

Research overview of the Parkinson's rollator

rollz motion rhythm



Prologue

Thank you for your interest in the Rollz Motion Rhythm.

This overview focuses on scientific evidence for the use of rollators in Parkinson’s disease, as well as background information about the development and functioning of the Rollz Motion Rhythm. The focus will be on Parkinson’s disease and the positive effects of exercise on the progression of this condition, as well as the effect of cues on exercise. The final section will showcase research underlining the effectiveness of the Rollz Motion Rhythm.

Hopefully, this will answer your questions about the Rollz Motion Rhythm. For more information, you can contact us via info@rollz.com.

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About Rollz International BV

At Rollz, we believe that a human has no shortcomings, only the technology is lacking to support one properly. By adapting the technology to meet the needs and abilities of individuals (*Figure 1*), the possibilities of the user enlarge. Rollz develops modular products that support people in the mobility they need to participate in society and to live life to the fullest.

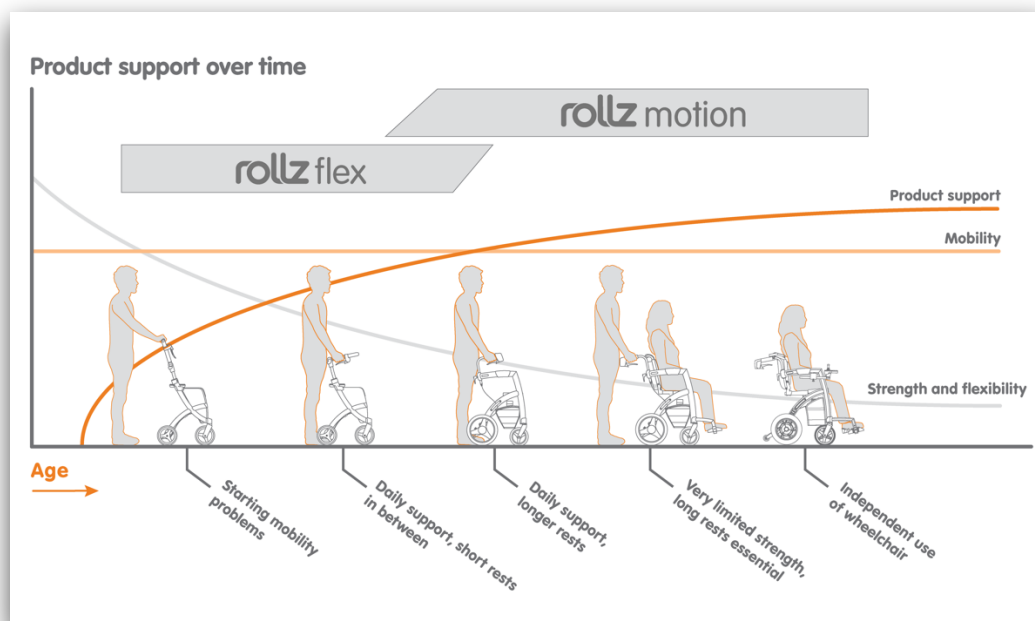


Figure 1: Rollz's vision

Motivation of developing a Parkinson's rollator

In 2017, we noticed that many Rollz Motion users were people living with Parkinson's disease. After conducting market research, we found that existing rollators for Parkinson's patients did not meet their needs. We discussed our findings with several medical specialists and concluded that it was necessary to build the first rollator that meets European Standards.

Rollz Motion Rhythm

The Rollz Motion Rhythm is a highly manoeuvrable rollator with unmatched stability and premium quality brakes. The large wheels cross obstacles easily and a folding mechanism allows compact transportation. Multiple adjustable cues are included to help one regain or keep up the walking pace.

