P., Bertoni M., Bissolotti L., Boldrini P., Bonaiuti D., et al. Balance

Rehabilitation through Robot-Assisted Gait Training in Post-Stroke Patients: A Systematic Review and Meta-Analysis. Brain Sci. 2023;13:92.

Nedergård H., Arumugam A., Sandlund M., Bråndal A., Häger C.K. Effect of Robotic-Assisted Gait Training on Objective Biomechanical Measures of Gait in Persons Post-Stroke: A Systematic Review and Meta-Analysis. J. Neuroeng. Rehabil. 2021;18:64.

Chang W.H., Kim T.-W., Kim H.S., Hanapiah F.A., Kim D.H., Kim D.Y. Exoskeletal Wearable Robot on Ambulatory Function in Patients with Stroke: A Protocol for an International, Multicentre, Randomised Controlled Study. BMJ Open. 2023;13:e065298.

Moucheboeuf G., Griffier R., Gasq D., Glize B., Bouyer L., Dehail P., Cassoudesalle H. Effects of Robotic Gait Training after Stroke: A Meta-Analysis. Ann. Phys. Rehabil. Med. 2020;63:518–534.

Eng J.J., Tang P.F. Gait Training Strategies to Optimize Walking Ability in People with Stroke: A Synthesis of the Evidence. Expert. Rev. Neurother. 2007;7:1417–1436.

Mikołajewska E. Bobath and Traditional Approaches in Post-Stroke Gait Rehabilitation in Adults. Biomed. Hum. Kinet. 2017;9:27–33.

Chen B.-L., Guo J.-B., Liu M.-S., Li X., Zou J., Chen X., Zhang L.-L., Yue Y.-S., Wang X.-Q. Effect of Traditional Chinese Exercise on Gait and Balance for Stroke: A Systematic Review and Meta-Analysis. PLoS ONE. 2015;10:e0135932.

Hesse S., Heß A., Werner C.C., Kabbert N., Buschfort R. Effect on Arm Function and Cost of Robot-Assisted Group Therapy in Subacute Patients with Stroke and a Moderately to Severely Affected Arm: A Randomized Controlled Trial. Clin. Rehabil. 2014;28:637–647.

Mehrholz J., Pohl M., Kugler J., Elsner B. The improvement of walking ability following stroke—a systematic review and network meta-analysis of randomized controlled trials. Dtsch Arztebl Int 2018; 115: 639-45.

Lang CE, Macdonald JR, Reisman DS, et al. Observation of amounts of movement practice provided during stroke rehabilitation. Arch Phys Med Rehabil. 2009;90(10):1692–1698. doi:10.1016/j.apmr.2009.04.005.

Moore JL, Roth EJ, Killian C, Hornby TG. Locomotor training improves daily stepping activity and gait efficiency in individuals poststroke who have reached a "plateau" in recovery. Stroke. 2010;41(1):129–135. doi:10.1161/STROKEAHA.109.563247.

Kaur G, English C, Hillier S. How physically active are people with stroke in physiotherapy sessions aimed at improving motor function? A systematic review. Stroke Res Treat. 2012;2012:820673. doi:10.1155/2012/820673.

MacKay-Lyons MJ, Makrides L. Cardiovascular stress during a contemporary stroke rehabilitation program: is the intensity adequate to induce a training effect? Arch Phys Med Rehabil. 2002;83(10):1378–1383. doi:10.1053/apmr.2002.35089.

Ballester BR, Ward NS, Brander F, Maier M, Kelly K, Verschure PFMJ. Relationship between intensity and recovery in post-stroke rehabilitation: a retrospective analysis. J Neurol Neurosurg Psychiatry. 2022 Feb;93(2):226-228. doi: 10.1136/jnnp-2021-326948.

Hornby TG, Henderson CE, Plawecki A, Lucas E, Lotter J, Holthus M, Brazg G, Fahey M, Woodward J, Ardestani M, Roth EJ. Contributions of Stepping Intensity and Variability to Mobility in Individuals Poststroke. Stroke. 2019 Sep;50(9):2492-2499.

Hornby TG, Plawecki A, Lotter JK, Scofield ME, Lucas E, Henderson CE. Gains in Daily Stepping Activity in People With Chronic Stroke After High-Intensity Gait Training in Variable Contexts. Phys Ther. 2022 Aug 4;102(8):pzac073.

Rackoll T, Nave AH, Ebinger M, Endres M, Grittner U, Flöel A; for the PHYS-Stroke study group. Physical Fitness Training in Patients with Subacute Stroke (PHYS-STROKE): Safety analyses of a randomized clinical trial. Int J Stroke. 2022 Jan;17(1):93-100.

Goikoetxea-Sotelo G, van Hedel HJA. Defining, quantifying, and reporting intensity, dose, and dosage of neurorehabilitative interventions focusing on motor outcomes. Front Rehabil Sci. 2023 Aug 10;4:1139251.

Dijkers MP, Akers KG, Dieffenbach S, Galen SS. Systematic Reviews of Clinical Benefits of Exoskeleton Use for Gait and Mobility in Neurologic Disorders: A Tertiary Study. Arch Phys Med Rehabil. 2021 Feb;102(2):300-313.

Park YH, Lee DH, Lee JH. A Comprehensive Review: Robot-Assisted Treatments for Gait Rehabilitation in Stroke Patients. Medicina (Kaunas). 2024 Apr 10;60(4):620. doi: 10.3390/medicina60040620. PMID: 38674266; PMCID: PMC11052271.

Yokota C., Tanaka K., Omae K., Kamada M., Nishikawa H., Koga M., Ihara M., Fujimoto Y., Sankai Y., Nakajima T., et al. Effect of Cyborg-Type Robot Hybrid Assistive Limb on Patients with Severe Walking Disability in Acute Stroke: A Randomized Controlled Study. J. Stroke Cerebrovasc. Dis. 2023;32:107020.

Yeung L.-F., Lau C.C.Y., Lai C.W.K., Soo Y.O.Y., Chan M.-L., Tong R.K.Y. Effects of Wearable Ankle Robotics for Stair and Over-Ground Training on Sub-Acute Stroke: A Randomized Controlled Trial. J. Neuroeng. Rehabil. 2021;18:19.

Louie D.R., Mortenson W.B., Durocher M., Teasell R., Yao J., Eng J.J. Exoskeleton for Post-Stroke Recovery of Ambulation (ExStRA): Study Protocol for a Mixed-Methods Study Investigating the Efficacy and Acceptance of an Exoskeleton-Based Physical Therapy Program during Stroke Inpatient Rehabilitation. BMC Neurol. 2020;20:35. doi: 10.1186/s12883-020-1617-7.

Jakob Tiebel studied Applied Psychology with a focus on Health-care 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.

SCIENCE

Positive influence of RAGT on muscle activity

Influence of robot-assisted end-effector gait training on muscle activity of the lower extremities in stroke patients compared to conventional gait training.

Jakob Tiebel

The rehabilitation of stroke patients is a complex challenge that requires targeted and effective therapy. In a study conducted by Naoki Tanaka from the Department of Physical Therapy of the School of Rehabilitation at the Tokyo Professional University of Health Sciences in Tokyo, Japan, the effectiveness of robot-assisted gait training (RAGT) compared to conventional gait training (CGT) was investigated in stroke patients. The study focussed on measuring muscle activity before and after the intervention and on differences in muscle activity changes between the two training methods.

A total of 30 stroke patients took part in the study, with 17 of the participants assigned to the RAGT group and 13 to the CGT group. Both groups underwent either robot-assisted gait training with a foot-pad movement interface robot or conventional gait training, each for 20 minutes and over a period of 20 sessions.

The measured results included muscle activity of the lower extremities and walking speed. The measurements were taken before the start of the intervention and at the end of the 4-week intervention.

The results of this study suggest that robot-assisted gait training with one type of end effector is more effective than conventional gait training, particularly in increasing muscle activity in the gastrocnemius muscle.

Analysis of the data showed that the RAGT group exhibited a significant increase in muscle activity in the gastrocnemius muscle, while the CGT group showed increased muscle activity in the rectus femoris muscle. Particularly in the terminal support phase of the gait cycle, the increase in muscle activity in the gastrocnemius muscle was significantly higher in the RAGT group compared to the CGT group.

The results of this study suggest that robot-assisted gait training with one type of end effector is more effective than conventional gait training, particularly in increasing muscle activity in the gastrocnemius muscle. This has potentially far-reaching implications for the rehabilitation of stroke patients, as targeted stimulation of specific muscles can promote functional recovery and improve walking ability. Future research and clinical applications could focus on how these findings can be integrated into individual patient care to further optimise the effectiveness of rehabilitation.

Participants & Methods

Stroke (n=32)
Within 6 months of onest
Functional ambulatory category <3

Randomisation

RAGT group	CGT group
Robot-assisted gait training five times a week for four weeks	Conventional gait trraining five times a week for four weeks

System overview of Gait Master used for RAGT

Outcome measures
Muscle activity in lower-limb muscles by surface electromyography

Original work
l.ead.me/therapy-24-02-42

SOURCES:
Tanaka N, Yano H, Ebata Y, Ebihara K. Influence of Robot-Assisted Gait Training on Lower-Limb Muscle Activity in Patients With Stroke: Comparison With Conventional Gait Training. Ann Rehabil Med. 2023 Jun;47(3):205-213. doi: 10.5535/arm.22147. Epub 2023 Jun 8. PMID: 37317795; PMCID: PMC10326393.

Learning to walk again with robotic support

Bad Wurzach rehabilitation clinic gets new gait trainer

Waldburg-Zeil clinics

The Waldburg-Zeil clinic in Bad Wurzach now boasts the "gold standard" in gait rehabilitation. This is how the Head of Neurology, Dr Martin Schorl (57), describes their new comprehensive treatment offering, featuring the newly acquired THERA-Trainer lyra gait trainer. This robot-assisted therapy device helps severely affected patients who have suffered a stroke or other damage to the nervous system to learn to walk again.

Professor Stefan Hesse, one of the pioneers of gait rehabilitation, coined the phrase: "If you want to learn to walk again, you have to walk!" With the new device, this specialised exercise can now be done with significantly greater intensity and frequency, Schorl explains, adding: "Wheelchair use can be avoided for one in seven patients thanks to this therapy. This has been scientifically proven."

Together with botulinum toxin therapy (see info box), the rehabilitation clinic now has a unique selling point that extends beyond the region. "For severely affected patients with spastic hemiplegia in the subacute phase of rehabilitation after a stroke, we can guarantee the best possible treatment with this combination," emphasises Schorl. Around 800 to 1,000 steps per day are required for the brain to "reprogramme" the sequence of movements when walking, explains the specialist.

The new therapy device provides significant relief on internal processes, confirms physiotherapist Johannes Schuschkewitz. "Previously, two or three therapists were needed for particularly severely affected patients to manage just a few steps. With the 'lyra', it will be possible to complete 2000 to 3000 steps in the same time. This is a real game changer when it comes to relearning to walk," says the 36-year-old. He adds: "A wheelchair can come straight in through the ground-level entrance. The individually adjustable weight relief helps when walking. The movements are guided by foot pedals to train the natural gait pattern."

