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The Effects of Visuomotor Training on the Functional Recovery of Post-Surgery Musculoskeletal Conditions: A Randomized Controlled Trial

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Abstract: (1) Background: Musculoskeletal conditions show increasing prevalence and high economic/human burden. Recovery for hip or knee surgery may require more than 26 weeks, while universally accepted rehabilitation guidelines are missing. Provided that multisensory-based training enhances motor learning, the study aims to verify if visuomotor training accelerates the recovery of lower limb motor function after orthopedic surgery. (2) Methods: Post-surgery subjects were randomly assigned to receive visuomotor training as an add-on to the conventional physical therapy (VTG), or receive the conventional therapy alone (CG). Subjects performed 40 one-hour training sessions in 8 weeks. The primary endpoint was the improvement in the Lower Extremity Functional Scale (LEFS) over the minimally clinical important difference (MCID) at 4 weeks post-randomization. The secondary endpoint included pain reduction. (3) Results: Eighteen patients were equally distributed into the VTG and CG groups. While LEFS and pain scores significantly improved in both groups, the VTG exceeded the LEFS MCID by 12 points and halved the pain value after the first 4 weeks of treatment, while the CG reached the endpoints only after treatment end (p = 0.0001). (4) Conclusions: Visuomotor training offers an innovative rehabilitation approach that accelerates the recovery of lower limb motor function in patients undergoing orthopedic surgery.

Keywords: musculoskeletal; visuomotor training; sensory-motor training; osteoarthritis; fractures; orthopedic rehabilitation; post-surgery

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1. Introduction

Musculoskeletal disorders are a common cause of disability in developed countries, affecting 20% to 40% of the adult population [1]. These various groups of conditions include arthritis, soft-tissue disorders, injury to the bones, joints, and supporting tissues such as fractures. The prevalence of many of these disorders, like fractures and osteoarthritis, is increasing with aging and other factors (such as obesity [2,3]), resulting in a profound economic, personal, and societal impact [4,5]. Musculoskeletal conditions usually present with pain and loss of function with a negative effect on the health-related quality of life [6]. Most people with a fracture or symptomatic osteoarthritis have surgery [7,8], after which a wide range of treatments can be delivered to assist recovery, especially in the cases associated with high rates of complications as for osteoarthritis of the ankle [9]. No universally accepted clinical guidelines are available to consistently structure rehabilitation for post-surgery conditions [10]. A common method is rehabilitation provided in an outpatient setting on a one-to-one treatment basis [11]. This method is resource-intensive. Post-surgery rehabilitation typically consists of physical therapy aimed at mechanically restoring the functionality of the musculoskeletal system and gait abilities by integrating passive and active limb movements [12–16].

Rehabilitative interventions could be commenced at any stage after the injury (during acute or rehabilitation admission, post-discharge, or across settings) and, generally, are continued until the main objectives are reached—therefore, even for many months and at least for 6–8 weeks [8,12]. Recovery from hip or knee surgery is greatest within the first 26 weeks, although hip patients improve more quickly in most outcomes [17]. Any injury of individual elements of the musculoskeletal system will change the mechanical interaction, sensory afferents and, indirectly, sensory-motor processing, causing degradation, instability, or disability of movement [18]. The functional consequence of impaired sensory-motor integration may be mitigated through augmented training, which ultimately improves motor planning and feedforward control abilities. In fact, motor learning is driven by information from multiple senses. For example, when arm control is faulty, then vision, touch, and proprioception can all impact on arm movements and help guide the adjustments necessary for correcting a motor error. Regardless, while it is well known that the brain integrates information from multiple senses for perception, some studies provided theoretical models describing the role of discrepancies in sensory information (e.g., vision and proprioception) on sensory plasticity and motor learning [19]. In particular, more accurate feedforward motor control is possible when visuomotor information is provided in combination with somatosensory signals and task practice [20,21]. Visuomotor training can be defined as any training or practice that integrates visual perception with motor performance. This training is able to induce changes in remote subcortical and/or spinal networks rather than adaptations in corticomotor pathways [22]. The visuomotor training has been effectively implemented in the treatment for the functional recovery of post-stroke subjects [20] as well as in athletes [23,24] and children with autism [25]; moreover, it was shown to improve function of lower back muscles [22]. The extent of corticomotor plasticity and motor learning induced by complex visuomotor tasks was similar in young and old adults [26]. Based on the above premises, we designed a randomized controlled study to test the effect of visuomotor training at accelerating the recovery of lower limb motor function after surgery as compared to conventional physiotherapy.