Multiple cues

The Rollz Motion Rhythm combines multiple cues that can be easily activated or deactivated on the go by pressing a button on the handgrip. The unique combination of visual, auditory, and haptic cues (*Figure 2*) allows Parkinson's patients to have the right cue at the right moment. Additionally, each cue can be adjusted to perfectly suit the user's needs in terms of speed, intensity, and duration, enabling every person living with Parkinson's to use the device in their own rhythm.



Figure 2: Description of the three cues integrated in the Rollz Motion Rhythm

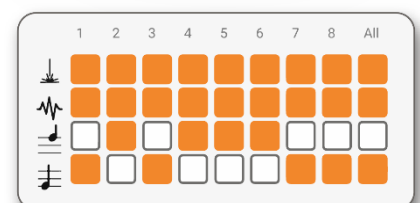
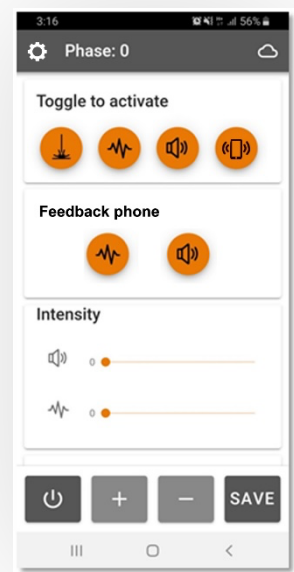
Synchronise the rollator to your phone

The pattern and composition of the cues on the Rollz Motion Rhythm can be set both manually and via the accompanying app. When wirelessly connected to the rollator, the app can sync the cues with the device and vibrate and/or play the metronome on the smartphone to increase the intensity of the cue. Alternatively, users can choose to play the cues solely on their smartphone, enabling them to plug in headphones and hear the metronome more privately.

Usability experiences

The Rollz Motion Rhythm was originally designed as a rollator for people living with Parkinson's disease, but we have observed that patients with other neurological conditions, such as Multiple Sclerosis, can also benefit from using cues while walking.

The effect of the Rollz Motion Rhythm cues on a user can be seen at the following videos on our YouTube channel (RollzInternational): ['Walking with Parkinson's disease'](#) ['Rollz Motion Rhythm tested by a Parkinson's patient'](#).



Cues can break the freezing of gait of Parkinson's patients

Parkinson's disease physiology

A human brain can be subdivided into three parts, each responsible for another level of functioning: archi for basic consciousness and reflexes, paleo for automatic movements and emotions, and neo for cognition and learning new behaviors. Parkinson's disease is a neurological disease that affects the paleo-part of the brain, and thus the generation of automatic movements. This causes several motor problems, like balance control and walking.

A common symptom of Parkinson's disease is a disruption of the walking pattern, also known as 'freezing of gait'. With freezing of gait, the forward movement of a patient is blocked, causing sudden imbalance and an increased risk of falling. This freezing usually occurs when starting to walk, while making a turn, when walking through a door frame, or is caused by stress. The feet suddenly sticking to the ground and the upper body moving forward -freezing-, can lead to a fall and fall-related injuries. However, the neo level of the brain has not been affected. So, with conscious effort, it is possible for the patient to suppress symptoms like freezing and perform voluntary movements. It is challenging, though, to stay focused on a task that is usually performed subconsciously. External stimuli can help to direct the focus back on the movement and regain or maintain balance.

Cues

There is extensive scientific proof that the use of cues helps Parkinson's patients to break freezing. Cues can address different senses, depending on the form. Auditory cues, for example, can be rhythmic metronome sounds or implemented in music. Visual cues are in the form of projected lines on the floor. Lastly, the haptic senses can be targeted with vibration cue. All cues form a tool through which the attention of patients stays on the movement.

Not only is freezing disrupted, but it is also shown that all three forms of cues influence the gait pattern of Parkinson's patients. Parameters playing a crucial part in the risk of falling, such as step length and step frequency, improve when walking with cues.

Rollz Motion Rhythm

This literature¹ provides the foundation on which the Rollz Motion Rhythm is designed. All three forms of cues are incorporated into the Rhythm module and can be customized based on user preference.