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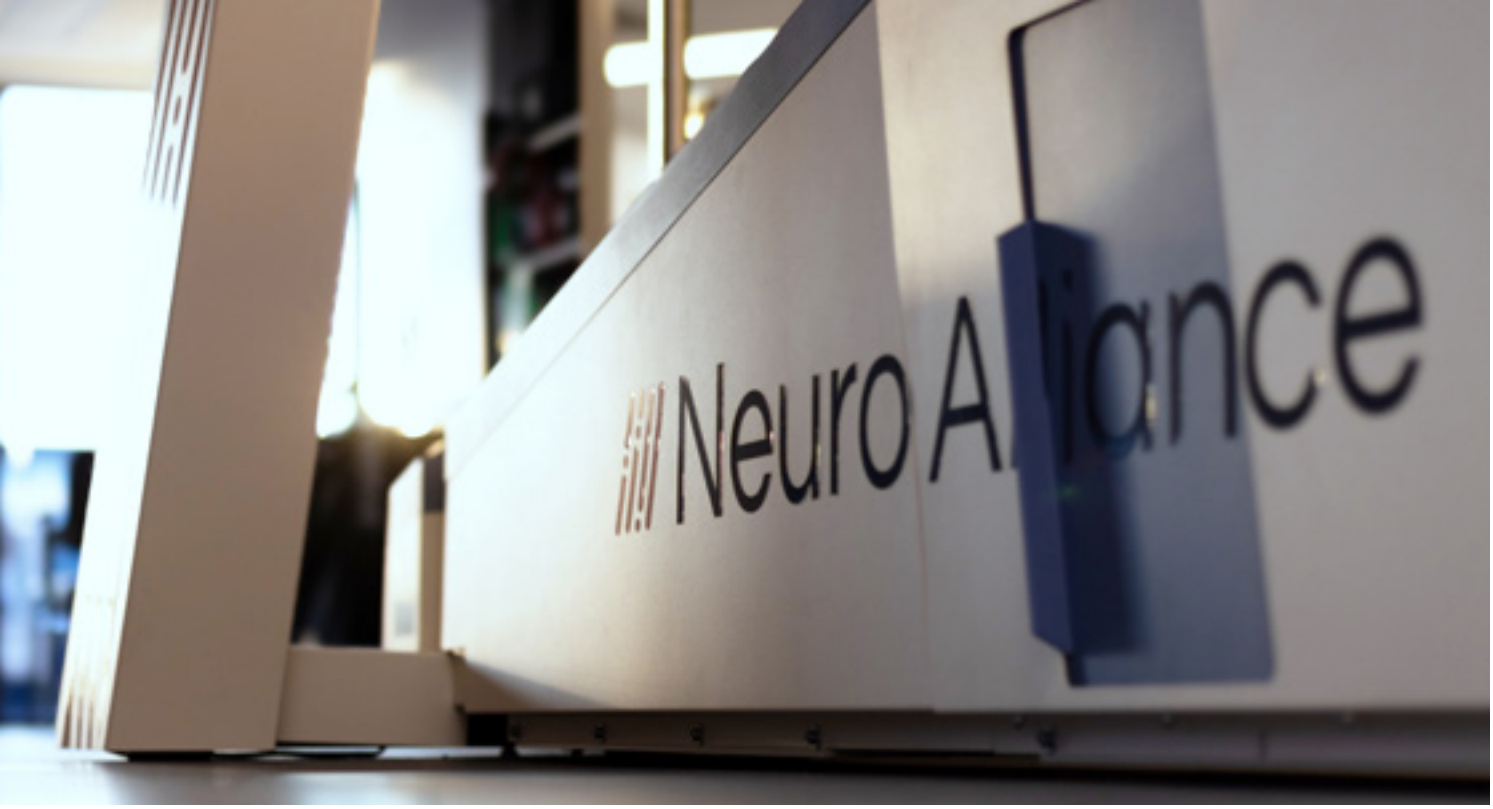
For severely affected patients with spastic hemiplegia in the subacute phase of rehabilitation after a stroke, we can guarantee the best possible treatment with this combination.

Botulinum toxin therapy:

If the muscles involuntarily contract, a condition known as spasticity that often occurs after a stroke, botulinum neurotoxin can be administered. It is injected into the affected muscles to relieve the cramps.



THERAY & PRAXIS

Neuro Alliance – State-of-the-art rehabilitation

Innovative Therapies for Complex Conditions: A Deep Dive into Neuro Alliance

Lars Timm

In this interview, we speak with Daniel Buck, Neurological Physiotherapist and General Manager, and Tim Mogg, Facilities Manager at Neuro Alliance, based in Thornton, Australia. Neuro Alliance is dedicated to providing state-of-the-art rehabilitation services for individuals with complex conditions. They emphasize goal-directed, intensive therapy programs designed to maximize client outcomes. We discuss how innovative technology, like the THERA-Trainer lyra, supports therapists in enhancing the effectiveness of treatments by increasing the volume of evidence-based task practice and repetitions.

Daniel Buck
General Manager APA
Neurological Physiotherapist

Daniel is a practicing titled Neurological Physiotherapist and former Occupational Therapist. He has a special interest in managing multi trauma rehabilitation cases and working with clients who have complex tone presentations. He also has a clinical focus on neurodegenerative conditions including movement disorders and rare genetic myopathies.

Lars Timm: Hi Daniel, thanks for joining us. Could you start by sharing some background on the history and mission of your clinic?

Daniel Buck: Hi Lars, absolutely. Neuro Alliance was established to provide gold standard neurorehabilitation to a range of clients. Using the principles of high volume, tasks specific training our therapy team is positioned to maximise the functional gains for clients with various neurological conditions.

Lars Tim: Can you tell us more about the mission that drives Neuro Alliance?

Daniel Buck: At Neuro Alliance, the mission is to build a strong therapeutic partnership with each client, guided by core values. Accountability is key, as the team takes responsibility for their actions and promptly addresses any issues. Compassion ensures that every client's unique needs and journey are understood and respected. Collaboration involves forming honest, trusting relationships, transparently aligning services with each client's goals and referring them to other resources if needed. Respect for each client's choices is central, prioritizing their preferences in all aspects of care. Finally, a commitment to evidence-based practice means that all methods are grounded in the latest research, providing effective and reliable interventions. Together, these values drive the provision of exceptional, personalized care that supports meaningful participation and progress in life.

Staff have an intimate understanding of the evidence base for many of the conditions we see at Neuro Alliance.

Lars Timm: What distinguishes your clinic from other neurorehabilitation centres in Australia?

Daniel Buck: Neuro Alliance along with a number of clinics around Australia provide high quality rehabilitation. In Australia the training standard of therapists if high and this is reflected across the many great services available.

Lars Timm: Are there any special therapy concepts or innovative approaches that you use?

Daniel Buck: Neuro Alliance are focusing on goal directed, intense therapy programs to maximise client outcomes. Technology like the Thera-Trainer Lyra help our therapists maximise the number of repetitions and volume of task practice. Technology like this can help reduce therapy staff costs and maximise value for money when clients are engaging in neurorehabilitation therapy.

Lars Timm: How do you integrate evidence-based practice into the day-to-day running of your neurorehabilitation clinic?

Daniel Buck: Staff have an intimate understanding of the evidence base for many of the conditions we see at Neuro Alliance. Whilst there is variability between conditions in terms of what is best practice, the key principles of neurorehabilitation and neuroplasticity do apply across conditions. At Neuro Alliance we are trying very hard to implement options for clients that allow them to increase their rehabilitation and exercise dosage to place them in the best position to maximise their functional gains.

Lars Timm: Can you give specific examples of how you incorporate evidence-based research findings into your treatment plans and therapies?

Daniel Buck: The Neuro Alliance Intensive Gait Lab is a great example of integrating evidence-based practice into our clinic. Client goals are clearly identified, then an intense therapy plan is implemented for a 5-week block at a time. With this higher level of dosage, it aligns with what the research has been telling us for many years, that being therapy needs to be goal directed, task focused, specific to the individual and have a high enough level of intensity to promote positive plastic change.

More about the Gait Lab
l.ead.me/therapy-24-02-46_01

Lars Timm: Are there specific processes or committees within your clinic that are responsible for regularly reviewing and adapting treatment protocols?

Daniel Buck: Within our team we have several high-caliber clinical leaders who develop and review our various programs. Those programs are modified to adapt to the needs of clients. Therapy programs need to be cost effective, practical and approved by our senior clinical leaders at Neuro Alliance.

Lars Timm: Can you share success stories or patient stories that illustrate the effectiveness of your programmes?

Daniel Buck: In Australia we are legally unable to provide patient testimonials. Currently when writing this article, we are at the end of our current 5-week Intensive Gait Lab. For example, just one client is now able to transfer out of her new car and walk with an aid into a public place. Another client is now standing from their wheelchair without physical assistance, another client has just started walking with Canadian crutches and another is now walking with a forearm support frame for the first time.

Lars Timm: How have the needs and requirements of your patients changed over the years?

Daniel Buck: Clients' needs have always been the same. That is, they want to maximise their functional gains after a neurological disease or injury onset. The approach to rehabilitation has now evolved to the point whereby clients' needs are more effectively met.

About Neuro Alliance

Neuro Alliance has a long history of providing high quality clinical care to people with a neurological condition. Started in 2010 by Daniel Buck it has since grown into an interdisciplinary allied health and medical service. In 2019, land was acquired in the epicentre of the Hunter, Thornton and by early 2020 construction of Neuro Alliance's state-of-the-art rehabilitation centre commenced. Born through a frustration of no such service existing in the Hunter Region, Daniel recognised clients' needs could not be met delivering community care alone. In 2022 Senior Occupational Therapist, Alicia Harris, became a co-owner of Neuro Alliance. Since this time Alicia and Daniel have launched Neuro Alliance Paediatrics, constructing, and commissioning a second building in Thornton for this purpose. Despite the size, the team of around 50 staff are a close-knit group who support and nurture each other's growth. The entire team is committed to delivering high-quality, evidence-based services to an incredible group of clients, both now and in the future.

Interested in more?

Watch the video:

l.ead.me/therapy-24-02-46_02

At Neuro Alliance we are trying very hard to implement options for clients that allow them to increase their rehabilitation and exercise dosage to place them in the best position to maximise their functional gains.

Technology like the Thera-Trainer Lyra help our therapists maximise the number of repetitions and volume of task practice.

Lars Timm: What future developments and innovations do you see in the field of neurorehabilitation?

Daniel Buck: We see technology playing a part in helping clinical staff maximise therapy dosage for clients. There will always be a need for a sharp clinical mind when working with a client, but the appropriately skilled therapist can certainly use a range of innovative technologies now that help explore new possibilities within neurorehabilitation that were not there 5-10 year ago, even 3 years ago.

Lars Timm: How are you preparing your clinic for future challenges and opportunities?

Daniel Buck: We are investing heavily in new technology like THERA-Trainer lyra, which is an end-effective gait trainer. Programs are heading in the direction of being more intense, for shorter periods of time with a heavy focus on goal direction. With the combination of this therapy approach, the skill of the clinician and the new technology now available to us, patients should see themselves in a better position to make functional gains.

Lars Timm: In your opinion, how does neurorehabilitation in Australia differ from that in other countries?

Daniel Buck: Australia do lead a lot of the research in relation to various neurological conditions worldwide. Australia has a strong presence especially in the stroke cohort which is helping us develop our clinical approach to managing stroke rehabilitation and management.

Australia is slowly adopting technology however due to our geographical location this does provide somewhat of a barrier to integrating this into practice. Whilst we cannot comment on the training standards in other countries, the training standard of allied health professionals in Australia is very high. This does make our country positively positioned to lead the way in promoting and showing how to integrate gold therapy standard treatment into reality.