2. Materials and Methods

2.1. Population

Subjects were recruited from patients referred to an outpatient Physical and Rehabilitation Medicine service for lower limb post-surgery care. A subject was considered for inclusion in the study if they were an adult who had undergone orthopedic surgery within the previous 2 months, had a Lower Extremity Functional Scale (LEFS) score between 20 and 50 in order to identify walking persons with significant gait disability (according to Dingemans SA et al.,2017) [27], and had provided signed informed consent for the study. Patients were excluded from the study if they were agonistic athletes or had an additional recent (within two years) history of osteoarticular and/or myotendinous trauma, surgery, severe osteoporosis, central and peripheral nervous system diseases, dementia, psychosis, vestibular disorders, or they presented any ocular pathology or any sign of deteriorated visual function.

This study was performed in accordance with the Good Clinical Practice and the Declaration of Helsinki, and the protocol was approved by our institutional review board (Project ID 262, 18 October 2018).

2.2. Intervention

The subjects were randomly assigned to receiving visuomotor training as an add-on to the conventional physical therapy (VTG), or to receiving only the conventional physical therapy (Controls-CG). The two groups of subjects trained for 40 sessions of 1 h duration over a period of 8 weeks (5 times per week). The VTG underwent visuomotor training and conventional therapy for the first four weeks and only conventional therapy for the last four. Visuomotor training consisted of different dual task exercises, both motor and visual, with increasing difficulty and complexity (see Appendix A for details). Conventional physical therapy included active and passive range of motion exercises, muscle strengthening, isokinetic training, proprioceptive exercises, manual lymph drainage as needed, stretching, and gait training.

2.3. Outcome Measures

We collected the following demographic and clinical data: age, gender, diagnosis, site, and side of musculoskeletal injury. The site of the surgery was recorded as follows: hip (pelvis, femoral neck and head, proximal femur), knee (distal femur, knee joint, proximal tibia, patella, and proximal fibula), and ankle (distal tibia and fibula, talus). The primary outcome measure was the LEFS, and the primary endpoint was the improvement in LEFS over the minimally clinical important difference (MCID) (i.e., 9 points according to Binkley JM et al. [28]) after the first four weeks of training (T1). Secondary outcome measures included Numerical Rating Scale (NRS) to rate subject pain, Hip injury and Osteoarthritis Outcome Score (HOOS) or Knee injury and Osteoarthritis Outcome Score (KOOS) or Foot and Ankle Disability Index (FADI) to investigate patients' perceptions of disability related to hip, knee, and ankle, separately; and two-minute walk test (2mWT) and ten-meter walk test (10MWT) to assess the endurance and walking speed. Static and dynamic baropodometric tests were performed during the same sessions to measure the load distribution on feet during rest and walking. In the static test, all individuals remained in a standing, bipedal position with the arms along the body and the eyes open mirrored to a fixed point on the wall of the examination room. They stayed on the platform for an average of 60 s to perform the calibration and measurements. Asymmetry indexes between the two feet and the barycenter were collected. During the assessment of gait (dynamic condition), we recorded the feet contact area and the contact time with the ground. All outcome measures were assessed pre-intervention (T0), after 4 weeks of treatment (T1), and at the end of treatment (T2).

2.4. Sample Size and Statistical Analysis

Conventional therapy is provided for very variable times but, generally, it takes at least two months to achieve the rehabilitation goals. Our hypothesis is based on the fact that visuomotor training in addition to conventional physiotherapy accelerates lower limb functional recovery in the majority of subjects. The sample size was based on the primary outcome measure, LEFS at four weeks post-randomization using an MCID of 9 points between T0 and T1. We estimated that 30% of the subjects in CG reached the MCID compared to 90% of VTG at four weeks post-randomization. A revised calculation (significance level 5%, power 80%) gave a sample size of 9 participants in each group.

