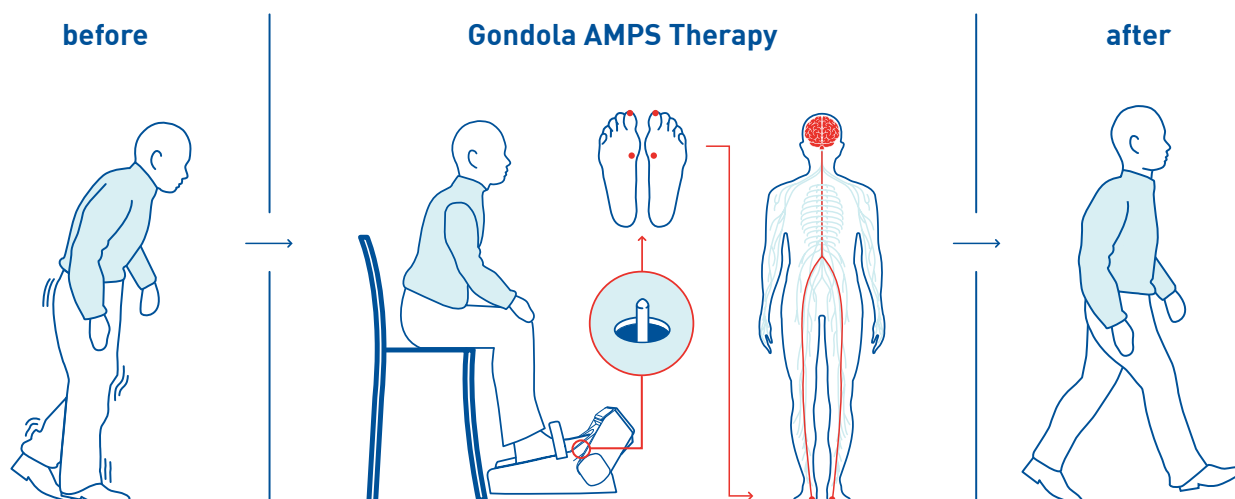




AMPS therapy for neurological disorders

a treatment for walking and balance impairments



THERAPY FOR NEUROLOGICAL DISORDERS

With a neurological disorder such as a **brain lesion** (e.g., stroke), **neurodegenerative disease** (e.g., Parkinson's disease), or **chronic neurological condition** (e.g., CIPN, chemotherapy-induced peripheral neuropathy), walking requires compensatory strategies to overcome the disability. These new walking compensations are demanding and increase the need for cognitive control. On the contrary, a healthy walking pattern is predominantly driven by **automatic patterns** with minimal cognitive control. One way to enhance the automatic circuits and to reduce the cognitive control is through the somatosensory pathway. Somatosensory afferences are known to be essential for body representation and walking control. Specifically, somatosensory stimulation of the soles of the feet can improve walking and balance performance¹⁻⁴ and lead to plasticity in the central nervous system^{5,6}.

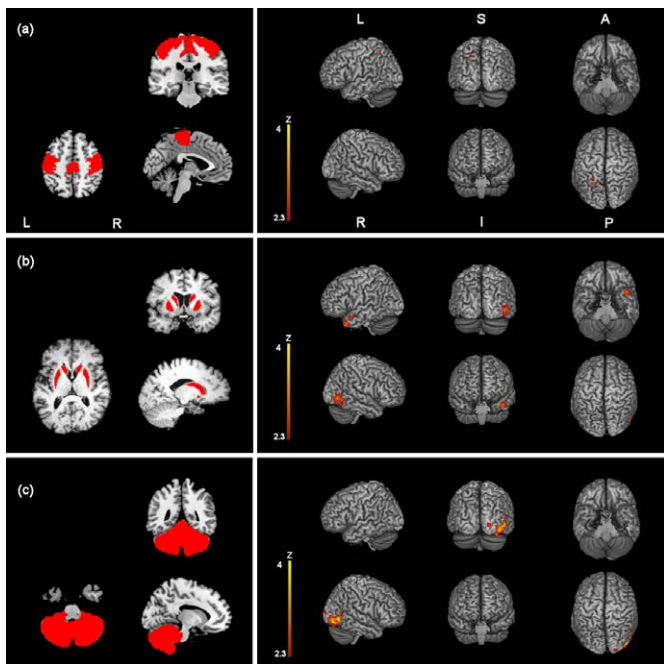
GONDOLA AMPS THERAPY

Gondola Medical Technologies has developed a novel **non-invasive somatosensory stimulation** therapy based on mechanical pressure pulses. The pulses are **applied in two specific areas of both feet**, the head of the big toe and the first metatarsal joint. The therapy comprises of four repetitions of a stimu-

