CASE REPORT

The influence of karate training on motor and cognitive functions among elderly with mixed dementia

A influência de um treinamento de caratê nas funções cognitivas e funcional em idoso com demência mista

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ABSTRACT

Among the different forms and recent non-pharmacological interventions for dementia patients already performed in Brazil, there are no studies that have investigated the effect of a protocol of karate in patients with this clinical conditions, more specifically in the elderly with a diagnosis of mixed dementia, Alzheimer's disease associated with vascular dementia. **Objective:** Thus, the present study aimed to analyze the effects of a karate training in cognitive and functional with an elderly mixed dementia. **Method:** The participant, clinically diagnosed with mixed dementia, underwent a anamnesis, followed by cognitive and functional assessment, pre and post training four months. The karate training was adapted and systematized, in order to muscle strengthening, flexibility, posture techniques, attack (punches and kicks), blocks (defenses) and kata (imaginary fight with multiple opponents), three times per week, lasting an hour session on nonconsecutive days. **Results:** The findings were maintaining cognitive function and improvement in static and dynamic balance. **Conclusion:** It was concluded that training adapted and systematized karate contributes to improved static and dynamic balance and maintenance of cognitive status. May, thus contribute to a new alternative non-pharmacological intervention in elderly patients with mixed dementia.

Keywords: Aged, Dementia, Motor Activity, Exercise Therapy, Martial Arts

RESUMO

Dentre as diferentes e recentes formas de intervenções não-farmacológicas para pacientes com demência realizadas no Brasil, não foram encontrados estudos que investigaram o efeito de um protocolo de caratê em pacientes com este quadro clínico, mais especificamente em idosos com diagnóstico de demência mista, doença de Alzheimer associada com demência vascular. **Objetivo:** O presente estudo teve como objetivo analisar os efeitos de um treinamento de caratê nas funções cognitivas e funcionais de um idoso com demência mista. **Método:** O participante, clinicamente diagnosticado com demência mista, passou por uma anamnese, seguida de avaliação cognitiva e funcional, antes e depois de um treinamento de quatro meses. O treinamento de caratê foi adaptado e sistematizado, visando fortalecimento muscular, flexibilidade, técnicas de posturas, ataque (socos e chutes), bloqueios (defesas) e katas (luta imaginária com vários oponentes), três vezes por semana, com duração de uma hora sessão em dias não consecutivos. **Resultados:** Os resultados encontrados foram manutenção das funções cognitivas e melhora no equilíbrio estático e dinâmico. **Conclusão:** Conclui-se que o treinamento adaptado e sistematizado do caratê contribui para melhora de equilíbrio estático e dinâmico e manutenção do status cognitivo. Podendo contribuir assim para uma nova alternativa de intervenção não-farmacológica em idosos com demência mista.

Palavras-chave: Idoso, Demência, Atividade Motora, Terapia por Exercício, Artes Marciais

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INTRODUCTION

Dementia is characterized by a decline in various cognitive functions to the point where it interferes significantly with an individual's functional performance.[1] Alzheimer disease (AD) is a neurodegenerative pathology characterized by an accumulation in the brain tissue of extra neuronal amyloid plaque and intraneuronal fibrillary tangles that lead to the death of neurons and consequent cognitive impairment, beginning with recent memory.[2] Vascular dementia (VD) is the second leading cause of dementia, after Alzheimer's disease, and occurs secondarily in the aftermath of a cerebrovascular accident (CVA) which can be ischemic (in the majority of cases) or hemorrhagic.[1]

Lesions occasioned by AD or CVA (especially of an ischemic nature) frequently occur together. Vascular lesions concomitant with AD in a patient increase the pathological effects and accentuate cognitive impairment.[3] The coexistence of AD and CVA is often termed mixed dementia (MD),[1] but is still a poorly defined pathological condition whose importance is coming to be better recognized. According to epidemiological studies, it is estimated that more than one third of AD patients also have cerebrovascular lesions-and a similar proportion of VD patients also exhibit the pathological characteristics of AD.[3]

The presence of cerebrovascular lesions in AD patients may be underestimated and appears to be associated with a more rapid clinical deterioration. The most common display of mixed dementia is that of a patient with clinical symptoms typical of AD who suffers an abrupt worsening accompanied by clinical signs of a CVA.

A systematic review[4] and a study of clinical cases[5] made recently showed the benefits of a practice of physical exercises on the cognitive functions, behavioral disturbances, and functional aspects for individuals with dementia.[4,5] Among the possible activities, one alternative intervention relatively challenging for these patients would be karate training adapted and systematized for this population. As a martial art, karate is popular in society as a means of self-defense and an ideal practice of physical activity. The regular practice of karate develops strength, speed, motor coordination, and physical conditioning.[6] The peculiarities of this activity contribute to the prevention of and the recovery from organic, psychological, and social ills, and aid in the overall development of those who practice it.