Data at baseline were analyzed for normality according to the Shapiro–Wilk test. Friedman test was used to compare the three repeated assessments within each group. A delta index was computed to quantify the change in outcome measures across two time periods: $\Delta T1 - T0 = [(T1\ score - T0\ score)/T0\ score] \times 100$, $\Delta T2 - T0 = [(T2\ score - T0\ score)/T0\ score] \times 100$, and $\Delta T2 - T1 = [(T2\ score - T1\ score)/T1\ score] \times 100$. We used Mann–Whitney U test to realize post hoc comparisons of delta index between groups. The FADI score was reported in the range [0, 100] through mathematical proportion to make it comparable with HOOS and KOOS scores. Hence, the resulting HKF index is a value normalized in the [0, 100] range. For LEFS, we also considered the MCID to test the clinical relevance of absolute changes across the time assessments. Statistical significance was set at $p < 0.05$. SAS StatView 5.0 was used for statistical analysis.

3. Results

3.1. Patient Characteristics

Nine patients were randomly assigned to the experimental group (VTG) and 9 patients to the control group (CG). They all completed the 8-week training program and attended all the visits. The main demographic and clinical characteristics of the study population are summarized in Table 1. At baseline, no significant differences were detected between the 2 groups ($p > 0.05$) in the demographic and clinical characteristics or motor function (LEFS), performance (2mWT, 10MWT), disability-related to lower limb disturbance (HOOS/KOOS/FADI), and baropodometric parameters.

Table 1. Demographic and clinical profile of the two groups at baseline.

	Total Sample	CG (N = 9)	VTG (N = 9)	Between-Group Comparison
Age mean ± SD	56.9 ± 10.1	52.3 ± 8.4	61.6 ± 9.9	ns
Gender (Males)	10 M	3 M	7 M	ns
Site injury and Diagnosis	6 hip (3 OA, 3 F) 6 knee (4 OA, 2 F) 6 ankle F	3 hip (1 OA, 2 F) 3 knee (2 OA, 1 F) 3 ankle F	3 (2 OA, 1F) 3 knee (1 OA, 2 F) 3 ankle F	ns
Side injury	10 left 8 right	6 left 3 right	4 left 5 right	ns

CG = control group; F = fracture; M = male; ns = not significant; OA = osteoarthritis; VTG = visuomotor training group.

3.2. LEFS

The mean score of the LEFS significantly improved in both groups at the end of the physical therapy program; however, the delta index across T0 and T1 was greater in VTG ($p = 0.0001$) and only VTG reached the MCID at T1 follow-up, as shown in Figure 1.

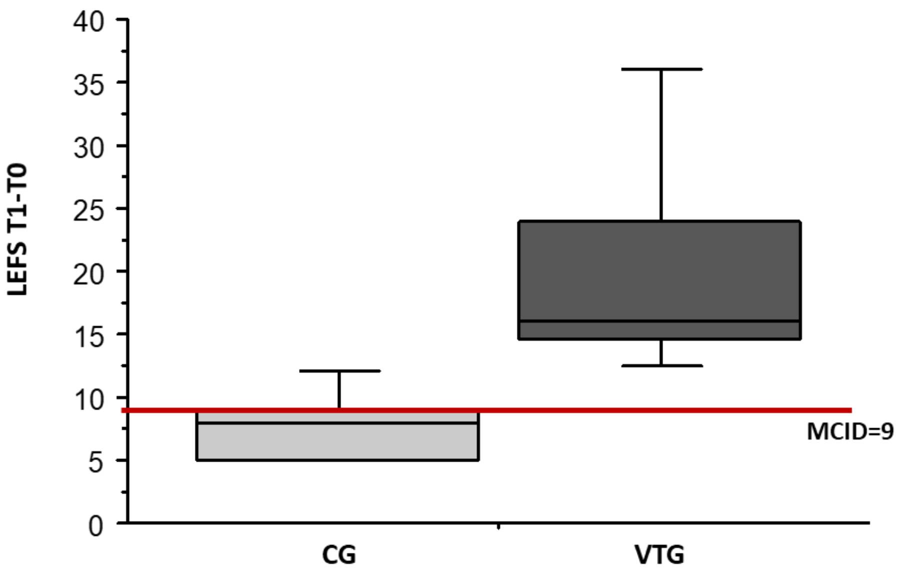

Figure 1. Lower Extremity Functional Scale (LEFS) absolute changes between T1 and T0. The horizontal line represents the LEFS minimum clinically important difference (MCID) that is 9 points. CG = control group; VTG = visuomotor training group.