Lars Timm: What role do technological innovations, such as robotic assistance or virtual reality, play in modern neurorehabilitation?

Daniel Buck: Currently the evidence based on both technology groups is limited. As some of this technology is adopted it will assist researchers in being able to implement robust study designs to assess effectiveness. Currently, robotic assistance we see as the most promising component in terms of being able to assist clinicians in delivering therapy with a higher level of repetitions and intensity.

Lars Timm: Are there certain technologies that have proven to be particularly effective in your clinic?

Daniel Buck: Biofeedback technologies are useful, and these can be basic in nature to complex. The more a patient understands their movement patterns, the better positioned they are to make adjustments and improve.

In addition to this any technology that allows a clinicians to help a client spend more time in standing and stepping, this may in some instances place them in a better position to improve their functional capacity.

Lars Timm: How does healthcare and insurance funding affect access and quality of neurorehabilitation services?

I enjoy mixing evidence based practice, interpersonal relationships, hard work and technical "know-how" to maximise outcomes.

Daniel Buck: Healthcare and disability funding in Australia is complex in nature. Overall, clients with their unique needs are in a good position to receive quality healthcare in Australia. As to what service, be that public or private, delivers this service essentially depends on that clients' access to funding.

Lars Timm: How do therapist education and training programs differ in Australia compared to other countries?

Daniel Buck: Australia has a high level of compliance in relation to the initial tertiary education of a Physiotherapist for example and also the ongoing education they require to undertake to remain registered. Tertiary education programs in Australia are world standard.

Tim Mogg
Facilities Manager

Tim is the Facilities Manager at Neuro Alliance. Coordinating the hydrotherapy pool, gyms and our Paediatric clinic at 7/B1 Poynton Place.

Lars Timm: Hi Tim, thank you for joining us as well to answer some questions. First of all a personal question to you. What made you decide to work in the field of neurorehabilitation?

Tim Mogg: Many thanks for having me. I'm happy to discuss my decision to work in neurorehabilitation and answer your questions. After graduating as a physiotherapist in 2009, I've worked in many areas of Physiotherapy and rehabilitation and I feel that neurorehabilitation is the place where I can make the biggest difference. I enjoy mixing evidence based practice, interpersonal relationships, hard work and technical "know-how" to maximise outcomes. I love helping people to get moving and I love finding solutions to difficult problems. I enjoy it so much that I have been completing a masters Degree in Neurorehabilitation, which should hopefully be completed by the end of next year!

Lars Timm: How do the different specialisms and therapists in your clinic work together to ensure holistic care?

Tim Mogg: We are very fortunate to have a multidisciplinary team at Neuro Alliance. Having occupational therapists, speech pathologists, exercise physiologists and physiotherapists all under the same roof means that we have easy access to a breadth of specialist knowledge and great working relationships with each other. We may be fortunate and have multiple

Neuro Alliance clinicians all working with the same client, which makes for easy communication amongst the treating team, and awareness of how we operate due to the close working relationships we all have. We can arrange formal case conferences or informal discussions about situations very easily. If we aren't so lucky and the client does not have access to the full multi-disciplinary team at Neuro Alliance we can still use each other as a resource and keep things moving forward.

Lars Timm: What role do interdisciplinary teams play in your daily work?

Tim Mogg: If, as a physiotherapist, I am able to identify an issue that is best suited to be explored and looked after by another discipline I have the option of completing an internal referral, which can speed up the process for a client to gain access to the health professional most suited to their particular issue. If I have a small question that is outside of my scope the answer is normally a brief conversation or email exchange away. There may be times where we are able to arrange a joint intervention, where two or more disciplines can provide input with a client at the same time. This can be a really efficient meeting of the minds, where big problems get solved really quickly!

Lars Timm: What are the biggest challenges you face in your daily work and how do you overcome them?

Tim Mogg: The biggest challenge in the field of neurorehabilitation is maximising use of time. There is always more work that could be done, but only so much time. We do everything we can to make our processes as efficient as possible by having a large resource library on our company intranet to reduce the time it takes to get the right plans in place. We also put a lot of effort into working with our clients' support network to involve them in the rehabilitation process. Having a well-trained support network can maximise the volume of practice that our clients are able to complete, which can make a world of difference.

Lars Timm: How do you motivate patients who have difficulties engaging with rehabilitation?

Tim Mogg: The environment and atmosphere at the Neuro Alliance clinics really help people to engage. When people come into clinic they see that there are lots of other people working hard and enjoying the process. Once our clients see how hard everyone else is working it is much easier to convince them that they are capable to do so as well. We also have a wide range of therapy equipment that keeps rehabilitation interesting and challenging. We have devices that help people to stand and walk that are pretty unique to our part of the world. We also have lots of interactive therapy devices that can feel more like games than therapy. We have pods that light up and react to being touched or stepped on that our clients love using. We have a therapy system that operates like a gaming console, that allows our clients to use their body as the controller. When clients use this system we find that they end up completing many repetitions with a smile on their face, all in the aim of achieving a high score! I also think we do an excellent job to "meet our clients where they are at." I think that recognising that everyone is on an individual journey and by demonstrating that we have the necessary skills within our practice and the connections to professionals who provide services outside of our scope gives our clients confidence to work with us, knowing that they are receiving high quality care.

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

THERAPY & PRACTICE

Back to everyday life, step by step

Device-based therapy to regain and improve mobility

Leoni Schulz

After suffering a severe traumatic brain injury in a car accident, Timo is faced with the challenge of relearning many things, including walking. During my visit to the THERAMotion practice in Schweinfurt, I get the opportunity to accompany Timo during his therapy. His physiotherapist, Stefanie Schwarz, guides us through the various exercises and explains how crucial device-based therapy is for restoring and improving his mobility.

At the THERAMotion therapy practice in Schweinfurt, patients with neurological disorders can expect a comprehensively equipped and specialised world of therapy. Here, patients can access a wide range of customised forms of therapy and modern treatment approaches that are tailored to the specific needs of people with neurological challenges. A central element of the treatment concept is device-based therapy to restore and improve mobility. "The ability to stand and walk is one of the most important goals for our patients and an essential prerequisite for regaining the greatest possible independence in everyday life," explains Stefanie Schwarz, occupational therapist and specialist in neurological rehabilitation.

I have the opportunity to accompany Timo, a young man who is now gradually finding his way back to everyday life after a serious traumatic brain injury in an accident, as he undergoes his therapy session today. At the start of therapy, he stands in a dynamic standing frame. Without the support of this device, Timo would face a high risk of falling when standing. By using the frame, Stefanie can stand a little apart and doesn't have to worry about securing Timo in the standing position, as the device takes care of this.

The two of them start with everyday reaching and grasping exercises. Timo has asked for a coffee. "I'm afraid I can't stretch my arm any further, Timo," says Stefanie, holding the aromatic cup up at a demanding distance. Timo has to twist far beyond his body's centre line and bend forwards to reach the cup. He's done it! "Now enjoy your coffee!"

After a few sips of coffee, Timo heads to the next station. His therapy is structured like circuit training, with various training stations where he works on improving his mobility.

Now we have arrived at the senso. Here Timo stands on a pressure-sensitive floor plate that detects his step movements. He receives instructions via a screen on which he plays an interactive therapy game. This motivates him to perform certain sequences of steps repeatedly.

What sounds simple turns out to be extremely challenging. I try it out myself and quickly realise how complex the exercises are. Full attention must be focussed on the screen, while the movements must be almost automatic.

The ability to stand and walk is one of the most important goals for our patients and an essential prerequisite for regaining the greatest possible independence in everyday life.

I can learn to keep my balance very well (...) I think it's great!

This intervention is called cognitive-motor training. Among other things, it helps you to cope better with everyday dual-tasking situations. Stefanie explains to me what the therapy is all about and what advantages the use of such technologies offers in practice: "We can get patients into the therapy situation quickly and work with a high number of repetitions. The games can also be customised in terms of difficulty." Another important aspect that Stefanie emphasises is that this training saves a lot of resources, as the patient can practise almost independently and she does not have to be present all the time to ensure efficient and effective therapy.

Timo also shows great enthusiasm for training on the senso. He clearly enjoys the exercises and can already feel the positive effects. "I can learn to keep my balance very well (...) I think it's great!" he reports. Timo's progress illustrates how effective cognitive-motor training can be and the benefits it offers in rehabilitation.

The success of the therapy is immediately visible thanks to the module, as it provides precise feedback on how well the training has been mastered. The patient's progress is presented in the form of an easy-to-understand curve that directly shows which goals have been achieved and in which areas improvements have been made. This transparent presentation of the results enables the patient to clearly understand their own progress, which additionally increases motivation and leads to more committed participation in the further therapy process.

For the next therapy session we use the tigo, a motorised movement exerciser for the legs and upper body. Timo particularly appreciates the opportunity to "cycle through a beautiful landscape at the same time and visualise my progress." Another significant advantage is that the tigo can be used as an approved aid for the home, as Stefanie Schwarz explains. This enables patients to flexibly and seamlessly incorporate their therapy into their everyday lives, ensuring consistent continuation of treatment and sustainable progress. Even watching the training is fun and makes you want to cycle along yourself.

Timo's last therapy session is gait training in the lyra. I am impressed by how quickly Timo is secured in the gait trainer and can start training. "With robot-assisted gait training using the lyra, the patient is able for the first time to be continuously guided into the walking movement over a longer period of time thanks to the secured position," Stefanie explains to me. The end-effector gait trainer is also ideal for maintaining and promoting general mobility. Thanks to the secure attachment, the patient feels protected and can concentrate fully on training. In addition, the patient's endurance is trained, which makes it possible to carry out increasingly longer therapy sequences.

Through this type of therapy, the physiotherapist can offer their patient efficient and effective ways to get back on their feet and provide quality support to

ensure rapid progress. In conversation with Stefanie, I realise once again how valuable these systems are for dealing with staff shortages. The exercises can be carried out more precisely, more frequently and also more independently, which saves the therapists' resources considerably without having a detrimental effect on the patients. When you watch Timo training in the lyra, you can clearly see the joy in his eyes: "We are friends – for sure!"

"The THERA-Trainer devices can be easily integrated into everyday practice," explains Stefanie. She emphasises that they are seen as a significant reduction in workload. Timo is also enthusiastic about the training sessions and always looks forward to his therapy. He is impressed by the THERA-Trainer devices and has achieved his first significant progress thanks to this innovative therapy approach – and in a much shorter time. The targeted use of the equipment not only enables him to achieve success more quickly, but also provides a motivating and varied therapy experience.

Would you like to find out more about Timo's story?

Then take a look at his Instagram profile and follow his amazing progress!

Leoni Schulz has been supporting the editorial team of THERAPY magazine since mid-2024. In addition to her responsibilities in the areas of 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.

The THERA-Trainer devices can be easily integrated into everyday practice.

TECHNOLOGY & PRACTICE

Motor-cognitive training in everyday therapy

Fall prevention through the use of innovative therapy devices

Miriam Keifert, Eleftheria Giannouli and Tim Fleiner

A precise interaction between motor, sensory and cognitive skills is necessary for everyday activities and should be taken into account for targeted fall prevention. Effects can be achieved in particular through integrated, interactive training. Through the use of innovative therapy devices, this can be implemented in everyday practice in an effective and evidence-based manner.