The present study sought to analyze the effects of adapted karate on the cognition and functionality of an older person with mixed dementia.

PRESENTATION OF A CLINICAL CASE

This was a longitudinal study carried out at the Aging and Physical Activity Laboratory (*Laboratório de Atividade Física e Envelhecimento*) within the Program for Functional and Cognitive Kinesiotherapy for the Elderly with Alzheimer's disease (*Programa de Cinesioterapia Funcional e Cognitiva de Idosos com Doença de Alzheimer* (PRO-CDA)) in the Physical Education Department, obeying the principles of ethics in research involving human beings, in conformity with resolution 196/96 from the National Health Council (*Conselho Nacional de Saúde*). It was analyzed and approved by the Committee on Ethics in Research from the Bioscience Institute at UNESP - Rio Claro Campus, in protocol nº 005/2011.

The sample was made up of one male participant, married, 74 years of age, with 15 years of schooling, a native of a city in the countryside of the state of São Paulo, and diagnosed with mixed dementia. In addition, the participant presented *diabetes mellitus* and had been using insulin for 40 years. He had smoked for 50 years and maintained a sedentary lifestyle. His caregiver reported that the participant suffered constant falls and needed help to carry out some of his daily life activities. At the beginning of his illness he had episodes of forgetfulness, depression, and showed musculoskeletal weakness. Over the years, there had been a worsening of behavior, recent memory, and spatial orientation.

Before the research began, the volunteer and his responsible caregiver were duly informed on the procedures to be followed. Once they agreed to participate in the study, they both signed the Terms of Free and Informed Consent and the patient went through a battery of cognitive and functional evaluations before and after the application of the karate movement intervention protocol, which consisted of the following aspects:

Cognitive Evaluation

a) Brief Cognitive Screening Battery (BCSB):[7] This consists of presenting the subject with pictures of ten common objects (shoe, spoon, comb, tree, turtle, key, airplane, house, book, and bucket). The subject then identifies or names these objects and is asked for an immediate memory of each one, with no advance notice that he should have memorized them (incidental memory); next, the drawings are shown to him again and he is asked to memorize them (short-term memory). The pictures are shown to the subject again with the instruction to memorize them (learning memory). Once again the pictures are shown and the subject is instructed to memorize them for later on, after five minutes.

b) Montreal Cognitive Assessment (MoCA):[8] This instrument assesses different cognitive domains: attention and concentration, executive functions, memory, languages, visual-constructive ability, and the ability for abstraction, calculation, and orientation.

c) Frontal Assessment Battery (FAB):[9] This evaluates the frontal cognitive and recently-used functions as a brief diagnostic tool to be used in cases of executive dysfunctions. The battery is composed of six subtests: abstract reasoning, cognitive flexibility, cognitive programming for motor action, sensitivity to interference, inhibition control, and autonomy of internal control of environmental stimuli.

Functional Assessment

d) Performance Oriented Mobility Assessment of Gait and Balance (POMA):[10] This was developed to detect risk factors for falls among the elderly based on the number of chronic impairments and illnesses, and is divided into two parts-one evaluates balance and the other, the gait. The functional tests for balance and gait have scores of zero and one, others of zero, one, and two, and there is one that can be scored from zero to four.

e) Southampton Assessment of Mobility (SAM):[11] This evaluates the

performance of elderly with dementia in 18 items broken into four sections in the following tasks: transference from seated to orthostatic, balance in orthostatism, gait, and transference from orthostatism to seated. The elderly subject is evaluated under direct supervision during the activities and can receive a score of one if he succeeds or zero if he does not complete the requested task. The final score can range from 0 to 18.

f) Force platform: This was used to assess postural control by means of different tasks in which the participant remains in a static bipedal position with feet parallel and spaced hip width apart, with the eyes directed to an object one meter away.[12] In this position he was to fulfill four experimental conditions:

- Eyes directed at a target and arms at his sides;
- Eyes directed at a target, arms at his sides, and count backwards from 30 at the same time;
- Eyes directed at a target and hold a tray;
- Eyes directed at a target, hold a tray, and count backwards from 30 at the same time.

Each condition was repeated twice for 40 seconds each time. A pause between the attempts could be requested by the participant. A minimum period of five minutes between the conditions was given for explaining the cognitive tasks. The average for each condition was considered for analysis.

The model AMTI/AccuGait force platform supplied the kinetic data as the oscillation of the center of pressure (CoP) at 100 Hz-in other words, the point of application of the resultant of the vertical forces acting on the support surface and the anteroposterior (AP) and mediolateral (ML) amplitudes. The data collected from the CoP was analyzed by the MATLAB program (version 6.5; MathWorks). The area on the Force Platform was a verified variable.

