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COGNITIVE STIMULATION BY MICROMOVEMENTS IN DYNAMIC MUSCLE REPROGRAMMING DURING POSTURE: A SYSTEMATIC REVIEW

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ABSTRACT

Objective: To analyze whether Dynamic Muscle Reprogramming stimulates cognition through micro movements. Materials and Methods: This is a systematic review in which searches were carried out in the PubMed Central (PMC), Scientific Electronic Library Online (SciELO), Virtual Health Library (VHL), and Cochrane Library, Pedro, Medline, considering a randomized clinical trial related to cognition, physical therapy rehabilitation and the

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method of dynamic muscle reprogramming, in adult men and women from 18 years of age, with neurological disorders and guidelines published during 2016-2021, and risk of bias was rated using PEDro. Results: A total of 6,246 articles were found in the different databases, filtered by articles on cognition, physiotherapy and the RDM method, with neurological deficits, reaching 20 articles potentially eligible for abstract and complete review. 3 articles were excluded because they addressed healthy individuals and 3 because they did not have access, resulting in 14 articles selected with a randomized clinical trial, being found in the Pubmed (13 articles) and VHL (1 article) databases, which were about aerobic exercise, dual task, virtual reality, tai chi and early mobilization. Conclusion: The RDM method improves the reacquisition of sensorimotor perceptions, followed by all information from the body and the environment, followed by the attention domains, promoting the control of movement by the intensity of the micro movements that are performed during the posture, stimulating the cognitive function through the reprogramming of the executive function, arising from the focus of attention, concentration and body perception, improving memory, decision-making and improving activities of daily living.

Keywords: Rehabilitation, Cognition, Perception, Sensation.

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INTRODUCTION

Dynamic Muscle Reprogramming (MDR) is a new physiotherapeutic method of postural corrective self-therapy by microflexion that has as its principle two bases: the balance of the proprioceptive system and neural reprogramming in the actions of the muscular system, both with the aim of treating the pain of the neural and muscular systems, aligning postural changes, which modify body symmetry, aiming to contribute to the resumption of motor control, and the self-recognition of limits, altering the body's strengths and redirecting the movement to neutral, without compensation. (Martini et al., 2018; Pinto, 2019; Slender; Dantas; Pinto & Martini, 2023)

This method is based on the analysis of the symmetry of the planes and axes of the human body, combined with flexion, motor control and postures that facilitate neural compressions by proprioceptive elements (PE). (Pinto, 2019)

The RDM method uses the execution of micro movements, which is performed on instruments defined as special proprioceptive instruments (IPCs: rollers (77cm); hexagonal polymers (23cm), postural modifier, palmar podalis, corrective, folding pillow and smooth mat), which have three different colors and densities (green, blue and yellow) that are in contact with the skin (body code/COC), identified by examining the postural vector map, controlling strength and intensity, and producing synergy of forces throughout the muscular system. (Pinto, 2019)

During the therapy, there is integration of all systems, facilitating the balance of the proprioceptive system and neural reprogramming, allowing for improved body awareness and movement control, intensifying fine coordination in non-verbal language, in the process of complex cognitive and motor domain, by the alternation of pressures induced in each region of the body. In this way, mechanoreceptors in contact with the IPCs send a new message to the central nervous system (CNS), which is interpreted by the sensory system and triggers biochemical and bioelectrical actions to respond to the stimuli. (Martini et al., 2018; Pinto, 2019; Slender; Dantas; Pinto & Martini, 2023)

As for the proprioceptive system, Charles Sherrington defined it as the sensation of proprioceptive, exteroceptive, and interoceptive stimuli, evidencing the influence of sensory neurons that innervate these proprioceptive organs on posture and movement control (Tuthill & Azim, 2018). However, in the RDM method, there is a joint action of the motor nerve and sensory nerve, which through the Golgi tendon organ (OTG) there is a rapid response to trigger the release by neurotransmitters in the range of motion or in the control

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of the postural tonic system, inhibiting the contraction of the agonist muscle and stimulating the contraction of the antagonist, When muscle tension reaches critical levels, it acts to restore the balance of the postural tonic system. (Pinto, 2019)

Proprioception is obtained by a sum of peripheral sensory information, changes which describe the degree and changes in muscle length and tension, joint angle, and skin stretch (Macefield & Knellwolf, 2018). Thus, we can discuss that the mechanoreceptors in the skin is one of them, which capture and respond to different stimuli such as force, such as touch, medium flow, sound in the air, substrate vibrations and tension. (Barth, 2019)