3.3. Secondary Outcomes

Both groups showed a statistically significant improvement in all outcome measures, except for the barycenter and contralateral contact time, which significantly changed only after visuomotor training (Table 2). The between-group comparison of variable change at T1, with respect to baseline, showed a significant difference in favor of VTG for the following outcome measures: NRS pain, HKF, 2mWT, 10MWT, asymmetry index, affected contact time, and contralateral contact area. The between-group comparison of T2–T0 changes showed a greater improvement after VTG only for 2mWT, whereas the T2–T1 delta index significantly greater in VTG for NRS pain, affected contact time, and contralateral contact area.

Table 2. Clinical variables at baseline (T0), after 4 weeks treatment (T1), and after rehabilitation (T2).

	CG				**VTG**				**Between-Group Comparison**		
	T0	**T1**	**T2**	**Within Group**	**T0**	**T1**	**T2**	**Within Group**	**T1–T0**	**T2–T0**	**T2–T1**
LEFS	33.2 ± 10.1	40.8 ± 9.6	50.9 ± 10.1	**p = 0.0001** **Chi^2 = 18**	29.4 ± 7.4	49.6 ± 9.6	55.9 ± 11.5	**p = 0.0003** **Chi^2 = 16.2**	**p = 0.007** **Z = −2.7**	p = 0.2 Z = −1.3	p = 0.3 Z = −1.1
HKF	58.2 ± 20.7	50.1 ± 12.6	42.6 ± 13.6	**p = 0.0006** **Chi^2 = 14.9**	65.6 ± 29.3	47.3 ± 23.9	42.9 ± 21.9	**p = 0.0006** **Chi^2 = 14.9**	**p = 0.01** **Z = −2.5**	p = 0.2 Z = −1.3	p = 0.3 Z = −1
NRS	5.9 ± 1.1	4.3 ± 0.7	2.3 ± 0.7	**p = 0.0003** **Chi^2 = 16**	6.8 ± 1.4	3.1 ± 1	2.5 ± 1.2	**p = 0.0009** **Chi^2 = 14**	**p = 0.002** **Z = −3**	p = 0.8 Z = −0.2	**p = 0.01** **Z = −2.5**
2mWT	134.2 ± 19.6	160 ± 19.5	185.6 ± 23.1	**p = 0.0001** **Chi^2 = 18**	107.2 ± 53.8	180.4 ± 21.6	204.6 ± 27.5	**p = 0.0001** **Chi^2 = 18**	**p = 0.009** **Z = −2.6**	**p = 0.04** **Z = −2**	p = 0.4 Z = −0.8
10MWT	7.4 ± 1	6.7 ± 0.9	6.2 ± 0.7	**p = 0.0001** **Chi^2 = 18**	7.9 ± 0.7	6.4 ± 0.4	6.2 ± 0.3	**p = 0.0003** **Chi^2 = 16.2**	**p = 0.007** **Z = −2.7**	p = 0.06 Z = −1.9	**p = 0.009** **Z = −2.6**
BC	1.7 ± 0.2	1.5 ± 0.4	1.3 ± 0.5	p = 0.1 Chi^2 = 4.2	1.7 ± 0.4	1.3 ± 0.3	1.2 ± 0.3	**p = 0.0006** **Chi^2 = 14.9**	p = 0.4 Z = −0.8	p = 0.6 Z = −0.6	p = 0.1 Z = −1.6
AI	18.2 ± 4.5	15.8 ± 4.9	13.7 ± 4.6	**p = 0.002** **Chi^2 = 12.7**	15.9 ± 3.9	10.3 ± 2.8	9.4 ± 2.7	**p = 0–002** **Chi^2 = 12.7**	**p = 0.04** **Z = −2**	p = 0.1 Z = −1.6	p = 0.8 Z = −0.3
ACA	153.7 ± 14.9	157.1 ± 13	160.8 ± 11.8	**p = 0.004** **Chi^2 = 10.9**	158.4 ± 19.6	167.7 ± 20.7	169.8 ± 19.5	**p = 0.0003** **Chi^2 = 15.9**	p = 0.1 Z = −1.6	p = 0.5 Z = −0.8	p = 0.5 Z = −0.8
ACT	915.7 ± 99.4	942.6 ± 77.5	983.7 ± 84.6	**p = 0.0006** **Chi^2 = 14.9**	862.7 ± 28	925.8 ± 29.7	938.1 ± 49	**p = 0.002** **Chi^2 = 12.2**	**p = 0.04** **Z = −2**	p = 0.2 Z = −1.4	**p = 0.02** **Z = −2.4**
CCA	173.6 ± 15.8	171.1 ± 14.9	168.3 ± 13.9	**p = 0.0003** **Chi^2 = 16.2**	178 ± 22.9	170.9 ± 20.6	170.1 ± 20.4	**p = 0.0006** **Chi^2 = 14.8**	**p = 0.003** **Z = −3**	p = 0.08 Z = −1.7	**p = 0.02** **Z = −2.4**
CCT	1083.2 ± 194	1034.2 ± 138	1001.4 ± 119	p = 0.06 Chi^2 = 5.6	1063 ± 105	969.1 ± 49	964 ± 39.8	**p = 0.002** **Chi^2 = 12.7**	p = 0.2 Z = −1.3	p = 0.4 Z = −0.9	p = 0.9 Z = −0.04