Key notes:

- Parkinson's disease obstructs automatic movement, like walking, causing patients to freeze.
- With external cues, automatic movements become conscious regaining ability to move.
- Cues can be visually, auditory and/or tactile.

¹ Reference:

- Koshimori Y, Thaut MH. (2018) Future perspectives on neural mechanisms underlying rhythm and music-based neurorehabilitation in Parkinson's disease. *Ageing Res Rev.* 47:133-139
- Nombela C, Hughes LE, Owen AM, Grahn JA. (2013) Into the groove: can rhythm influence Parkinson's disease? *Neurosci Biobehav Rev.* 37(10 Pt 2):2564-70.
- Rutz DG, Benninger DH. (2020) Physical Therapy for Freezing of Gait and Gait Impairments in Parkinson Disease: A Systematic Review. *PM R.* 12(11):1140-1156.
- Literature

Active lifestyle has beneficial mobility effects on Parkinson's patients

Despite the advancing possibilities in the medical world, a cure for Parkinson's has not yet been found. Treatment focuses on suppressing the symptoms through the application of dopamine or deep brain stimulation. Recent research² has also shown the positive effects of exercise on both the symptoms and the progression of Parkinson's disease.

Beneficial effects of exercise

It is well-known that physical activity is beneficial for both the mental and physical health of human beings. These health benefits are also observed in Parkinson's patients who engage in exercise. Motor degradation in gait pattern, balance, and mobility can be reduced and even improved through exercise, which contributes to the quality of life of Parkinson's patients.

In addition to the regular benefits of exercise, it has been shown that physical activity can influence the progression of Parkinson's disease. Through exercise, the death of essential brain cells is significantly delayed, and compensatory motor pathways are created that allow patients to maintain their mobility for a longer time.

Cues effect on activity

To engage in this beneficial activity, Parkinson's patients face certain challenges, such as the occurrence of freezing, which disrupts the automatic gait pattern. However, when external cues are applied, freezing can be broken, and movement can be continued. Recent research has shown that Parkinson's patients who follow therapy with cues are more active. The increased level of physical activity led to improvements in mental health, contributing to an improved quality of life.

Parkinson's patients can optimally benefit from the above-mentioned advantages by walking with a rollator that incorporates cues, such as the Rollz Motion Rhythm.

Key notes:

- Physical activity is beneficial for the overall mobility in able-bodied and Parkinson's patients.
- The progress of Parkinson's disease can be influenced by physical activity.
- Application of cues improves the level of activity.

² Reference:

- Zhen K, Zhang S, Tao X, Li G, Lv Y, Yu L. (2022) A systematic review and meta-analysis on effects of aerobic exercise in people with Parkinson's disease. *NPJ Parkinsons Dis.*, 8(1):146.
- Almikhlaifi MA. (2023) The role of exercise in Parkinson's Disease. *Neurosciences (Riyadh)*, 28(1):4-12.
- Forte R, Tocci N, De Vito G. (2021) The Impact of Exercise Intervention with Rhythmic Auditory Stimulation to Improve Gait and Mobility in Parkinson Disease: An Umbrella Review. *Brain Sci.*, 11(6):685
- van Wegen E, de Goede C, Lim I, et al. (2006) The effect of rhythmic somatosensory cueing on gait in patients with Parkinson's disease. *Neurol Sci.*, 248(1/2):210-214.
- Frazzitta, Giuseppe MD; Balbi, Pietro MD; Maestri, Roberto MS; Bertotti, Gabriella PT; Boveri, Natalia PT; Pezzoli, Gianni MD. (2013) The Beneficial Role of Intensive Exercise on Parkinson Disease Progression. *American Journal of Physical Medicine & Rehabilitation* 92(6):p 523-532.