Sensory receptors are mostly specific, responding preferentially or exclusively to certain stimuli, and their response is directly related to the strength of the stimulus they receive and adapt. (Pinto, 2019)

Consequently, the stimuli are sent to the executive functions, allowing the mental process and enabling the individual to pay attention and maintain the focus of attention; reason and problem solving; exercising choice, discipline and self-control to avoid being impulsive, hasty or reacting without thinking; view the episodes from different perspectives and consider alternatives. (Diamond, 2020)

Cognition is related to all participating processes from the capture of external stimuli, through sensory and transformation pathways, reduction, elaboration, storage, recovery, as well as the use of these stimuli, comprising all mental processes that allow us to remember, learn, recognize and be able to exchange information in the environment in which we live, and can also refer to planning, problem-solving, monitoring, and judgment, which are defined as high-level cognitive functions. (Santos, 2018). Thus, we can raise the issue that the RDM method stimulates cognition, because the performance of individualized or associated micro movements demands concentration, attention, auditory and body perception of the individual who is being rehabilitated.

To this end, in the phases of feeling and interpreting each individualized or associated movement, they culminate in the increase of cognitive stimulation and motor learning capacity, because the actions of control and recognition of the intensity of one's own force, pass through the parasympathetic system to be memorized and executed with performance and precision in the factors strength, intensity, control and rhythm. (Pinto, 2019)

Therefore, individuals living with neurological disorders may often have motor and cognitive deficits, affecting executive function in terms of memory and attention, reducing

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the performance of everyday tasks and basic activities of daily living (ADLs; such as bathing) and instrumental ADLs (such as meal preparation). (Harrison et al., 2019)

As far as the RDM is concerned, in the execution of micro movements, the muscular system is activated according to the continuous stimuli, through the IPCs, by a relationship with the mechanics and accommodation of its fibers and with the fascia, with synergy of forces occurring in the muscular system, requiring the development of consciousness in the control of the movement, providing time, intensity and fine coordination in non-verbal language in the process of complex cognitive and motor domain (Pinto, 2019; Slender; Dantas; Pinto & Martini, 2023), which helps in the understanding and execution of micro movements, stimulating cognitive function.

Therefore, the objective of the study is to analyze whether Dynamic Muscle Reprogramming stimulates cognition through micro movements.

METHODOLOGY

This is a systematic review study in which searches were carried out in the PubMed Central (PMC), Scientific Electronic Library Online (SciELO), Virtual Health Library (VHL), and Cochrane Library, Pedro, Medline databases considering randomized clinical trials and guidelines published in the last 6 years (2016 to 2022).

The eligibility criteria were studies that addressed the method and efficacy of cognitive stimulation through micro movements in individuals, by Dynamic Muscle Reprogramming, in posture.

Randomized clinical trials were included in the research that addressed issues related to cognition, physical therapy rehabilitation and the method of dynamic muscle reprogramming in adult men and women. Individuals without non-neurological diseases, studies that did not address cognition, physical therapy rehabilitation in adult men and women, were excluded.

The research was carried out by two independent researchers, in Portuguese and English, using the descriptors and/or and appropriate keywords with the following descriptors: Cognition or Cognition; Sensory function or Sensation; Exercise Movement Techniques or Techniques d'exercices physiques; Focus of Attention or Attention; Physiotherapy or phisiotherapy, dynamic muscle reprogramming/reeducation or reprogrammation/rééducation musculaire dynamique; Neurological disorders (Table 1).

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The data were analyzed using the PICO (Population, Intervention, Control and Outcome) strategy and the following data were extracted: type of study, age, gender, comorbidities, intervention (duration of consultations), types of exercises used and results of interventions. And, to ensure methodological quality, this study was based on some recommendations from PRISMA (Preferred Reporting Items for Systematic) reviews and Meta-Analyses. (Galvão & Pansani, 2015)

The analysis of bias was performed using the Physiotherapy Evidence Database (Pedro) Scale, which is composed of 11 criteria: (1) criteria of eligibility and origin of the participants; (2) random allocation; (3) hidden allocation; (4) comparability from baseline; (5) blinding of the subjects; (6) blinding of therapists; (7) evaluators were blinded; (8) measures of the main outcomes of more than 85% of participants; (9) intention-to-treat analysis; (10) statistical comparisons between groups; (11) point measures and variability measures. The scale is scored from 10 to 10, with one point being assigned to each of the items (2 to 11) that are clearly satisfied and reported by the trial. When available, the score of the studies described in the database website was used and, when the score was not available, the evaluations were carried out by the author of this study. (Shiwa et al., 2011)