ACA = affected contact area; ACT = affected contact time; AI = asymmetry index; BC = barycenter; CCA = contralateral contact area; CCT = contralateral contact time; HKF = HOOS KOOS FADI; LEFS = Lower Extremity Functional Scale; NRS = Numerical Rating Scale; 10MWT = ten-meter walk test; 2mWT = two-minute walk test; VTG = visuomotor training group.

4. Discussion

In this study, a physical therapy program including visuomotor training provided significantly faster improvement of lower limb function after orthopedic surgery than conventional rehabilitation. Moreover, VTG compared to CG achieved greater improvement in LEFS score and in almost all outcome measures, including pain NRS, by the term of 4 weeks of treatment. These results are in line with those obtained in different cases, such as on neurological subjects and athletes [20,23,24,29]. After musculoskeletal disorder, a key limitation of rehabilitation is the inability to facilitate the acquisition of injury-resistant motor patterns that persist beyond the clinic [30]. This limitation likely contributes to high rates of secondary injury and long-term pathologic sequalae, such as asymmetric joint loading and pain. The incorporation of motor learning principles may facilitate the acquisition of lasting, injury-resistant movement patterns that can facilitate neuroplasticity [31]. Specifically, the use of an external focus of attention and implicit learning may serve an adjunctive role [32]. Human motion is based on the refined interplay between the intention of moving and continuous monitoring from sensory information that adjusts such motor action [33]. Multi-joint movements, like locomotion, require the activation of the nervous and musculoskeletal systems to a large extent. The spinal interneuronal networks, termed central pattern generators, respond to signals in proprioceptive and skin afferents, modifying the locomotor pattern in cooperation with descending signals from the brainstem structures and the cerebral cortex. Information processing between the basal ganglia, cerebellum, and brainstem may enable automatic regulation of muscle tone and rhythmic limb movements in the absence of conscious awareness [34]. When a locomoting subject experiences a musculoskeletal disorder in the lower limbs, they somewhat alter this sensory-motor processing and develop individual compensation strategies to avoid pain during walking [35]. In particular, in the case of subjects undergoing joint replacement for osteoarthritis, these strategies are expressed in gait patterns characterized by clearly evasive movements, which are so highly automated that they still endure post-surgery [36]. Possible consequences include side asymmetries in gait parameters as shown by our population at baseline. The asymmetry index significantly decreased in both groups across the study; however, the VTG showed a greater reduction than CG at T1. The fact that a musculoskeletal injury in an anatomic district may affect joint movement at other levels due to a disruption of the afferent stimuli processing, especially for patients with the more severe disorders [18], suggests that training of global movement control is essential for rehabilitating these patients. A conventional approach may be insufficient to break up existing automatisms and initiate new movement patterns in the brief term. Furthermore, immobilization and inactivity after injury and/or surgery may also lead to cognitive dysfunctions [37], and the motor cortex undergoes a reorganization that is correlated with the duration of immobilization and is independent of age [38]. Hence, the importance of a timely approach that counteracts the slowdown of sensory-motor processes induced by immobilization. A combined sensory-motor