Application of cues via Rollz Motion Rhythm

During the development process of the Rollz Motion Rhythm, it was researched which cue would be most beneficial for Parkinson's patients. The purpose of this study was to determine whether the functions of the Rollz Motion Rhythm could contribute to an improved user experience and walking pattern for people with Parkinson's.

This was achieved by testing several participants on three different setups: a straight 10m walk, walking an 8-figure of 5m, and a 10m walk with a narrowing (*Figure 3*). Each participant performed the separate settings several times with a different combination of cues. After each setup, an interview was conducted to investigate the participants' experiences.

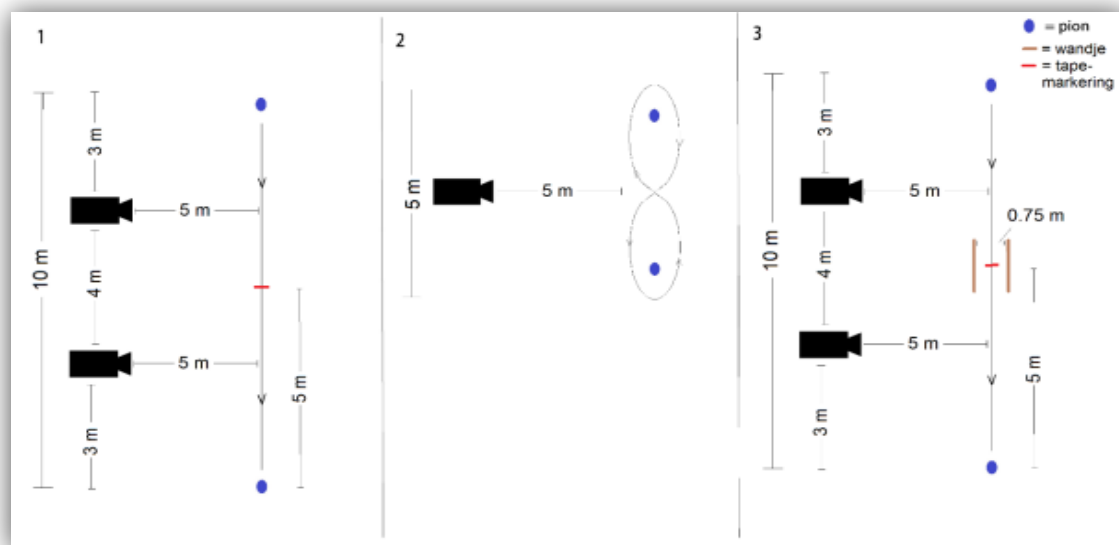


Figure 3: Overview measurement set-ups

Results

Based on this research³ it was concluded that the laser, vibration, and random metronome pattern all contributed to an improved user experience. Scores for the vibration and random metronome pattern were higher than for the audio cue with a specific pitch, as indicated by the questions asked and the grades given to the cues. The placement of the laser on the ground could be improved to enhance the user experience, as suggested by the participants. Specifically, the laser should be projected more forward so that the person doesn't have to look down as much. Some participants suggested placing the laser in front of the rollator, while others felt that a projection of 20 cm forward from the current spot would be sufficient. To further optimize the rollator, the height of the tones could be adjusted so that people with poor hearing can also hear them well.

The laser was experienced as pleasant and helpful for navigating turns. The random metronome pattern contributed the most to an improved gait pattern, with participants taking smaller steps and longer strides while walking with this cue.

³ User study in collaboration with the research group Assistive Technology for Mobility and Sports and Expert Centre Human Movement Technology from The Hague University of Applied Sciences (2020-2021).

Research shows benefits of Rollz Motion Rhythm in Parkinson's

Parkinson's disease affects the functioning of the brain, making it difficult to control muscle movements. This can lead to 'freezing of gait' (the stagnation of walking) and a higher risk of falling. Exercising has a positive influence on the physical health of Parkinson's patients. Auditory, visual, and tactile cues can help break the freeze of gait.