Table 1 – Descriptors that were related to each other

Descriptors	Findings	Result with filter	Selected	Filters	Database
Cognition and Sensory function and Exercise and movement techniques and Focus of Attention	32	1	0	5 years	Cochrane
Cognition and Sensory function and Exercise and movement techniques and Focus of Attention	101	14	1= randomized trial	Adults and middle age, clinical studies, clinical trial, randomized controlled trials, analysis and 5 years	Pubmed
Cognition and Sensory function and Focus of Attention and Physical therapy modalities	1	0	0	5 years	VHL
Cognition an Sensory function and Focus of attention and physical therapy modalities	69	13	1= randomized clinical trial	Adults and middle aged, clinical studies, clinical trial, randomized controlled trials, analysis, and 5 years.	Pubmed
Dynamic muscle reeducation and cognition	1	0		5 years	Pubmed
Dynamic muscle reeducation and cognition	24	5	1 = pilot study	5 years	VHL

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Neurological rehabilitation and cognition	5679	436	14= randomized clinical trial	Adults and middle aged, clinical studies, clinical trials, randomized controlled trials, analysis and 5 years.	Pubmed
Neurological rehabilitation and cognition	339	40	3= randomized clinical trial	Adults and middle aged, clinical studies, clinical trials, randomized controlled trials, analysis and 5 years.	Pubmed

Source: Authorship

RESULTS

In the period, which comprises August 2016 to March 2022, 6,246 articles were found in the different databases, which were found by the descriptors represented in Table 1, filtered by articles on cognition, physical therapy, and the RDM method, carried out in men and women aged 18 years and older, with neurological deficits.

The reading of the articles was complete from the selection in the previous stage, where after being analyzed, 20 articles potentially eligible for abstract and complete review were classified. 3 articles were excluded because they addressed healthy individuals and 3 because they did not have access to the full article, resulting in 14 randomized clinical trial articles for review, with 13 articles being found in the databases (Pubmed), 1 article (VHL) (Figure 1).

Figure 1 – Flowchart of the screening process and selection of articles for inclusion in the review.

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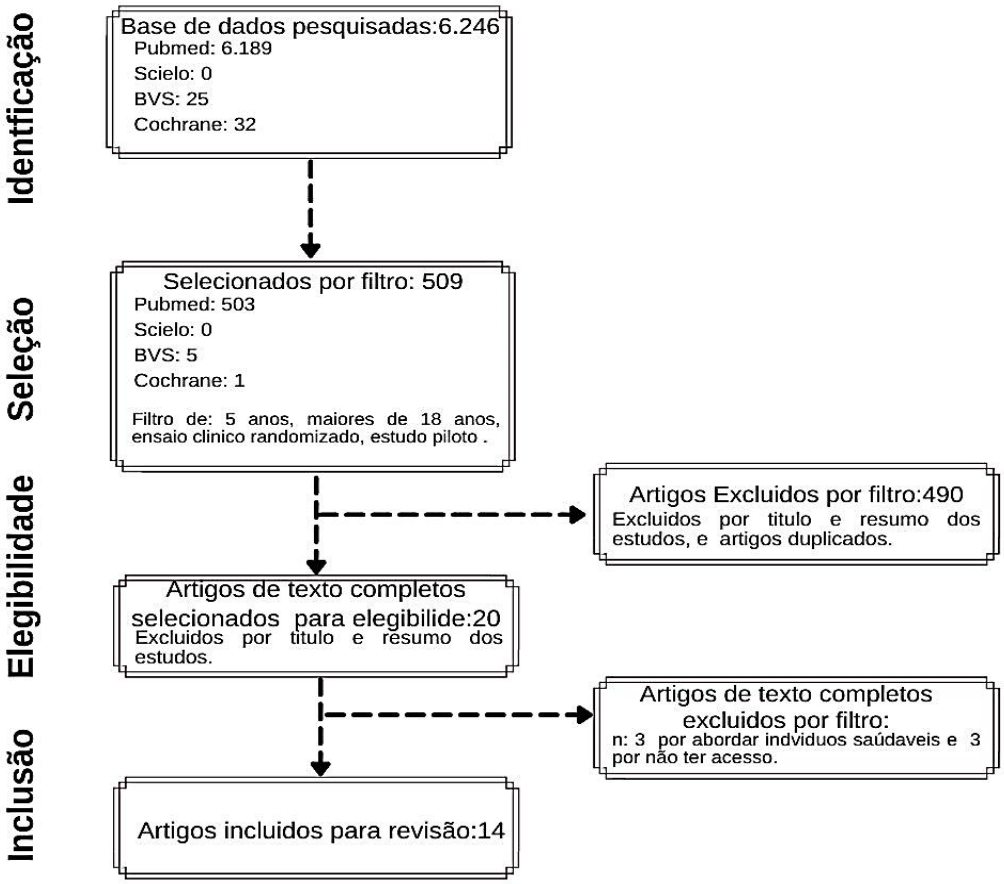