Fall prevention is an important aspect of physiotherapy, partly due to the ageing population and the large number of falls with sometimes serious consequences, high healthcare costs and scarce resources. The importance of fall prevention is increasingly being recognised and focuses, for example, on environmental conditions, behaviour or individual training programmes. According

to the "World guidelines for falls prevention and management for older adults", training programmes should take everyday life into account and therefore include functional exercises (e.g. stepping) and dual-task exercises (1). Balance and strength training should also be incorporated as part of an individual, challenging and progressive exercise programme (1).

The combination of movement and thinking tasks proves to be far superior to purely physical training.

Figure 1a: Weight shifting on the THERA-Trainer senso (stepping).

Motor-cognitive interaction

On a physical level, the main causes of an increased risk of falling are loss of muscle mass (sarcopenia) and loss of muscle power (dynapenia). Interestingly, dynapenia progresses faster than sarcopenia. This illustrates that one of the most important fall risk factors, muscular weakness, is due to deficits not only of the motor system but also of the nervous system [2]. This suggests that the focus of training therapy should not only be on motor functions, but that the cognitive component should also be taken into account. Precise interaction between motor skills, sensory systems and the central nervous system is necessary for all activities of everyday life. Mirelman et al. (3) found in their prospective study of people living in retirement homes that the risk of future falls could be predicted by performance in executive functions and attention tests. They therefore recommend training executive functions to reduce the risk of falling (3). Training the interaction between the body (motor and sensory system) and the brain is central here (4). In dual-task paradigms in particular, it becomes clear that walking also requires cognitive resources. If a person is asked to perform a cognitive task such as arithmetic in addition to walking, the gait pattern changes. The additional task requires resources that are no longer available to control walking (5).

Motor-cognitive training: many possibilities, but what works well?

Motor-cognitive training can be carried out sequentially or simultaneously. An example of sequential training is running on a treadmill followed by cognitive training, as is still frequently practised today. Simultaneous training can involve unrelated tasks, for example running and solving cognitive tasks at the same time. Interactive training involving related tasks, such as dancing or exergames, should lead to better training effects and more closely resembles everyday situations, since the thinking task cannot usually be separated from the movement task. The advantages are that tasks are not prioritised. Due to the similarity to everyday tasks, the trainees experience a greater perceived sense of purpose, which is also reflected in their adherence to training. In addition, exergames are usually more time-saving and are perceived as motivating due to their playful character (4).

Motor-cognitive training is used in many areas, including neurology, orthopaedics, geriatrics and even paediatrics.

Figure 1b: Weight shifting on the THERA-Trainer senso (weight shift).

Improving step reaction playfully

One example of an innovative approach to motor-cognitive training is the THERA-Trainer senso, which was developed by the Swiss company Dividat as Dividat senso and has been used in numerous studies. The device uses pressure sensors in the floor plates to detect the trainee's step movements and weight shifts. At the same time, a screen displays the games for training specific cognitive functions, which can be customised and controlled via the reactions of the floor plates (see Figure 1). For example, therapeutic staff can use a tablet to create training plans with different focal points for individual patients or view their training history. The senso is not only a training device, but also a test device that can be used to carry out assessments (see Figure 2). To ensure the right training stimulus at all times, a progression algorithm adjusts the difficulty in real time. Preventing under- and overexertion, as well as rewarding learning achievements, can be seen as essential elements in this context for maintaining motivation and optimising training success.

MindMotion® GO from Mindmaze also offers a very motivating approach. Using a monitor, the patient can interactively train their motor and cognitive

Figure 2a: Assessment and analysis of balance ability (carrying out an assessment).

Figure 2b: Assessment and analysis of balance ability (assessment).

skills in an immersive virtual environment based on games. The movements of the entire body are recorded by a camera, enabling training of the upper and lower extremities. For long-term training, the MindMotion® home therapy programme can be used in the home environment. It can be remotely monitored and adjusted by therapy staff, enabling a step towards telerehabilitation.

Neuroscience Research Australia developed the smart±step training game system (see Figure 3) to enable users to train intuitively, safely and independently at home. This approach uses a wireless step mat and customised versions of popular video games displayed on a monitor, such as your own TV, to improve balance and cognitive function. In one study, the participants trained for 120 minutes a week over 12 months. The group with the smart±step training was able to reduce the number of falls by 26 per cent compared to the control group, which carried out cognitive training in a seated position (6).

Therapeutic benefits – not only effective for fall prevention

The combination of movement and thinking tasks proves to be far superior to purely physical training. Synergistic effects are present, as physical activity appears to cause neuroplastic effects in the brain, such as the development of new nerve cells (4). In particular, the cognitive challenge might be critical to maintaining these effects (e.g. integration of the new cells into an existing network) (4). Motor-cognitive training can improve cognitive performance, such as concentration and cognitive flexibility. Physical performance can also benefit from this type of training, which may result in improved balance or faster reaction and walking speed, among other things. These parameters are in turn associated with a reduced risk of falling (7-10).

Motor-cognitive training is used in many areas, including neurology, orthopaedics, geriatrics and even paediatrics. The results were promising: people

The devices can be used by most people and are very popular with therapeutic staff and patients.

with severe cognitive impairments showed an improvement in their general cognitive status and mental well-being as a result of motor-cognitive training, while the control group deteriorated (8).

Motor-cognitive training in everyday therapy

The use of such innovative devices in everyday therapy is very versatile and differs depending on the setting and target group. However, a key common feature is that the appliances are almost never left unused. The reason for this is that the devices can be used by most people and are very popular with therapeutic staff and patients.

Many report that they enjoy the training because of the playful component. In addition, the overview of the training progress after each therapy game motivates them as they endeavour to be even better next time.

The motor-cognitive training can be integrated into an efficient group training programme, but self-therapy is also possible if the person does not require direct supervision. The basis for this is the very intuitive operation via the floor plates alone. The therapy staff can assign therapy plans to the exercisers, who log in to the device, for example using a chip, and the training progress can be monitored at all times. As well as being used as training equipment, these devices can also be used for assessments to record step reaction time, for example. Ideally, an assessment is carried out before the intervention so that the therapy can be planned accordingly. In addition, further assessments should take place halfway through the stay and at the end to review progress. The results of the assessments can be clearly visualised and also taken into account for further care in the outpatient setting.

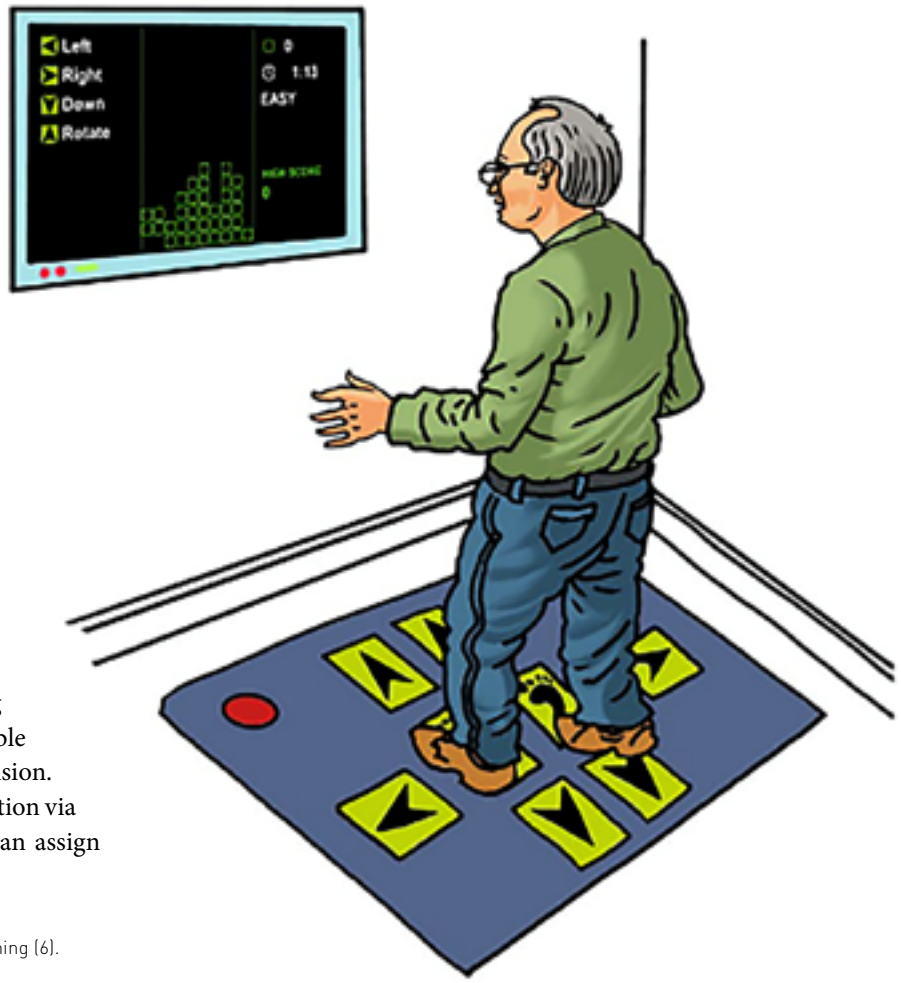


Figure 3: Graphical representation of smart±step training (6).

Outlook: step reaction training in everyday PT

The aim of step reaction training is to react quickly and effectively to external stimuli, for example to take steps in a certain direction in response to visual or auditory signals. Unpredictable situations, such as tripping, require a quick reaction time in order to maintain stability and gait safety. According to recent findings, the assessment of step reaction time and stepping training based on this has proven to be an effective approach to fall prevention (11). Approaches for reactive and involuntary training, such as by means of perturbation training or volitional motor-cognitive training, for example via senso, are currently being investigated.

Portable mats with integrated pressure sensors are also used, which are connected to a tablet, a screen or the TV at home and provide a playful training programme. This portable approach of "stepping training" has proven to be very practicable and effective in preventing falls (6).

Thanks to innovations such as these, the recording of step reaction time and the motor-cognitive training based on it can be used in prevention and the entire care process. It is not only available in clinics and specialised outpatient facilities. When implemented in everyday care, including as a test and training device for home visits, step reaction training becomes an interesting prospect for physiotherapy and for the healthcare of older people in general.

Scan the QR code for the original report: Motor-cognitive training in everyday therapy • pt magazine for physiotherapists
l.ead.me/therapy-24-02-58

SOURCES:

Montero-Odasso M, et al. World guidelines for falls prevention and management for older adults: A global initiative. Age Ageing 51, 9: afac205; 2022

Clark BC, et al. What is dynapenia? Nutrition 28, 5: 495-503: 2012

Mirelman A, et al. Executive function and falls in older adults: New findings from a five-year prospective study link fall risk to cognition. PLoS ONE 7, 6: e40297; 2012

Herold F, et al. Thinking while moving or moving while thinking – concepts of motor-cognitive training for cognitive performance enhancement. Front Aging Neurosci. 10: 228; 2018

Beurskens R, et al. Age-related deficits of dual-task walking: A review. Neural. Plast. 2012: 1-9; 2012

Sturnieks DL, et al. Exergame and cognitive training for preventing falls in community-dwelling older people: A randomized controlled trial. Nat. Med. 30, 1: 98-105; 2024

Schättin A, et al. Adaptations of prefrontal brain activity, executive functions, and gait in healthy elderly following exergame and balance training: A randomized-controlled study. Front. Aging Neurosci. 8: 278; 2016

Swinnen N, et al. The efficacy of exergaming in people with major neurocognitive disorder residing in long-term care facilities: A pilot randomized controlled trial. Alzheimers Res. Ther. 13, 1: 70; 2021

Altorfer P, et al. Feasibility of cognitive-motor exergames in geriatric inpatient rehabilitation: A pilot randomized controlled study. Front Aging Neurosci. 13: 739948; 2021

Jäggi S, et al. Feasibility and effects of cognitive–motor exergames on fall risk factors in typical and atypical Parkinson's inpatients: A randomized controlled pilot study. Eur. J. Med. Res. 28, 1: 30; 2023

Okubo Y, et al. Stepping impairment and falls in older adults: A systematic review and meta-analysis of volitional and reactive step tests. Ageing Res. Rev. 66: 101238; 2021

Together for people – against stroke

Prevention, acute care and aftercare for a healthy life

Dr Michael Brinkmeier

Since its establishment by Liz Mohn in 1993, the Stiftung Deutsche Schlaganfall-Hilfe (German Stroke Foundation) has pursued the goal of preventing strokes and counteracting the consequences of this condition. From prevention and health promotion to emergency management and acute care through to rehabilitation and aftercare, the Foundation is involved in all areas.