training modality is mainly used in neurological rehabilitation, where it is reportedly more effective than conventional motor-oriented approaches [39], or in athletes [40,41]. In orthopedic rehabilitation, there is poor evidence of sensory-motor training [36,42,43] and even less for visuomotor training, so this is one of the first studies investigating the efficacy of this approach in subjects with musculoskeletal disorders, whereby VTG recipients experienced a greater reduction in pain than compared with CG, with a NRS score more than halved by 4 weeks as it decreased from 6.8 ± 1.4 to 3.1 ± 1. Pain is an index of severity and activity of the underlying condition as well as a prognostic/therapeutic indicator and a determinant of health-resource use [44]. It is one of the most feared postoperative complications and is associated with reduced satisfaction with medical rehabilitation [45]. Sometimes pain can last for many months after surgery, especially in osteoarthritis patients, being a cause of distress and poor quality of life [46]. Except for the most severe cases in which the pain is usually neuropathic [47] and a multimodal pharmacological intervention [46] is recommended, sensory-motor training seems to be effective in reducing pain intensity [42,43] as demonstrated by our results. The effect of the experimental intervention was appreciable also for the 2MWT. The 2MWT has excellent test–retest reliability in patients with musculoskeletal disorders. In particular, changes in 2MWT distances above 14.96 and 17.56 m represent a "real" clinical change in an individual after knee and hip surgery, respectively [48–50]. Moreover, 2MWT may assist in the early identification of patients who may need additional rehabilitation to reduce the potential for poor outcomes of rehabilitation after surgery [49]. Both groups exceeded this result at T1 follow-up. The VTG improved by more than 70 m compared to CG that improved 25 m on average. Such differences may be related to a faster recovery from pain, symmetry of gait, and muscle strength. Postoperative rehabilitation is of the utmost importance following musculoskeletal surgery to ensure the pain-free function of the joint and improve the patient's quality of life. The total duration of treatment is generally adapted to a patient's general health, disability status, and living circumstances. In any case, the current practice may often not be primarily guided by the available evidence or needs and is likely provided at a far greater cost than it would be if the best available evidence were adopted [17]. A sensory-motor approach may be very important for accelerating the recovery process and for the prevention of complications. The development of evidence-based techniques and guidelines in this area is needed.

5. Conclusions

The combination of visuomotor training and conventional physical therapy offers an innovative rehabilitation approach that seems able to accelerate the recovery of lower limb motor function and rapidly reduce pain after orthopedic surgery. The long-term benefits need to be investigated in future studies using larger samples.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy concerns.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Visuomotor Training Protocol

Tasks	Instructions
Hart Chart	Participants were instructed to read the Hart Chart in binocular viewing condition alternately with one letter at 3 m in the primary position and another at 40 cm with the Hart Chart placed 30 degrees inferiorly. The patients simultaneously performed motor task with lower limbs with 3-level difficulty: 1. Perform an oscillatory movement over the proprioceptive platform; 2. March in place; 3. march in place following the beat of the metronome