Source: Authorship

The mean score on the Pedro scale was 6.5, ranging from 3 to 9 points, and random allocation occurred in 100% of the studies. In most studies there were: Secret subject allocation 76%, Similar groups 100%, Key outcome measurements >85% with 76%, Intention-to-treat analysis 69% and between-group difference with 92%, while blinding of participants occurred only in 3 studies and blinding of therapists in none, blinding of raters in 6 studies (Table 2).

Table 2 - Methodological quality of studies according to PEDro.

	Authors	Random allocation	Secret Subject Allocation	Similar groups	Participant blinding	Blinding of therapists	Blinding of evaluators	Key Result Measurements> 85%	Intent-to-treat anacisis	Difference between groups	Measures of central tendency and variability	Punctuatio
	Tang *et al.*, 2016	S	N	S	N	N	S	S	S	N	S	6
erobic	Feys *et al.*, 2019	S	S	S	S	N	N	S	S	S	S	8
ercises	Koch *et al.*, 2020	S	N	S	N	N	N	N	S	S	S	5
	Christensen *et al.*, 2021	S	S	S	N	N	N	N	S	S	S	6
Virtual eality	Hung *et al.*, 2017	S	S	S	N	N	S	S	N	S	S	7

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	Kanan *et al.*, 2019	S	S	S	S	N	N	N	S	S	S	7
	Rogers *et al.*, 2019	S	S	S	N	N	N	S	N	S	S	6
	Ozdorgar *et al.*, 2020	S	S	S	N	N	N	S	S	S	S	7
	Park & Lee, 2018	S	S	S	S	N	S	S	S	S	S	9
	Pang *et al.*, 2018	S	S	S	N	N	S	S	S	S	S	8
ual task	Park & Lee, 2019	S	N	S	N	N	S	S	N	S	S	6
	Gutiérrez & Cruz *et al.*, 2020	S	N	S	N	N	N	N	N	N	S	3
Tai chi	Song *et al.*, 2021	S	S	S	N	N	N	S	S	S	S	7
Early andling	Cumming *et al.*, 2018	S	S	S	N	N	S	S	N	S	S	7

Source: Authorship

DISCUSSION

The main objective of this study was to analyze whether the RDM method stimulates cognition through micro movements in posture. However, the types of interventions carried out over the course of the studies ranged from aerobic training, elliptical training, virtual reality training on Wii Fit, Tetrax biofeedback, dual-task training, conventional rehabilitation involving stretching, motor and balance tasks, Tai Chi and early mobilization.

Of the 14 selected studies, 10 studied the population with cerebrovascular accident (CVA), 4 with multiple sclerosis (MS), and we will continue to clarify the studies and their evolution.

Song et al. (2021) rehabilitated with Tai Chi alone, demonstrating to have effects on cognition, while Cumming et al. (2018) reported on early mobilization and effects on cognition, demonstrating that in the intervention period of 14 days or until discharge from the acute stroke unit, it did not affect cognitive outcome.

Regarding the intervention with aerobic training, two studies were with the multiple sclerosis population (Feys et al., 2019; Christensen et al., 2021) did not obtain statistically significant results. However, in the study by Feys et al. (2019) there was an improvement in memory and visual perception with running training, while in the study by Langeskov-Christensen et al. (2021) there was also an improvement in processing speed with progressive aerobic exercises. Subsequently, it was noticed that in two other studies with the post-stroke population (Tang et al., 2016; Koch et al., 2010), also did not present statistically significant results, but both showed improvement in memory.