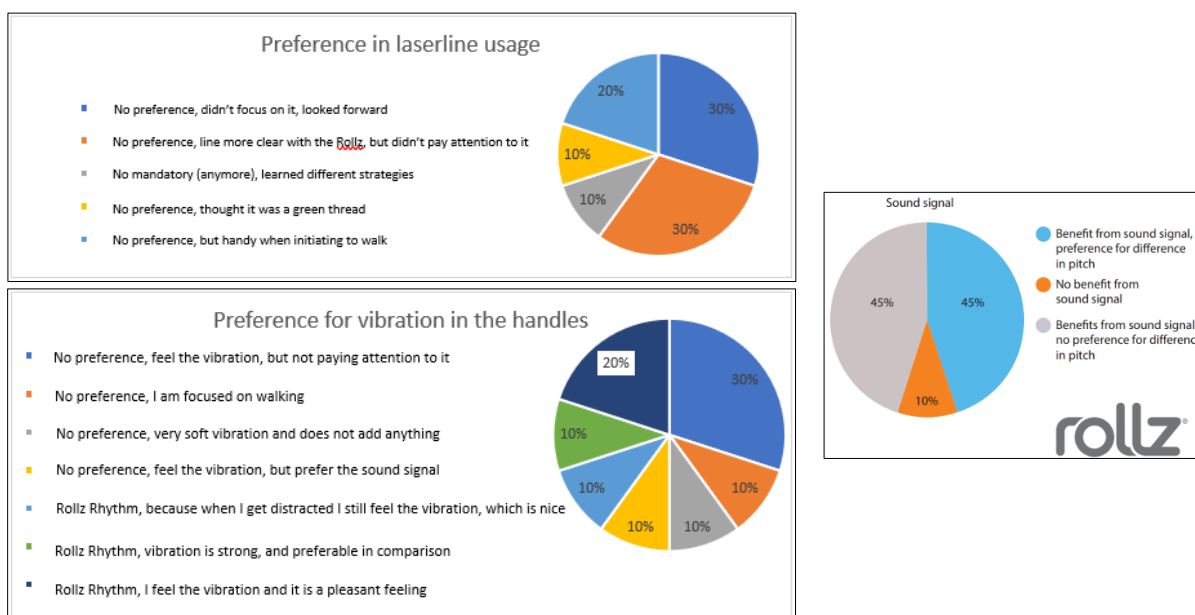
The Rollz Motion Rhythm features a rhythmic sound signal, vibrating handles and a laser line projected on the ground. The rollator is linked to a mobile app, with which the cues can be adjusted and personalised. For example, cues can be switched on and off, a pattern can be made, or the intensity can be customized, which prevents habituation and allows the cues to remain effective. This walker has been developed to promote an active lifestyle for people with neurological disorders, like Parkinson's and MS.

This study⁴ included Parkinson's patients who use a walker in daily life. Using the Rollz Motion Rhythm and another walking aid, the participants had to complete an obstacle course two times (including bends, narrowing, a slalom, and coming to a stop and walking away again). Various measurements have been made to map the effects of the cues, including interviews and gait parameters.

The study shows that 80% of the participants benefited from using the Rollz Motion Rhythm with different cues.

Effects of the three cues

90% of the participants in the study indicated that they benefited from the sound signal and almost half experienced a positive effect from the vibrations. Both cues indicate the walking rhythm and help the user to stay in the personally walking rhythm. The laser line does not appear to be of added value for every Parkinson's patient, but it can help to get moving from a standstill.



⁴ User study in collaboration with the research group Assistive Technology for Mobility and Sports and Expert Centre Human Movement Technology from The Hague University of Applied Sciences (2020-2021).

Case study Rollz Motion Rhythm

This case study intends to use PEO model to explore and reflect on an occupational therapy assessment, intervention, and formulation of recommendations.