Almost 270,000 people in Germany suffer a stroke every year.

Every year, almost 270,000 people in Germany suffer a stroke, almost 200,000 of which are first-time strokes. Strengthening acute therapy was therefore one of the Foundation's first milestones after it was established over 30 years ago. Today, there are more than 350 specialised stroke units in Germany, which are certified by the Foundation and the German Stroke Society in order to promote their quality. As a result, almost twice as many patients survive strokes today than 30 years ago. The German Stroke Foundation aims to achieve further improvements for those affected by regularly contributing to medical guidelines from the acute and aftercare sectors. The Foundation is therefore also keen to engage in dialogue with various stakeholders in the healthcare system, such as therapeutic and medical professionals. It is also present at trade fairs such as OTWorld.

Improving aftercare

The German Stroke Foundation sees potential for improvement above all in the area of aftercare. Improving aftercare is therefore an important goal for the coming years. To achieve this, the Foundation has launched innovative pilot projects, including the introduction of stroke guides. Stroke guides accompany those affected as they make their way back to everyday life for a year after the stroke. Their aim is to improve the independence and quality of life of those affected. To this end, they coordinate treatments by doctors and therapists, promote adherence to therapy and provide support with everyday questions, for example about social benefits or other care services. The aim of the Foundation is for the stroke guides to become part of standard care in the future. This year, the German Stroke Foundation launched the LEX LOTSEN OWL project, which is subsidised by the Innovation Fund, in order to test how the transfer to standard care can succeed.

Strong voluntary work

But the stroke guides are not the only aftercare project run by the Foundation. Because those affected and their relatives often feel overwhelmed during aftercare, the German Stroke Foundation has launched the concept of volunteer stroke helpers. They provide support in everyday life. The Foundation has already trained more than 600 stroke helpers throughout Germany. It also promotes self-help groups by providing organisational support during the start-up phase, training opportunities for group spokespersons and financial support. Around 350 stroke self-help groups have already been set up under the umbrella of the Foundation. It is supported in its work by around 190 regional representatives, mostly doctors from clinics and rehabilitation centres. They work for the Foundation on a voluntary basis and pass on their expert knowledge in lectures, for example.

Living a self-determined life again

Therapists are important contacts for people who have suffered a stroke. They are "up close and personal" and provide valuable tips on returning to life. The same applies to the provision of medical aids. The right aids make everyday life easier for people who have suffered a stroke. Intensive counselling is necessary to ensure that the aids are precisely tailored to individual needs. The German Stroke Foundation qualifies medical supply stores to

Potential for growth is seen above all in the area of aftercare.

Founder and President Liz Mohn

Stroke guides accompany those affected as they make their way back to everyday life.

provide optimal, individualised care for those affected. Rehabilitation sport has many benefits for people who have suffered a stroke: here they can improve their endurance, strength, coordination and flexibility in a group of people with similar experiences. With the SPORTnachSCHLAG model project, the Foundation therefore supports sports clubs in the model state of North Rhine-Westphalia financially and with advice on setting up new rehabilitation sports groups for those affected.

Stroke counselling

The German Stroke Foundation sees itself as the number one point of contact for those affected and their relatives. Its service and advice centre is available free of charge to answer any questions you may have about strokes. In addition to information on rehabilitation measures and aids, the team also provides advice on everyday problems. In cooperation with the Foundation, 30 regional offices throughout Germany also offer a point of contact for those affected. They know their region inside out when it comes to stroke care.

Help for all age groups

A stroke can affect anyone. Age is the biggest risk factor here: 80 per cent of those affected are over 60 years old. But strokes also affect around 30,000 people under the age of 55 every year. As the needs of different age groups differ, the German Stroke Foundation offers separate series of events for younger and older people affected by stroke. Few people realise that children can also have strokes, even unborn babies in the womb. Several hundred cases are reported in Germany every year, but the number of unreported cases is much higher, as many childhood strokes remain unrecognised. The Foundation does not leave the often very burdened, affected families alone and supports them with parent seminars, summer camps and child stroke counsellors.

Strokes also affect around 30,000 people under the age of 55 every year

Preventing strokes

In addition to its commitment to those affected and their relatives, the German Stroke Foundation also sees itself as a driving force in education and prevention work. At events, in the media and at www.schlaganfall-hilfe.de, it provides information about the causes and symptoms of strokes and the correct behaviour in an emergency. The FAST test

The concept of the summer camps: fun and games for the children and valuable dialogue for the parents.

Playing sport together with other stroke sufferers: rehabilitation sport after a stroke.

app helps you to quickly and easily check whether stroke symptoms are present in an emergency. The Foundation's "online risk test" allows anyone interested to determine their personal risk profile at any time and free of charge. And for companies, the Foundation offers a "risk check": in just 15 minutes, employees are informed about the lifestyle-related risk factors for cardiovascular disease and prevention options by means of a personal risk test.

More than 600 stroke helpers have already been trained throughout Germany.

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Assistive technologies in fall prevention in the home environment

Results of a Health Technology Assessment

Dominik Fuchs, Stefanie Schmid, Matthias Gaßner, Andreas Hechtl,
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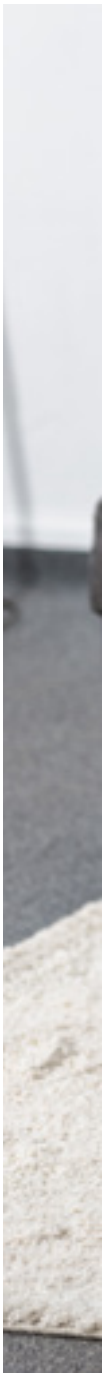
CARE REGIO project



Falls in old age represent a considerable health risk and result in high costs. Assistive technologies such as sensor systems and smart home solutions offer innovative approaches to fall prevention and could both improve the quality of life of older people and reduce the burden on the healthcare system. Discover how these technologies work, what the challenges are and what recommendations have been developed for their successful implementation.

Falls pose a considerable health risk for older people. Around a third of over-65s and half of over-80s fall at least once a year, with the majority of these falls occurring at home (Endress et al., 2023; Jansen et al., 2021). Fall-related injuries are among the most common causes of hospitalisation and the need for long-term care in old age (Schoene et al., 2023). In addition to the individual consequences for those affected, falls also represent an enormous economic burden for the healthcare system. In Germany alone, the total annual costs are expected to be in the billions (Jansen et al., 2021).

In view of the demographic ageing of society, fall prevention is becoming increasingly important. Numerous studies show that the fall rate can be significantly reduced through targeted measures, in particular through physical training and the elimination of fall hazards in the living environment (Becker & Bauer, 2023; Schoene et al., 2023).

Assistive technologies offer promising new approaches for recognising risk factors at an early stage and preventing falls (Moers, 2023). These include, for example, sensor systems for fall detection, robotics-supported training programmes and smart home solutions for adapting the living environment. The widespread implementation of

effective technology-supported prevention strategies could not only improve the quality of life of older people, but also contribute to considerable cost savings in the healthcare system.

The central research questions focus on:

1. The effectiveness of medical care compared to conventional measures and factors influencing acceptance.
2. Technological challenges and security aspects.
3. Health economics cost-benefit assessment.
4. Ethical, social and legal aspects such as data protection and privacy.

German and English-language studies from 2015 to July 2024 were selected from relevant databases for the systematic literature search. These include studies with seniors over 65 years of age in a home setting that investigated assistive technologies for fall prevention. The study quality was assessed using customised criteria. This article presents results from sub-project 4 "Assistive systems" of the CARE REGIO joint project.

Innovative approaches such as sensor systems and smart home solutions can reduce the risk of falls in older people.

Efficacy and safety

Current evidence suggests that various assistive technologies can be effective in preventing falls in older people in the home environment. A meta-analysis by Lee et al. (2024) showed that telehealth programmes, exergames, smart home systems and wearable sensors were able to significantly reduce the risk of falling compared to control groups. Exergames in particular, which combine physical training with cognitive stimulation, appear to be very promising. Several meta-analyses show that exergaming can improve balance control and reduce falls in healthy seniors with similar or even better effects than conventional training (Chen et al., 2021; Cieślik et al., 2023). There is also evidence that virtual reality training improves balance and gait (Piech & Czernicki, 2021).

In the field of wearable sensors, studies suggest that algorithms that combine acceleration data from body sensors with questionnaire data can assess the risk of falling with high accuracy and thus represent an objective alternative to clinical assessment tools (Greene et al., 2021). The detection of near-falls using wearables to identify high-risk individuals at an early stage also appears promising (Pang et al., 2019). For smart home solutions such as intelligent lighting or fall sensors, there is also evidence of an effective reduction in the fall rate as a useful addition to active training programmes (Del Miranda-Duro et al., 2021).

Despite these positive results, the quality of evidence is still limited. Many studies have methodological limitations, such as small samples, short intervention durations or a lack of comparisons with established methods. In particular, there is a lack of controlled long-term studies that allow a comparison with conventional measures and an investigation of hard endpoints such as the actual incidence of falls (Del Miranda-Duro et al., 2021).

In terms of technical aspects and safety, a number of challenges still need to be overcome to ensure reliable everyday use. These include a user-friendly design, sufficient battery life, stable data transmission and

Successful implementation could lead to considerable cost savings in the healthcare system.

processing performance as well as the fulfilment of high quality and safety standards (Del Miranda-Duro et al., 2021; Zhao et al., 2021). Regular maintenance and reliable support are essential, as technical failures in fall prevention can have serious consequences (Merda et al., 2017). It is also crucial to protect the privacy and sensitive health data of users through suitable encryption and authentication procedures (Merda et al., 2017).

User acceptance and implementation

Older people often express reservations about new technologies due to fear of contact, fear of stigmatisation or concerns about surveillance and loss of autonomy (Peek et al., 2016). To break down these barriers, the systems must be easy to use, reliable and immediately recognisable as useful (Thordardottir et al., 2019). An intuitive user interface, sufficiently large displays and buttons, easy-to-understand instructions and a target group-orientated look are just as important as taking into account possible sensory and motor impairments of the user (Gaspar & Lapão, 2021).