Regarding virtual reality (VR) interventions, three studies were with the population with stroke sequelae: the studies by Hung et al. (2017) showed improvement in the

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abstract/judgment and language domains and improvement in cognitive function, during the performance of dual-task in the slip disorder test; in the study by Kannan et al. (2019) and Rogers et al. (2019) they obtained improvement in all cognitive functions; while Ozdohar et al. (2020) compared conventional rehabilitation with VR, using the control group in the MS population, obtaining findings that VR is as effective as conventional rehabilitation, with VR being superior in working, visual and verbal memory, while in the conventional rehabilitation group significant improvements were observed only in visual and verbal memory.

With regard to dual-task training, three studies were carried out with the post-stroke population, with the study by Park and Lee (2018) comparing dual-task cognitive-motor training (CMDT) and auditory motor synchronization training (AMST) associated with CMDT, demonstrating improvement in cognitive functions with the association of the 2 techniques; while, in the study by Pang et al. (2018) they only observed verbal fluency and mental tracking present in the studies and did not show significant effects; and, in another study by Park and Lee (2019) pointed out significant effects in the domains of auditory attention, memory, executive function and balance with dual-task training, using cognitive tasks instead of conventional occupational therapy; in the study by Gutiérrez-Cruz et al. (2020) with the MS population, there was application of a combined training program (CTP) targeting disparate abilities, but they did not analyze cognition. Thus, we can see in (Table 3).

Table 3 - Characteristics of the studies selected in a systematic manner.

Author/Year	Type of study	Participants	Intervention	Exercises	Results in cognition
Tang *et al.*, 2016	Randomized controlled trial	47 participants with stroke, 50-80 years old, 22 (aerobic exercise) and 25 (flexibility and balance).	Both lasted 6 months, with 3 sessions of 60 minutes/week.	Participants in high-intensity aerobic exercise (AE) training were given an individualized exercise program, exercise intensity progressed from 40 to 80 percent of heart rate reserve. In the low-intensity Balance and Flexibility (BF) program activities, the intensity remained below 40% heart rate reserve.	There was an improvement in verbal item memory in both groups and that 6 months of high- or low-intensity exercise was not effective in improving cognitive function, specifically executive functions.
Hung *et al.*, 2017	Randomized	43 stroke participants met	Wii Fit groups, Tetrax	The rehabilitation program focused on	Training with Wii Fit games can be

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	controlled trial	the inclusion criteria and were randomized, 14 were assigned to the Wii Fit group; 15 for the Tetrax group; and 14 for the conventional weight change training group.	biofeedback or conventional weight change training. All interventions were administered 30 minutes per session, twice a week for 12 weeks.	maintaining motor function; No cognitive training was given. An additional protocol with Wii Fit, Tetrax or conventional weight.	beneficial in some cognitive functions, such as abstraction/judgment, language. Wii Fit games, the commercial entertainment exergames, had a superior effect on the abstract/judgment and language domains over the rehabilitation exergame.
Cumming *et al.,* 2018	Randomized controlled trial	Of the 2,104 stroke patients, 317 were evaluated before the introduction of the Montreal Cognitive Assessment. Of the remaining 1,787, 1,189 had complete data from the Montreal Cognitive Assessment, 456 had partially or completely missing data, 136 died, and 6 were lost to follow-up.	In surviving participants with complete data, adjusted for age and stroke severity, the total Montreal Cognitive Assessment score was not different in intervention (n = 595) and usual care (n = 594).	The intervention group began with early mobilization within 24 hours of stroke onset, focusing on activity in bed (e.g., sitting, standing, walking), and resulting in at least 3 additional out-of-bed sessions to usual care. The intervention period lasted 14 days or until discharge from the acute stroke unit.	The results indicate that exposure to early and more frequent mobilization after stroke did not affect cognitive outcome.
Pang *et al.,* 2018	Randomized controlled trial	78 participants with stroke provided fall data (dual-task group = 25, single-task group = 26, controls = 27	Each group exercised for three 60-minute sessions per week for 8 weeks.	The dual-task group: underwent 30 minutes of dual-task cognitive-motor training and 30 minutes of balance/mobility exercises progressed in several ways, such as: decreasing the support base, increasing the demand for speed of movement, and standing/walking on flexible surfaces and the cognitive ones naming objects, talking, and remembering numbers. The single-task :O The single-task balance and mobility training	The 8-week dual-task exercise training was most effective in improving dual-task mobility, the cognitive domains involved in the testing paradigm (verbal fluency, mind tracking). Other cognitive domains (reaction time, discrimination, and decision-making tasks) were not examined due to concerns about our participants' physical and mental fatigue with repetitive testing. Because only dual-task interference was used, this study may be insufficient to detect a significant