Summary of the case to be applied

Vincent* is a 79-year-old gentleman, widowed 5 years ago and has a diagnosis of Parkinson's Disease (PD). He has recently moved from his long-term home due to be closer to family. Now living in a two bed-detached bungalow Vincent is presenting with symptoms of PD, such as stooped posture, masked expression, and slow motor co-ordination. In addition, Vincent has presentations including shuffling gait and freezing while mobilising, particularly at thresholds where there are changes in colour or texture under foot. His son and daughter in law are supporting with his care and transport needs.

One of the recommendations for Vincent was a trial⁵ of the Rollz Motion Rhythm to increase confidence and consequently engagement of meaningful activities. Designed specifically to support the symptoms of Parkinson's Disease, particularly for gait freezing, with sensory feedback through a laser line, vibration and tones promoting continuous and placing of steps.

Trial of the Rollz Motion Rhythm

As hoped, the three key elements of the Rollz Motion Rhythm had a dramatic impact on Vincent's mobility due to its unique features:

- *Laser line:* The line projected onto the floor surface provided a visual prompt to support longer stride length and reduced feedback from the thresh.
- *Sound:* The metronomic beep appeared to regulate step frequency, which created a rhythmical, uninterrupted stride pattern.
- *Vibration:* The pace of the vibration, delivered through the handles, appeared to reinforce the rhythm created by sound, but delivered through an alternative sensory experience. Vincent also stated that he would prefer the vibration when in public, as only he would know it was happening.

As well as the impact on gait and balance, Vincent's posture immediately became more upright, further impacting on step length increased and became more fluent. Vincent's son stated that he had not seen his dad "stand like that for about 10 years" and mobilised throughout his property without any need for supervision or support, which his son had needed to provide since the most recent fall. Both Vincent and his son felt that it was "life-changing", as the use of the new walking aid has facilitated a more independent and active lifestyle.

Use of the Rollz Motion Rhythm has broken the fall cycle, which occurs from anxiety, leading to inactivity and increased risk, due to the psychological and physical reassurance it provided. This increase in activity and confidence has a profound impact on Vincent's overall health, wellbeing, and projected outcomes.

* Name used for illustration purposes only

⁵ The clinical evidence and content for this case study was collated, developed, and written by The OT Service, UK's leading occupational therapy expertise body.

Appendix

This attachment includes all mandatory guidelines regarding safety and health risks as a certified laser (that will not cause blindness or eye-damage), radiation standards and TUV norms.

Security measures during development Rollz Motion Rhythm

- NEN-EN 111999 Loophulpmiddelen die met beide armen worden bediend – Eisen en beproevingsmethoden – Deel 2: Rollators.
- NEN-EN 12182:1999 Technische hulpmiddelen voor gehandicapten – Algemene eisen en beproevingsmethoden.
- NEN-EN 12183 Manual wheelchairs – requirements and test methods.
- NEN-EN 14971:2001 Medische hulpmiddelen – Toepassing van risicomangement voor medische hulpmiddelen.
- NEN-EN 1985:1998 Loophulpmiddelen – Algemene eisen en beproevingsmethoden.
- ISO 7176-1:2000 Wheelchairs – Determination of static stability
- ISO 7176-3:2000 Wheelchairs – Determination of effectiveness of brakes
- ISO 7176-5:2000 Wheelchairs –Determination of overall dimensions, mass and turning space.
- ISO 7176-7:2000 Wheelchairs – Measurement of seating and wheel dimensions
- ISO 7176-8:2000 Wheelchairs – Requirements and test methods for static impact and fatigue strengths
- ISO 7176-16:2000 Wheelchairs – Resistance to ignition of upholstered parts – Requirements and test methods
- ISO 7176-22:2000 Wheelchairs – Set-up procedures
- NEN-EN-ISO 16840-3:2006 Wheelchair seating – part 3: Determination of static impact and repetitive load strengths for postural support devices
- NEN-EN-IEC 60825-1 (en) Safety of laser products - Part 1: Equipment classification and requirements (IEC 60825- 1:2014)