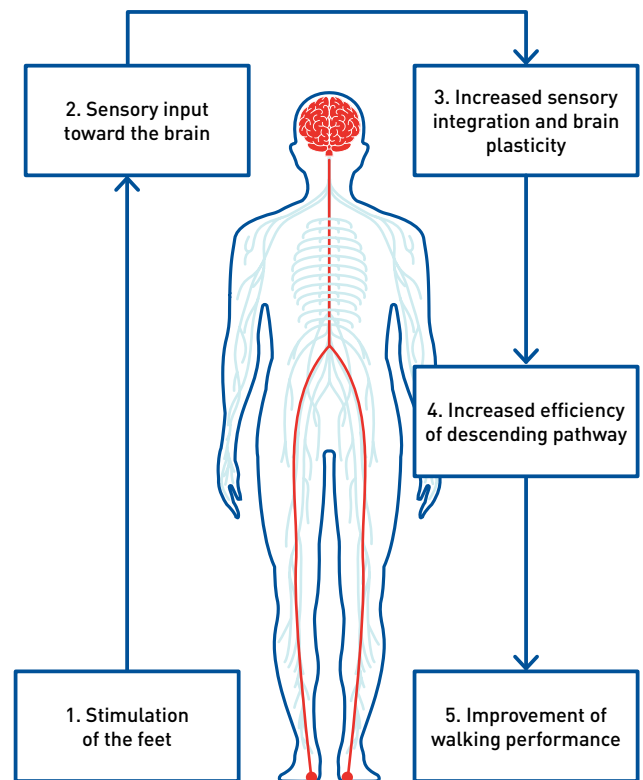
lation cycle that lasts 24 seconds, resulting in an overall therapy time of only 96 seconds. The stimulation cycles each consist of a six-second stimulation of the four specific target areas. This approach is termed the Gondola "**Automated Mechanical Peripheral Stimulation**" (AMPS) therapy. Somatosensory inputs (pressure and tactile inputs) are integrated and processed by the central nervous system, leading to a **synaptic reinforcement** within the sensory-motor system and improved **walking and balance functions**.

THERAPY EFFICACY

The **efficacy** of the AMPS therapy delivered using the Gondola® medical device has been documented in **12 clinical research** studies of over 230 Parkinson's disease patients. These studies showed that AMPS induced a **significant improvement in walking abilities**⁷⁻¹⁴, including speed, stride length, gait symmetry, and turning. Interestingly, the beneficial effects were apparent **after a single AMPS therapy session** and could **remain up to ten days** afterwards⁹. Additionally, it has been demonstrated that AMPS has a **beneficial effect on cardiovascular autonomic control** with a reduced resting blood pressure and improved cardiovascular ability to react and maintain constant blood pressure⁷.



Source: Quattrocchi CC, de Pandis MF, Piervincenzi C, Galli M, Melgari JM, Salomone G, et al. (2015) Acute Modulation of Brain Connectivity in Parkinson Disease after Automatic Mechanical Peripheral Stimulation: A Pilot Study. PLoS ONE 10(10): e0137977. doi:10.1371/journal.pone.0137977



MECHANISM OF ACTION

The mechanism believed to be associated with AMPS is an induced synaptic plasticity with strengthening of the neural circuits involved in walking automaticity. This hypothesis is supported by the clinical outcomes, the discovery of increased connectivity between brain regions involved in walking control^{15,16}, and an increase in brain-derived neurotrophic factor (BDNF) after AMPS¹⁷. BDNF is an essential regulator of synaptic plasticity, supporting motor learning¹⁸. This reinforcement of the neural network might lead to reinforced walking automaticity. Indeed, after AMPS, dual-task performance while walking is also improved¹². This result highlights that cognitive control is decreased after AMPS and thus walking automaticity is improved.

GONDOLA® MEDICAL DEVICE

As delivered using the Gondola® medical device (CE marked and FDA Breakthrough Device Designation), the AMPS therapy is an innovative neuro-rehabilitation technique employing



neuroplasticity mechanisms to enhance walking automaticity. This therapy can be applied to all neurological disorders affecting walking and balance performance due to the generalizability of the therapy mechanisms. The objective of the AMPS therapy is to provide an efficient solution to enhance walking function and improve patients' daily life quality.

REFERENCES (bit.ly/gondolapublications)

- Jenkins ME, et al. Parkinsonism Relat Disord. 2009;15:697-702.
- Lirani-Silva E. Gait Posture. 2017;58:495-497.
- Qiu F, et al. PLOS ONE. 2013;8(12):8.
- Brognara L, et al. Brain Sci. 2020;10(2).
- Clark DJ, et al. J Gerontol A Biol Sci Med Sci. 2014;69(11):1422-1428.
- Fallon JB, et al. J Neurophysiol. 2005;94:10.
- Barbic F, et al. J Appl Physiol. 2014;116(5):495-503.
- Galli M, et al. IJEIT. 2015;4(11):9.
- Stocchi F, et al. Int J Rehabil Res. 2015;38(3):238-245.
- Kleiner A, et al. Park Dis. 2015;2015:1-6.
- Pinto C, et al. Am J Phys Med Rehabil. 2018;97(6):383-389.
- Kleiner AFR, et al. Arch Phys Med Rehabil. 2018;99(12):2420-2429.
- Galli M, et al. Eur J Phys Rehabil Med. 2018;54(6):860-865.
- Prusch JS, et al. Funct Neurol. 2018;33(4):206-212.
- Quattrocchi CC, et al. PLOS ONE. 2015;10(10):e0137977.
- Pagnussat AS, et al. Acta Neurol Scand. 2020;142(3):229-238.
- Pagnussat AS, et al. Restor Neurol Neurosci. 2018;36(2):195-205.
- Alcantara CC, et al. Front Neurol. 2018;9:637.

CONTACT

Gondola Medical Technologies SA
Route de la Corniche 4
1066 Epalinges - Switzerland
Email: info@gondola-medical.com
Headquarters: +41 91 921 38 38