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				group engaged in the same balance and mobility activities as the dual-task group, but with no concurrent cognitive task for 30 minutes, they also practiced the same cognitive exercises as the dual-task group for 30 minutes in a sitting position. Control group: upper limb exercises, participants in this group performed only all-limb flexibility exercises and upper limb strengthening exercises without additional cognitive tasks. The exercises were performed mainly in the sitting or lying position to control possible effects of the training on balance and gait. Throughout the training, the level of difficulty progressed increasing the resistance of the theraband, depending on individual performance.	difference in the results.
Park & Lee, 2018	Randomized controlled trial	30 patients diagnosed with stroke, one experimental group (n=15) and one control group (n=15).	dual-task cognitive-motor training (CMDT) and auditory motor synchronization training (AMST) associated with CMDT. The experimental group received 3 sessions of CMDT + AMST per week for 6 weeks, the control group received CMDT only 3 times per week for 6 weeks.	Control group: received three 30-minute sessions of CMDT per week for 6 weeks, consisting of motor tasks associated with balance and posture while sitting and standing, which were performed simultaneously with cognitive tasks associated with attention, memory, and executive function. Experimental group: composed of CMDT and AMST 15-minute session, for a total session time of 30 minutes. CMDT equal to that of the control group. AMST consisted of 13 motor	The combined CMDT and AMST intervention has been shown to be an effective method to increase the cognitive functions of stroke patients, rather than CDMT alone

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				tasks while pressing the trigger at an appropriate interval from the reference sound. The following AMST tasks were: 2-hand task, right-hand task, and left-hand task. The 2-handed task involved tapping both hands in time with the reference sound while performing a semicircular motion, while each one-handed task involved pressing the right or left trigger in response to the reference sound.	
Feys *et al.,* 2019	Randomized controlled trial	42 participants, diagnosed with MS, 21 in the experiment and 21 in the control.	12-week running training versus (EXP) no training (WLC)	During the first few weeks, the training consisted of long walks, interspersed with short, jogging runs, gradually increasing until participants could run 5 km without interruption at 12 weeks.	The intervention in execution improved memory and visual perception, but no significant interaction effects were found compared to the control group.

Kannan *et al.,* 2019	Randomized clinical trial.	24 participants, with a diagnosis of stroke 12 in cognitive-motor training in exergame or conventional training and 12.	6-week training, exergame cognitive-motor training (CMT) was to play Wii Fit (Nintendo Co, Ltd. Kyoto, Japan) games in conjunction with the presentation cognitive tasks during all 20 sessions, conventional training (CT) was subjected to a series of personalized balance training exercises for 90 minutes.	The CMT each session was divided into three sub-sessions, with each The sub-session consisting of four Wii-fit games (Bub ble Balance, Table Tilt, Tight-Rope Walking, Head Soccer) played for five minutes, also incorporating three different cognitive tasks. The CT in the first 10 m of regular warm-up, stretching exercises such as arm movements and trunk twists, neck movements and lunges to the sides and forwards, 15 minutes of functional strengthening exercises including	The group that used VR had a significant improvement in cognitive function during dual-task performance on the slip disturbance test.

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				high steps, lunges and squats, and progressing to resistance training using TheraBands and weights, 35m of balance training exercises such as standing on a firm or accommodating surface with eyes open and Closed by varying durations, exercises sit standing, stand on one leg, maintain upright posture sitting on a ball, and extend hand, increase steps to start stepping, and walk on the treadmill as resistance training for 10-15 minutes.	
Park & Lee, 2019	Randomized controlled trial	30 patients diagnosed with stroke, 15 in dual-task training and 15 in the control group.	The interventions were performed 18 times, at 30 minutes per session, 3 sessions per week, for 6 weeks.	Dual-task group: Passing a bow with both hands intertwined while sitting on an unstable surface, Reciting the days of the week, Stacking the cups from left to right with both hands intertwined while sitting on an unstable surface, reciting the months of the year in reverse order, Using both hands to toss a bean bag into a basket placed in front of the subject while sitting on a surface recite 3 digits given by the therapist, using both hands to move a box from side to side while sitting in a chair, recite 4 digits given by the therapist among others. Control group: Upper extremity hand exercise, active and passive ROM exercise, maize stacking, passage of the ROM arch, bilateral or unilateral upper extremity activities. DL Functional Training:	Dual-task training using multiple cognitive tasks had a greater positive effect than conventional occupational therapy on auditory attention, memory, executive function, and balance.