It is also crucial to involve users in the development and testing of the technologies at an early stage. Their expectations, wishes and experiences provide valuable information for a needs-based design (Merda et al., 2017). For example, exergames should be both motivating and challenging through age-appropriate game content and difficulty levels (Mähs, 2021). Flexible adaptation to individual abilities and preferences, for example with regard to the range of functions or the wearability of sensors, can also increase acceptance (Chaccour et al., 2017).

In addition to user-friendly design, training and support play a key role in successful implementation. Both the older users and their relatives and carers need guidance and support to be able to use the systems effectively (Ohneberg et al., 2023). This calls for target group-specific, low-threshold approaches that gradually introduce the technology and include practical everyday exercises. Continuous support and the involvement of more tech-savvy caregivers can also help to solve any problems that arise and maintain motivation (Parzen et al., 2021).

Nursing staff also need to be sensitised to and trained in the use of assistive technologies. There are often still reservations that the systems could lead to additional work or replace interpersonal attention (Scorna et al., 2021). To counteract this, the technologies should be communicated as a supplement and to make work easier. Interprofessional training courses that combine nursing science and technical aspects can help to reduce fear of contact and strengthen the technical skills of carers (Braeseke et al., 2022).

Last but not least, assistive technologies must be sensibly integrated into existing care and nursing processes. To date, the needs of people requiring care and existing care routines have been given too little consideration in the development of technology (GKV-Spitzenverband, 2021). Stronger networking between manufacturers, research and care practice is necessary in order to develop solutions suitable for everyday use. It is also important to examine how the systems can be integrated into higher-level care structures such as GP practices, care support centres or hospitals (Braeseke et al., 2022). Cross-sector collaboration and interface management could promote acceptance among professional carers.

Health economics aspects

The health economics consideration of assistive technologies in home-based fall prevention is an important aspect in the assessment of their feasibility and dissemination. In the long term, these technologies could pay off economically if their use avoids the consequential costs of falls. In the USA alone, around 50 billion dollars are spent annually on fall-related injuries in older people, so effective prevention measures could make significant savings (Tanwar et al., 2022). The need for personal support could also be reduced by customised digital solutions (Hamm et al., 2016).

Braeseke et al. (2022) emphasise that although the costs of implementing technical assistance systems are high, long-term savings are possible due to the potential for reducing care times and relieving the burden on staff. Accordingly, age-appropriate technologies could be used to help older people or those in need of support to carry out everyday tasks and ensure their safety. This could reduce the workload for carers and caregivers and delay or even prevent admission to a care facility (Mähs, 2021).

However, the currently still high costs are a major obstacle to widespread use. As Scorna et al. (2021)

state, many of the current systems for fall prevention are too cost-intensive, which is an argument against purchasing them. This applies in particular to the outpatient sector, where the investment costs often cannot be justified by a high frequency of use and rapid amortisation (Braeseke et al., 2022). The costs of clinical gait analysis tools are also often too high for use at home (Chaccour et al., 2017).

Another problem is the unresolved financing issue. Neither long-term care insurance nor health insurance companies have yet covered the costs of assistance systems to any great extent, which is slowing down the spread of such services (Merda et al., 2017). As Lee et al. (2024) show, lower household income goes hand in hand with lower technology use, so high costs can make it more difficult for lower-income groups to adopt technology.

To date, only a few high-quality studies are available on the health economics evaluation of age-appropriate assistive technologies for fall prevention. In order to improve the economic potential of these technologies, various criteria should be used in their evaluation. In addition to the acquisition costs, subsequent costs such as installation, maintenance, repairs, training and ongoing operating costs must also be included in the cost evaluation. This is offset by potential savings, e.g. by avoiding fall-related injuries and the need for care. A long-term perspective is important in order to be able to map sustainable effects (Mähs & Fachinger, 2022; Merda et al., 2017).

In addition, the evaluation should take into account different perspectives, such as those of the health insurer and the insured person as the beneficiary. For health insurance, the direct, tangible costs and benefits are primarily relevant in order to consider the potential reduction in expenditure. From the perspective of the insured, on the other hand, non-monetary benefits such as subjective health and quality of life are particularly important (Mähs & Fachinger, 2022).

Ethical and social implications

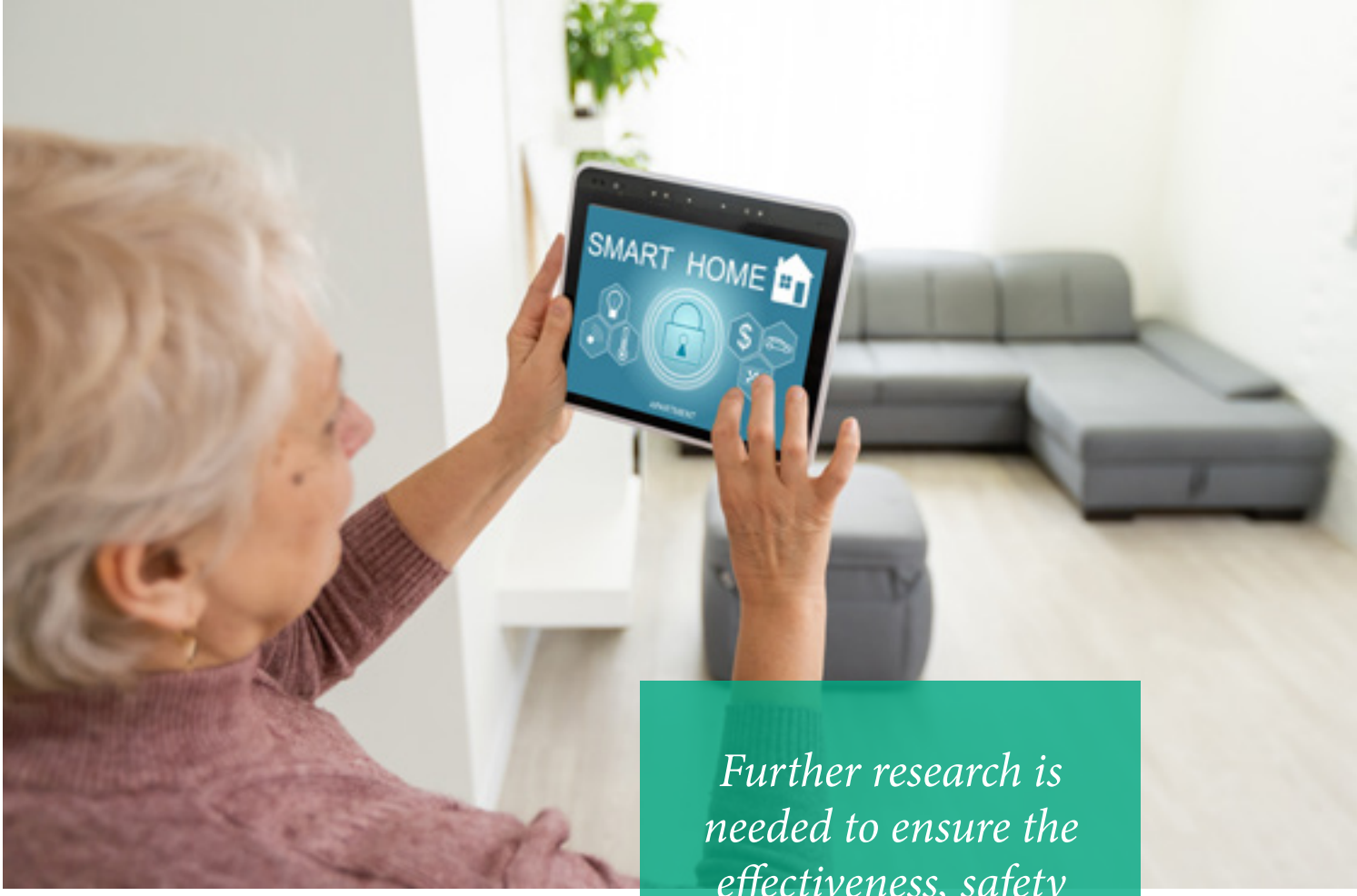
One key aspect is the processing of personal and sensitive health data by the assistive systems. The requirements of the General Data Protection Regulation (GDPR) must be observed here, which is a challenge due to the complexity and diversity of the technologies. It is important to clearly define responsibilities, obtain consent, guarantee data security and transparency and take into account the rights of data subjects. There are special requirements for the use of cloud services, localisation functions and learning systems (GKV-Spitzenverband, 2021; Merda et al., 2017).

The protection of privacy is a critical issue. Many older people express reservations about this, especially when cameras or tracking systems are used. There is a risk of surveillance and restriction of self-determination here. On the other hand, monitoring can also increase safety. An appropriate balance must be found between protection and autonomy and individual preferences must be taken into account (Del Miranda-Duro et al., 2021; Madara Marasinghe, 2016).

In addition to data protection and privacy, the effects on social relationships and care structures must also be considered. On the one hand, assistive technologies can relieve and support carers and professionals. On the other hand, there is concern that human attention and care will be pushed back as a result. This calls for models that see technology as a supplement to human care rather than a substitute for it. The GKV-Spitzenverband (2021) emphasises that technical innovations must not lead to a substitution of personal care, but must be seen as supplements.

It is also important to maintain motivation over a longer period of time (Lee et al., 2024; Mähs, 2021). In addition, socio-cultural reservations about the use of technology in care must be taken seriously, especially among carers. Targeted information and training programmes are needed to bring about change (Braeseke et al., 2022).

The debate about the benefits of digital applications for people in need of care remains central to the ongoing discussion in this area. This is because in the area of health and care provision for older people, it is about criteria that are not only focussed on medical benefits, but also take into account aspects that are aimed at self-determination, independence and quality of life (GKV-Spitzenverband, 2021).



Further research is needed to ensure the effectiveness, safety and acceptance of these technologies.

Conclusion and outlook

The present analysis shows that assistive technologies offer promising approaches for improving the prevention of falls in older people at home. Telehealth, exergames, assistance technologies for movement training, smart homes and wearables can supplement or even surpass the effectiveness of conventional measures by specifically addressing risk factors such as balance and gait disorders. However, the evidence base is still limited and there is a need for further research, particularly on long-term effects and comparisons with established methods.

In addition to effectiveness, aspects such as economics, user acceptance and ethical and legal implications must also be taken into account for successful implementation in practice. There are still various barriers that need to be broken down through user-orientated development, training, financial incentives and education. It is crucial to consistently focus on the needs and preferences of the target group, which is often far removed from technology, in order to reduce fear of contact and promote adherence. In addition, data protection and self-determination must be safeguarded and technology must always be seen as a supplement rather than a substitute for human attention.

In order to utilise the potential of assistive technologies in fall prevention, the following recommendations for research, development and practice can be derived:

- Methodologically high-quality studies with sufficiently large samples, longer time periods and hard endpoints are necessary to prove the effectiveness beyond doubt in comparison to conventional measures.
- Technology development should be carried out in a participatory manner with the early involvement of people in need of care, relatives and carers in order to increase needs and acceptance. User motivation and adherence must be promoted through target group-specific design.
- Technical improvements in terms of energy efficiency, reliability and sensor fusion should be sought and supported through standardisation. In addition to effectiveness, intervention studies should also investigate long-term implementation in everyday care.

- Health economics analyses, taking into account direct and indirect costs, long-term effects and different perspectives, are necessary to evaluate costs and benefits and develop viable financing concepts.
- Data protection, ethics and user autonomy must take top priority during development and use. Technical innovations must not replace personal care, but complement it in a targeted manner. All stakeholders must be closely involved.