Tasks	Instructions
Modified Hart Chart	Participants were instructed to read the numbers (1 to 4) on two strips positioned at a 1 m distance on their side. The patients simultaneously performed motor tasks with lower limbs: 1. March in place following the beat of the metronome; 2. Perform an oscillatory movement over the proprioceptive platform combining the oscillation with the color of the numbers; 3. March in place, combining the leg to move with the color of the number; 4. Step forward or backward (with both legs) combining it with the number; 5. Go up a step (with both legs) combining it with the number; 6. Step forward or backward (with both legs) combining it with the number and simultaneously stretching forward the arm, combining this movement with the color of the number; 7 Go up a step (with both legs) combining it with the number and simultaneously stretching forward the arm, combining this movement with the color of the number; 8. March in place combined with the leg lifting with the color of the number and simultaneously touching the raised leg with the hand combined with the number (even or odd).
King-Devick	Participants were instructed to read aloud a series of random single-digit numbers from left to right as they move their lower limbs with increasing level of difficulty: 1. March in place; 2. Perform an oscillatory movement on the proprioceptive platform; 3. Perform an oscillatory movement on the spherical platform; 4. Perform a step forwards or backward alternating feet; 5. Go up and down a step, alternating feet.
Visual Tracing	The patients positioned approximately 3 m from the chart must identify the letter–number connection as quickly as possible while performing the following movements with the lower limbs: 1. March in place; 2. Perform an oscillatory movement over the proprioceptive platform following the beat of the metronome; 3. March in place following the beat of the metronome.
Visual Tracking	The patients positioned approximately 2 m from a table with a succession of numbers from 0 to 9 (10 lines of 10 numbers each) must identify the number read by the operator as quickly as possible while performing the following movements with the lower limbs: 1. March in place; 2. Perform an oscillatory movement on the proprioceptive platform following the beat of the metronome; 3. March in place following the beat of the metronome.
Van Orden Star	Participants were instructed to read the numbers in the Van Orden Star table as quickly as possible while they performed the motor task with lower limbs with 3-level difficulty: 1. March in place; 2. Perform an oscillatory movement over the proprioceptive platform following the beat of the metronome; 3. March in place following the beat of the metronome.
Mac Donald	The patients (positioned approximately 2 m from a Mac Donald table with a series of letters arranged around a fixation point that are increasing size as they move away from the center) must read the letter pointed by the operator as quickly as possible while performing the following movements with the lower limbs: 1. March in place; 2. Perform an oscillatory movement over the proprioceptive platform following the beat of the metronome; 3. March in place following the beat of the metronome

Tasks	Instructions
Stroop Test Modified	The patients positioned approximately 3 m from a Stroop table must perform motor tasks following the indications: 1. Perform an oscillatory movement over the proprioceptive tablet with 1 axis of movement, combining the oscillation with the color of the rectangle (2-color table); 2. Perform a step forward or backward according to the color of the rectangle (2-color table); 3. Perform a march in place combined with the leg moving with the color of the rectangle (2-color table); 4. Perform a step combined with the moving first with the color of the rectangle (2-color table); 5. Perform a step forward, backward, or a squat according to the color of the rectangle (3-color table); 6. Perform an oscillation or squat over the proprioceptive tablet according to the color of the rectangle (3-color table); 7. Perform an up step, a down step, or a squat combined with the leg moving first with the color of the rectangle (3-color table); 8. Perform an oscillatory movement over the proprioceptive tablet combining the color of the rectangle with the oscillation and the color of the writing with the card to be touched with both hands (2-color table); 9. Perform a march in place combined with the leg moving with the color of the rectangle and the color of the writing with the card to be touched with both hands (2-color table); 10. Perform an oscillating movement or a squat on the proprioceptive table, combined with oscillation with the color of the rectangle and the color of the writing with the card to be touched with both hands (3-color table); 11. Perform a step forward or backward (with both legs) according to the color of the rectangle and touch with the hand opposite to the moving leg according to the card of the writing color; 12. Perform a squat, a step on tiptoe, and a march in place (each leg is combined with a color) by associating them with the color of the rectangle and touching the card of the writing color with both hands (4-color table).
Visual Infinity	The patients positioned approximately 3 m from a visual infinity table (a sequence of colored numbers arranged to form the infinity symbol) must perform motor tasks following the indications: 1. Read all the numbers as quickly as possible by marching in place following the beat of the metronome; 2. Perform an oscillatory movement over a proprioceptive, combining the color with the oscillation; 3. Perform an oscillatory movement over the proprioceptive tablet combining the even and odd numbers to the oscillation; 4. Perform an oscillatory movement over the spherical proprioceptive table combining the numbers with the oscillations (forward, back, right, and left); 5. Perform a march in place combining the color of the number with the leg to be raised; 6. Perform a step forward or backward (with both legs) according to the number on the table; 7. Step forward or backward (with both legs) according to the number of the table and stretch forward the arm according to the number color; 8. Perform a march in place combining the color number with the leg to be raised and touch this leg with the hand associated with the number (even or odd).

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