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				Dressing, Hygiene, Change from wheelchair to chair.	
Rogers *et al.,* 2019	Randomized Plot Study	21 stroke patients, 11 patients randomized to the control group and 10 patients were randomized to the experimental group.	There were 4 weeks of virtual Elements rehabilitation (three weekly sessions of 30 to 40 minutes) combined with usual treatment (conventional treatment and physiotherapy) or usual treatment alone.	The experimental and control groups received 3 hours of conventional occupational therapy and physical therapy (TAU) daily. Experimental group: TAU + RV. Task 1 (Bases) consisted of the initial base and four potential movement targets, all of which were 78 mm in diameter. Circular targets are signaled in a fixed order (east, north, west, south) using an illuminated border. Task 2 (Random Bases) has the same configuration of targets, but they are highlighted in random order. Task 3 (Chase Task) starts with a blank canvas. A target circle then appears randomly in one of nine locations. These locations are configured along three radials that emanate from the base. Task 4 (Go/No-Go) uses the same target positions as Task 3, but additional distraction targets (a pentagon, triangle, and rectangle) appear. Participants were instructed to place the object only on the circular targets and resist moving to distractors. Tasks 5, 6, and 7 require participants to explore the virtual environment.	The intervention group showed significantly greater improvement in motor function in the hand most affected by stroke and in all measures of cognitive function.
Ozdogar *et al.,* 2020	Randomized controlled trial	60 MS patients were randomly divided into three groups; Video-based ExerGaming (n	The experimental groups received therapy sessions once a week for 8	The video-based exergaming was applied using a game console (Microsoft Xbox One and Kinect motion sensor) the	VR is as effective as conventional rehabilitation, VR was superior in working, visual and verbal memory while in the

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		= 21), conventional rehabilitation (n = 19) and control groups (n = 20).	weeks. All participants were assessed at baseline and after 8 weeks.	games included bowling, Jet Ski racing, rock rock, rock climbing, soccer, tennis and target shooting, it was applied 45 min per session, once a week for 8 weeks under observation by a physiotherapist and the sessions were completed in an upright position. Conventional rehabilitation group included balance, arm, and core stability exercises, sessions had warm-up and cool-down periods of 5 to 10 minutes, which consisted of posture and stretching exercises. The difficulty of the program was progressed by increasing the number of repetitions and then the number of sets, to 45 min per session, once a week for 8 weeks under a physical therapist supervision. The control group was evaluated at baseline and after 8 weeks.	conventional rehabilitation group the improvement was only in visual and verbal memory.
Gutiérrez-Cruz *et al.,* 2020	Randomized controlled trial	31 participants with a diagnosis of MS, 17 in the intervention group and 14 in the control group.	The intervention group completed three weekly training sessions for 24 weeks for 60 minutes, the control group pursued their normal daily activities.	The sessions were carried out in groups of 5 to 6 subjects grouped by level of disability, with a general warm-up of 5 minutes, walking exercises and joint mobility. The combined training program (CTP) was structured in four sets of 10-minute exercises aimed at training different skills: General dynamic strength: static and dynamic strength exercises using the body as the only load, Dynamic strength	The results obtained demonstrate that individuals with MS who engage in a 24-week CTP improve their balance, strength development rate, and static strength muscles, compared to the control, but did not specifically analyze cognition.

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				against resistance: weight machines, elastic bands or manual resistance, walking and/or double running, double task on unstable plates. The sessions were concluded with 5 min of stretching.	
Kocheet *al.,* 2020	Randomized controlled trial	131 participants, with stroke, 86 in CARET (combined aerobic and resistance training) + ICU (cognitive training intervention) and 45 in the control group.	3 weekly sessions of 40 to 60 minutes CARET and 40 minutes CTI sessions.	For aerobic training, stationary treadmills or stationary bicycles (sitting or reclining) were used. Strength training included core exercises (back and abdominal extension) and 10 resistance exercises on stacked weight machines (leg press, leg extension, leg curl, chest press, lat pull, shoulder press, seated row, triceps press, biceps curl, and chest fly). The ICU consisted of four 10-minute training tasks aimed at attention, memory, psychomotor speed, and working memory, and the control group underwent a simulated CARET and ICU.	Combined CARET+CTI intervention is safe, feasible and has satisfactory adherence of participants over 12 weeks. Although they found gains in strength, cardiovascular fitness, and cognition in the intervention group when compared to an active control group, these differences were not significantly different after the intervention.
Christensen *et al,* 2021	Randomized controlled trial	86 participants, diagnosed with MS, 43 in the exercise group and 43 on the waiting list.	Duration of 24 weeks, separated into exercise group (progressive aerobic exercise (PAE), followed by self-guided physical activity) and wait-list group (usual lifestyle, followed by supervised PAE).	EAP occurred 2 times a week, with one continuous and one interval exercise session held each week. In summary, the volume of the session increased from 30 to 60 minutes during the intervention while the intensity from 65% to 95%.	There was no significant improvement, but there was an improvement in processing speed in a subgroup comprising cognitive impairment.
Song *et al.,* 2021	Randomized controlled trial	34 participants, diagnosed with stroke, 18 in tai chi and 16 in the control group.	The Tai Chi class as a group was led by a trained Tai Chi instructor twice a week for 6 months in the physiotherapy	Each session consisted of a 5-minute warm-up, a 5-min qigong, a 35-min of Tai Chi movements in a sitting or standing position, and a 5-minute cool-down and	Tai Chi participants showed significant improvements in symptoms related to swallowing, ambulation capacity, flexible muscle strength and cognitive