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If these aspects can be implemented consistently, age-appropriate assistance technologies can make a valuable contribution to preventing falls, promoting independence and improving the quality of life of people in need of care. This opens up new perspectives for overcoming the challenges of demographic change and ensuring needs-based, dignified care in the long term.

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SOURCES:

Becker, C. & Bauer, J. M. (2023). Leitlinien und Leitplanken für die Fallprävention [Guidelines and guiding principles for the prevention of falls]. Zeitschrift fur Gerontologie und Geriatrie, 56(6), 445–447. https://doi.org/10.1007/s00391-023-02234-8

Braeseke, G., Pflug, C., Lingott, N. & Pörschmann-Schreiber, U. (2022). Technische Assistenzsysteme in der pflegerischen Versorgung. [Technical assistance systems in nursing care.] In E.-W. Luthe, S. V. Müller & I. Schiering (eds.), Gesundheit. Politik - Gesellschaft - Wirtschaft. Assistive Technologien im Sozial- und Gesundheitssektor [Assistive technologies in the social and health sector] (p. 649-667). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-34027-8_26

Chaccour, K., Darazi, R., El Hassani, A. H. & Andres, E. (2017). From Fall Detection to Fall Prevention: A Generic Classification of Fall-Related Systems. IEEE Sensors Journal, 17(3), 812–822. https://doi.org/10.1109/JSEN.2016.2628099

Chen, Y., Zhang, Y., Guo, Z., Bao, D. & Zhou, J. (2021). Comparison between the effects of exergame intervention and traditional physical training on improving balance and fall prevention in healthy older adults: a systematic review and meta-analysis. Journal of neuroengineering and rehabilitation, 18(1), 164. https://doi.org/10.1186/s12984-021-00917-0

Cieślik, B., Mazurek, J., Wrzeciono, A., Maistrello, L., Szczepańska-Gieracha, J., Conte, P. & Kiper, P. (2023). Examining technology-assisted rehabilitation for older adults' functional mobility: a network meta-analysis on efficacy and acceptability. NPJ digital medicine, 6(1), 159. https://doi.org/10.1038/s41746-023-00907-7

Del Miranda-Duro, M. C., Nieto-Riveiro, L., Concheiro-Moscoso, P., Groba, B., Pousada, T., Canosa, N. & Pereira, J. (2021). Occupational Therapy and the Use of Technology on Older Adult Fall Prevention: A Scoping Review. International journal of environmental research and public health, 18(2). https://doi.org/10.3390/ijerph18020702

Endress, C., Schwenk, M., Werner, C., Becker, C. & Jansen, C.-P. (2023). Lebensstilintegriertes funktionelles Training zur Sturzprävention: Wie und warum verändert sich das Gehverhalten? [Lifestyle-integrated functional exercise for fall prevention: How and why do walking characteristics change?]. Zeitschrift fur Gerontologie und Geriatrie, 56(6), 464–469. https://doi.org/10.1007/s00391-023-02230-y

Gaspar, A. G. M. & Lapão, L. V. (2021). eHealth for Addressing Balance Disorders in the Elderly: Systematic Review. Journal of medical Internet research, 23(4), e22215. https://doi.org/10.2196/22215

GKV-Spitzenverband. (2021). Forschung für die Pflege: Impulse zur Weiterentwicklung der Pflegeversicherung. [Research for long-term care: Impulses for the further development of long-term care insurance.]

Greene, B. R., McManus, K., Ader, L. G. M. & Caulfield, B. (2021). Unsupervised Assessment of Balance and Falls Risk Using a Smartphone and Machine Learning. Sensors (Basel, Switzerland), 21(14). https://doi.org/10.3390/s21144770

Hamm, J., Money, A. G., Atwal, A. & Paraskevopoulos, I. (2016). Fall prevention intervention technologies: A conceptual framework and survey of the state of the art. Journal of biomedical informatics, 59, 319–345. https://doi.org/10.1016/j.jbi.2015.12.013

Jansen, C.P., Gross, M., Kramer-Gmeiner, F., Blessing, U., Becker, C. & Schwenk, M. (2021). Empfehlungspapier für das körperliche Gruppentraining zur Sturzprävention bei älteren, zu Hause lebenden Menschen: Aktualisierung des Empfehlungspapiers der Bundesinitiative Sturzprävention von 2009 [Group-based exercise to prevent falls in community-dwelling older adults: Update of the 2009 recommendations of the German Federal Initiative to Prevent Falls]. Zeitschrift fur Gerontologie und Geriatrie, 54(3), 229–239. https://doi.org/10.1007/s00391-021-01876-w

Lee, K., Yi, J. & Lee, S. H. (2024). Effects of community-based fall prevention interventions for older adults using information and communication technology: A systematic review and meta-analysis. Health informatics journal, 30(2), 14604582241259324. https://doi.org/10.1177/14604582241259324

Madara Marasinghe, K. (2016). Assistive technologies in reducing caregiver burden among informal caregivers of older adults: a systematic review. Disability and rehabilitation. Assistive technology, 11(5), 353–360. https://doi.org/10.3109/17483107.2015.1087061

Mähs, M. (2021). Anforderungen an die Evaluation von altersgerechten Assistenztechnologien aus gesundheitsökonomischer Sicht. [Requirements for the evaluation of age-appropriate assistive technologies from a health economics perspective.] In D. Frommeld, U. Scorna, S. Haug & K. Weber (eds.), Gute Technik für ein gutes Leben im Alter? [Good technology for a good life in old age?] (p. 317-340). transcript Verlag. https://doi.org/10.1515/9783839454695-014

Mähs, M. & Fachinger, U. (2022). Die Analyse ökonomischer Potentiale assistierender Technologien im Pflege- und Gesundheitssektor – Zur Problematik einer adäquaten Kosten-Nutzen-Bewertung. [Analysing the economic potential of assistive technologies in the care and health sector – The problem of an adequate cost-benefit assessment.] In E.-W. Luthe, S. V. Müller & I. Schiering (Hrsg.),Gesundheit. Politik - Gesellschaft - Wirtschaft. Assistive Technologien im Sozial- und Gesundheitssektor [Assistive technologies in the social and health sector] (p. 527–545). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-34027-8_21

Merda, M., Schmidt, K. & Kähler, B. (2017). Pflege 4.0 – Einsatz moderner Technologien aus der Sicht professionell Pflegender. [Care 4.0 – The use of modern technologies from the perspective of professional carers.]

Moers, S. (2023). Für Sie analysiert – Globale Leitlinie zur Sturzprävention. [Analysed for you – Global guideline for fall prevention.] physiopraxis, 21(03), 14-17. https://doi.org/10.1055/a-1976-0076

Ohneberg, C., Stöbich, N., Warmbein, A., Rathgeber, I., Mehler-Klamt, A. C., Fischer, U. & Eberl, I. (2023). Assistive robotic systems in nursing care: a scoping review. BMC nursing, 22(1), 72. https://doi.org/10.1186/s12912-023-01230-y

Pang, I., Okubo, Y., Sturnieks, D., Lord, S. R. & Brodie, M. A. (2019). Detection of Near Falls Using Wearable Devices: A Systematic Review. Journal of geriatric physical therapy (2001), 42(1), 48–56. https://doi.org/10.1519/JPT.0000000000000181

Parzen, M., O'Keefe-McCarthy, S., Salfi, J. & Taplay, K. (2021). Perceptions of Informal Caregivers Use of Smart Technology in Caring for an Older Adult. Occupational Health, 230–239.

Peek, S. T. M., Wouters, E. J. M., Luijkx, K. G. & Vrijhoef, H. J. M. (2016). What it Takes to Successfully Implement Technology for Aging in Place: Focus Groups With Stakeholders. Journal of medical Internet research, 18(5), e98. https://doi.org/10.2196/jmir.5253

Piech, J. & Czernicki, K. (2021). Virtual Reality Rehabilitation and Exergames—Physical and Psychological Impact on Fall Prevention among the Elderly—A Literature Review. Applied Sciences, 11(9), 4098. https://doi.org/10.3390/app11094098

Remmers, H. (2019). Pflege und Technik. Stand der Diskussion und zentrale ethische Fragen. [Care and technology. State of the debate and key ethical issues.] Ethik in der Medizin, 31(4), 407–430. https://doi.org/10.1007/s00481-019-00545-2

Schoene, D., Gross, M., Stengel, S. von, Kohl, M., Kladny, B., Gosch, M., Sieber, C. C., Peters, S., Kiesswetter, E., Becker, C. & Kemmler, W. (2023). Empfehlungen für ein körperliches Training zur Sturzprävention bei älteren, selbständig lebenden Menschen. [Recommendations for physical training to prevent falls in older people living independently.] Osteologie, 32(03), 183-195. https://doi.org/10.1055/a-2110-7105

Scorna, U., Frommeld, D [Deborah], Haug, S. & Weber, K. (2021). Digitale Technik in der Pflege als Generallösung? Neue Perspektiven auf altersgerechte Assistenzsysteme. [Digital technology in care as a general solution? New perspectives on age-appropriate assistance systems.] In C. Freier, J. König, A. Manzeschke & B. Städtler-Mach (Hrsg.), Perspektiven Sozialwirtschaft und Sozialmanagement. Gegenwart und Zukunft sozialer Dienstleistungsarbeit. [Perspectives on social economics and social management. Present and future of social service work] (p. 301–314). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-32556-5_21

Tanwar, R., Nandal, N., Zamani, M. & Manaf, A. A. (2022). Pathway of Trends and Technologies in Fall Detection: A Systematic Review. Healthcare (Basel, Switzerland), 10(1). https://doi.org/10.3390/healthcare10010172

Thordardottir, B., Malmgren Fänge, A., Lethin, C., Rodriguez Gatta, D. & Chiatti, C. (2019). Acceptance and Use of Innovative Assistive Technologies among People with Cognitive Impairment and Their Caregivers: A Systematic Review. BioMed research international, 2019, 9196729. https://doi.org/10.1155/2019/9196729

Zhao, G., Chen, L. & Ning, H. (2021). Sensor-Based Fall Risk Assessment: A Survey. Healthcare (Basel, Switzerland), 9(11). https://doi.org/10.3390/healthcare9111448

TECHNOLOGY & DEVELOPMENT

Continuous improvement through feedback from the field

How THERA-Trainer focuses on practical experience – from development test to real application: insights into the continuous improvement of our medical products

Lorena Aumann

For over 30 years, THERA-Trainer has stood for the development and distribution of high-quality movement exercisers and therapy devices that are used in neurological and geriatric rehabilitation worldwide. THERA-Trainer medical products are intended for exercise therapy and must therefore fulfil the strict quality and performance requirements that are essential in this field. As part of the Post Market Clinical Follow-up (PMCF), THERA-Trainer is committed to proactively collecting and analysing clinical data to confirm the safety and performance of the products throughout their lifetime.

"The safety and efficiency of our products make an important contribution to the therapeutic success of the patients whose state of health we want to improve sustainably with the help of our devices," explains Miriam Keifert, Product Manager at THERA-Trainer. "That's why our products undergo extensive and often lengthy testing at our sites to ensure the highest quality and reliability." This thorough examination is essential, but it alone is not enough to recognise all practical challenges.

Questions often arise in the application that can only be answered through direct practical experience: What difficulties arise when using the bemo bed bike in the hectic everyday life of an intensive care

unit? What special requirements arise when using the tigo movement exerciser for different clinical pictures? And how can the lyra electromechanical gait trainer be customised even better to the needs of patients and therapists?