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			room of the rehabilitation center of the university hospital.	the control group received the symptom management program.	function, and consequently also in the dimensions of self-care.

Source: Authorship

However, as the Muscle Dynamic Reprogramming (MDR) method is new, and has very few articles, we did not obtain findings of clinical cases that could support the confirmation of cognitive stimulation. However, it was possible to deduce that, due to the proposal of performing micro movements and how it promotes the reprogramming of body movement, the RDM method stimulates cognition, because it demands focus of attention, concentration and performance of micro movements and maintenance of position.

For this reason, we will focus on the discussion of some other interventions that focused on the search for cognitive stimulation, through dual-task activity, virtual rehabilitation, aerobic exercise, early mobilization and the content available on the MDR.

The findings in studies with virtual rehabilitation stimulate abstract/judgment and language domains, execution of processing speed, as well as planning. However, the systematic review by Zhang et al. (2021) showed that virtual reality did not show significant benefits in cognition, when compared to conventional rehabilitation therapy.

Regarding aerobic interventions, this study demonstrated improvement in memory, visual perception and processing speed with exercises, the review by Zheng et al. (2016) supports the findings of the study, because it demonstrated a significant effect on the stimulation of global cognition, memory and visuospatial ability, however, no significant effects were observed on execution, language or the verbal fluency domain of cognition. So, if the RDM method, which is performed with micro movements (individualized or associated), requiring focus of attention and concentration, it is possible to deduce that it improves cognitive functions, evolving memory, decision-making, improving activities of daily living.

In dual-task exercises, results were presented that the exercises stimulate cognitive functions in the domains of auditory attention, memory, and executive function, which can corroborate the RDM method, with regard to exercises with micro movements (Park & Lee, 2018). Therefore, Chen et al. (2020) point out in their study that dual task brings activations in specific brain areas, but also in secondary areas that help with executive functions and the attention system.

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In support of our objective, we found 2 case studies reporting the application of the RDM method and 1 article with intervention by the RDM method in workers with complaints of low back pain. Pinto et al. (2010) compared 2 groups in their study and concluded that the group of industrial workers who received the intervention with the RDM had a significant improvement in postural balance and a reduction in low back pain. However, the studies by Martini et al. (2018) and Delgado et al. (2023), proved that patients with spinal cord injury and traumatic brain injury showed an improvement in the reacquisition of their sensorimotor perceptions, coming from all the information (commands) of the body and the environment, promoting awareness of sensations. However, although the authors have not researched cognition, it is understood that the perception of the senses, thinking, perceiving, remembering, reflecting stimulate executive functions, as well as the cognitive process, sending information to the central nervous system and promoting feedback and the ability to produce movements after external stimuli.

CONCLUSION

Regarding the objective, we point out the few studies on the RDM method, but with a small clinical intervention that proves the cognitive stimulation of the cases studied. But, during this study, we clarified studies that elucidated several physiotherapeutic resources addressing cognition, improving memory, visuospatial capacity, demanded by attentional focus and concentration.

However, it is possible to deduce and conclude that the RDM method improves the reacquisition of sensorimotor perceptions, coming from all the information (commands) of the body and the environment, followed by the domains of attention, promoting the control of movement by the intensity of the micro movements that are performed during posture, stimulating cognitive function through the reprogramming of executive function, arising from the focus of attention, concentration and body perception, improving memory, decision-making and improving activities of daily living.

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