"You don't get answers to questions like these in simulated test environments," emphasises the product manager. "These insights are only gained through feedback from users in practice." For this reason, THERA-Trainer launched a Germany-wide online survey this year among therapists who work with the equipment on a daily basis. The aim of the survey was to gather information on the safety, performance and benefits of the therapy and training equipment and to further optimise the products on this basis. Some of the results of this survey are presented below.

tigo movement exerciser (cycling)

The THERA-Trainer tigo is a medical training device that is used for movement therapy. It is especially designed for people who have lost their mobility due to illness, injury or other restrictions. The device enables training of the upper or lower extremities, whereby both passive (supported by the device), assistive (partially supported) and active (independent) training is possible.

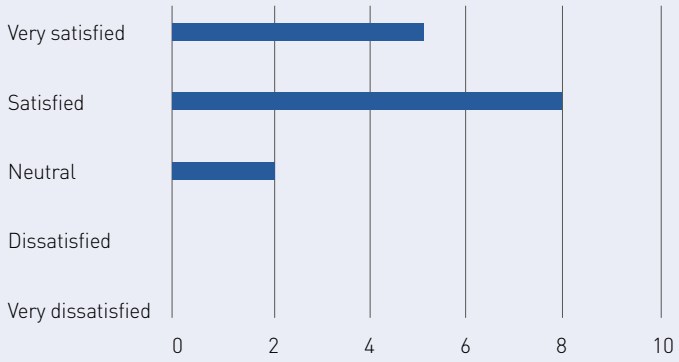
The THERA-Trainer tigo is mainly used in the rehabilitation of people with neurological disorders such as strokes, multiple sclerosis or Parkinson's disease. People with geriatric and orthopaedic restrictions also benefit from the targeted promotion of movement.

The results of this survey provide valuable insights into the utilisation and effectiveness of THERA-Trainers.

Customisability of the tigo

The THERA-Trainer tigo's adaptability is crucial for optimising its use in the therapy of a wide range of patients. Patients in rehabilitation centres differ not only in terms of their body size, but also in terms of their clinical pictures and therapy goals. The tigo is intended to offer the opportunity to cater for these diverse needs on an individual basis.

The results of the survey show a high level of satisfaction among therapists with the customisability of the therapy device, which indicates its versatility. This supports targeted and effective rehabilitation, regardless of the patient's individual circumstances.



Therapists' satisfaction with the customisability of the tigo to patients' needs.

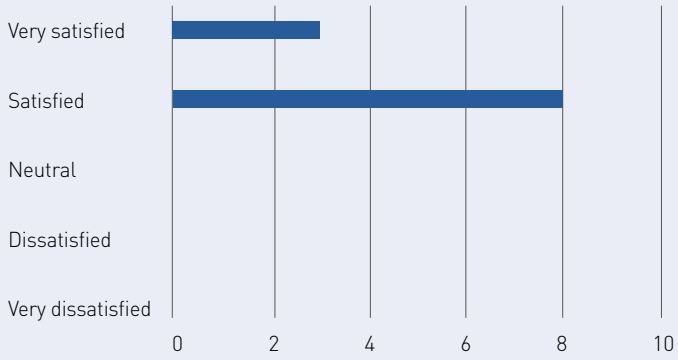
Therapeutic efficacy of the tigo

Furthermore, 14 out of 15 therapists feel that the therapeutic effectiveness of training with the tigo is better than with alternative forms of therapy. According to customer feedback, an important plus point is that patients feel more motivated and have a stronger drive when training with the tigo. This also results from the clear visibility of the successes for the patients.

Standing & balancing devices

The THERA-Trainer standing & balancing devices are specialised rehabilitation devices designed to improve the standing and balancing skills of people with motor impairments or neurological disorders. These devices support patients in regaining mobility, stability and balance and are often used in neurorehabilitation.

Customisability of the standing & balancing devices
The devices in the standing & balancing product line show equally good results in terms of adaptability to patient needs as the tigo. They are also suitable for treating a wide range of patients and can be adapted to different conditions.



Therapists' satisfaction with the customisability of the standing & balancing devices to patients' needs.

The feedback shows us what really matters when designing and using the therapy devices

lyra gait trainer

The THERA-Trainer lyra is a state-of-the-art gait therapy device that has been specially developed for the rehabilitation of patients with neurological impairments in order to re-learn or improve walking. It is a robot-assisted gait training system that simulates the natural walking movement in a safe environment. The lyra is frequently used in neurorehabilitation, e.g. for patients with strokes, craniocerebral injuries or other neurological diseases that lead to limitations in walking ability.

The THERA-Trainer lyra helps to improve patients' walking ability and gait pattern, increase their muscle power and endurance and regain confidence in their own mobility.

Therapeutic efficacy of the THERA-Trainer lyra
In the case of the lyra, the possibility of starting therapy at an early stage is a particularly positive feature. In comparison to walking with a therapist's assistance or walking on a treadmill, the use of the lyra allows the first steps to be taken earlier in the course of therapy. The number of repetitions achieved is also much higher than with comparable therapy methods. However, the lyra not only has advantages for the patients; the therapists also benefit from the relief provided by the use of the gait trainer.

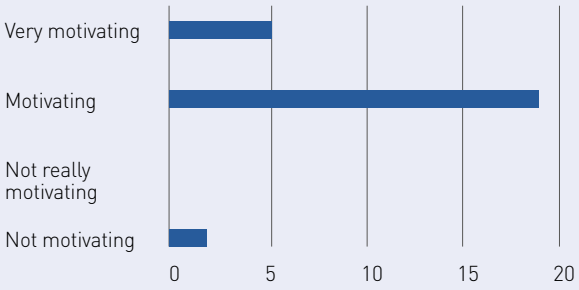
Utilisation of the devices

The information provided by the therapists on the average duration of a training session and the number of daily sessions per device provide informative values on the frequency of use. High utilisation indicates that the devices are used regularly and intensively in everyday therapy, which is an important factor for cost-effectiveness and acceptance.

The information provided by the therapists on the average duration of a training session and the number of daily sessions per device results in the following values:

	tigo	Standing & balancing	lyra
∅ Training duration (min)	14.3	21.9	20.0
∅ Utilisation $(\frac{1}{\text{Day} * \text{Device}})$	18.1	7.6	6.3
∅ Walking time	4.3	2.8	2.1

The THERA-Trainers are used several times a day in the therapy sessions and make a significant contribution to enriching everyday therapy. The tigo in particular has an impressive average utilisation rate of 4.3 hours per day. This corresponds to about half of a working day and illustrates how much the devices help to relieve the therapists. Depending on the patient's condition, 1:1 supervision by the therapist is often not required during training with one of the THERA-Trainers, so the therapist can supervise several patients at the same time. In times of a shortage of specialists, this is a great advantage, as patients can still receive a comprehensive range of treatment options.



Patient motivation through the games/biofeedback with the THERA-Trainers

Motivation through biofeedback

Biofeedback plays an important role in rehabilitation as it gives patients real-time feedback on their physical functions and progress. This direct visualisation of your own performance not only helps to increase awareness of your own body, but also promotes targeted training. In rehabilitation, biofeedback can be used as a motivational tool to actively involve patients in the therapy process and support them on their way to a better recovery. It serves as a motivating element that makes progress clear and comprehensible, which in turn can lead to greater therapeutic success.

The playful forms of therapy are intended to encourage patients to enjoy the sessions and at the same time increase their motivation during training, thereby achieving better therapy results. With the help of biofeedback, patients and therapists can visualise the results of each training session and clearly recognise progress.

The assessment of the therapists surveyed shows that 24 out of 26 patients find the combination of games and biofeedback motivating or even very motivating. This increased motivation is aimed at improving the patients' drive and stamina, which can have a direct positive influence on the rehabilitation process.

Summary and conclusion

The results of this survey provide valuable insights into the utilisation and effectiveness of THERA-Trainers. They illustrate both existing potential for improvement and the strengths of the devices in everyday therapeutic practice. The feedback shows us what is really important in the design and use of the therapy devices and provides us with concrete pointers for optimisation.

It is important to note that the results are based on a limited number of data sets and therefore no generalised statements can be made. Nevertheless, they provide a significant assessment of how well the THERA-Trainers are matched to the requirements of therapeutic practice.

We would like to thank all the therapists who took part in our survey. Their experience from daily practice is invaluable and contributes significantly to the continuous improvement of THERA-Trainers. We always welcome your feedback and greatly appreciate your support.

Lorena Aumann recently completed her studies in medical technology and is starting her career as a trainee at THERA-Trainer by medica Medizintechnik GmbH.

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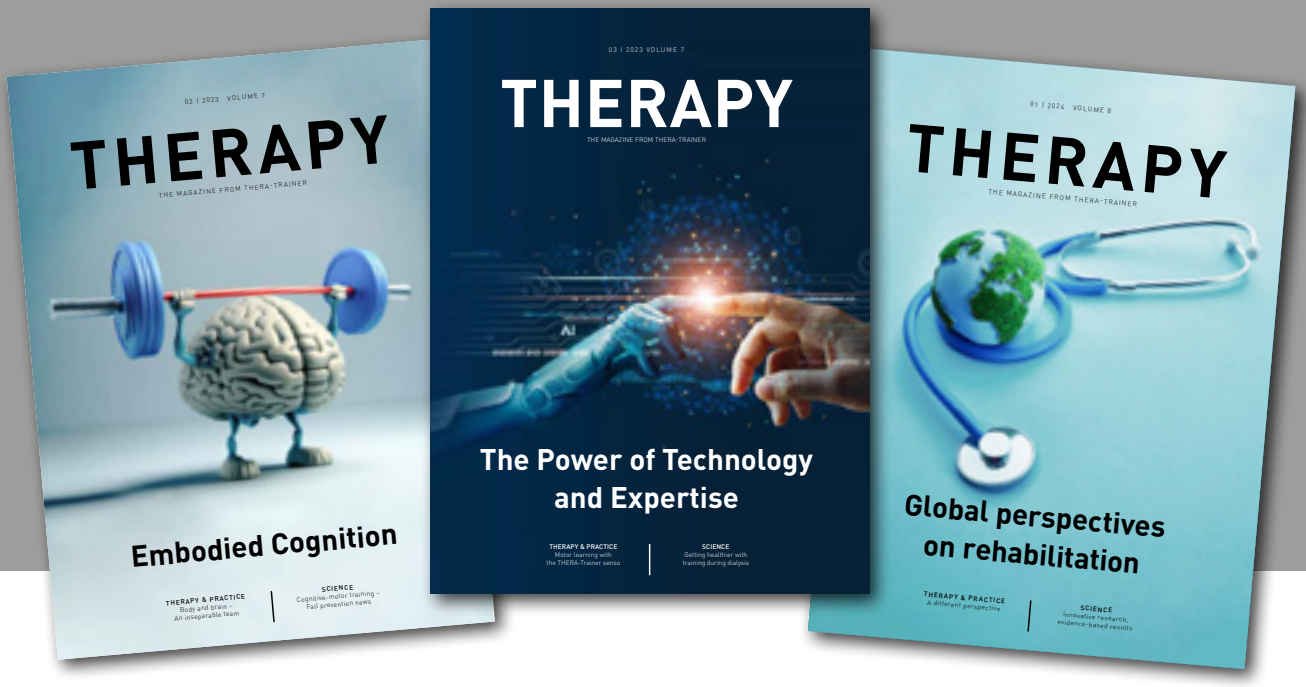

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