Training Protocol

A systematized protocol of karate moves was developed based on the participant's physical abilities and pathologies. For four months, the 60-minute sessions were done three times a week on non-consecutive days. The interventions took place in a dojo at the Physical Education Department at UNESP in Rio Claro, São Paulo. The patient had an interview with a delegate from the Karate Federation of the State of Sao Paulo (*Federação Paulista de Caratê*) to guarantee that he had no previous experience with this modality.

Blood pressure measurements were taken before and after each session and the participant's pulse rate was monitored throughout the activity. The class was structured as follows: the first 20 minutes were for aerobic conditioning, including warm-up and stretching, working joints all over the body; the last 40 minutes consisted of adapted karate moves.

In all there were 37 sessions, divided into three training phases. The first phase, called the adaptation phase, consisted of nine classes in which activities were proposed for the development and similitude of the modality, technical postures, fundamental basics of karate, dynamic movements, coordination, and strengthening of the lower members. The second phase of the protocol, called refinement, also consisted of nine classes and involved activities using the upper members, cognitive stimulation, reaction time, and all the components of functional capacity. The third phase consisting of 19 classes was called training; dynamic movements were emphasized here, which together evolved into two specific karate techniques: kihon and kata.

DISCUSSION

After the intervention, a cognitive evaluation demonstrated a higher overall score in the BCSB and in the domains: incidental memory, short-term memory, and learning memory. There was an increase in the total MoCa score and also in the attention and orientation domains. Performance in the frontal cognitive functions, as assessed by the FAB, also showed an improvement in mental flexibility, similarity, inhibitory control, and the FAB total (Table 1).

Such findings corroborate the findings of studies that investigated the effects of physical exercise on the cognitive functions of individuals with dementia. Christofoletti et al.[5] observed an attenuation of cognitive functions after doing a motor intervention protocol with an individual diagnosed with AD. This type of result is important in that it concerns people with dementia, since the progression of the disease is irreversible and, therefore, to attenuate the compromising of functions such as cognition is an important treatment strategy to be considered for this population.

As with the cognitive functions, the evaluation of functionality after the intervention showed positive results. There was an increase in POMA scores, which could indicate a lessening of the risk of falls. Similarly, there was an improvement in the final SAM assessment, which could imply greater autonomy in changing postures and balance (Table 2). These findings might also contribute to a better prognosis in the evolution of the disease, with greater independence in daily life activities.

The results obtained in this context by analysis of the kinetic data supplied by the force platform highlight what was observed by the POMA and SAM. The kinetic data showed that after the intervention the oscillation area of the CoP was smaller in all proposed conditions, which therefore points to a greater postural control, thereby emphasizing greater functional independence, which was already pointed out (Table 3).

With these results in mind, one can see the contribution of an intervention with a karate program and the retention of cognitive and functional components that lead to independence in daily life activities and give the individual more quality of life. The concentration required to execute the moves and to remain in certain positions can contribute to these findings and consequently have an effect on the participant's daily life activities. These findings are in accordance with those of Hernandez et al.[13] and Christofoletti et al.[14,15] that highlighted the contribution of regular physical activity on the prevention, protection, and rehabilitation of these individuals as regards falling and improving their balance.

Although this is a clinical case study, the results of which do not need statistical treatment, it is worth pointing out the importance of studies such as this. There is an observable increase of one or two points in the total scores or in specific domains; such findings might not reflect improvements, but on the other hand, they call for a reproduction of this protocol in larger studies with more participants and, in addition, may help health professionals define better intervention protocols in clinical practice and individualized treatments.

Another particularity of this karate protocol is its originality, which distinguishes it from all the other proposed interventions of physical activity that have been studied. The need for a suitable space for its execution, including a tatami and clothing such as a kimono, added

Table 1. Initial and final scores on the cognitive tests for the research participant

BCSB	Initial scores	Final scores
Naming	10	10
Incidental memory	3	7
Short-term memory	6	9
Learning memory	5	7
5-minute memory	6	6
Recognition	10	10
Total	40	48
MoCA		
Visuospatial	5	5
Naming	3	3
Memory	0	0
Attention	2	5
Language	2	2
Abstraction	2	2
Delayed recall	0	0
Orientation	4	5
Total	18	22
FAB		
Similitude	0	2
Cognitive flexibility	2	3
Programming	3	3
Sensitivity to interference	3	3
Inhibitory control	2	3
Environmental autonomy	3	3
Total	13	17

BCSB: Brief Cognitive Screening Battery; MoCA: Montreal Cognitive Assessment; FAB: Frontal Assessment Battery. Scores expressed by points

Table 2. Initial and final scores from the tests used for motor assessment of the participant

	Initial scores	Final scores
POMA	38	57
SAM	14	18

POMA: Performance Oriented Mobility Assessment of Gait and Balance; SAM: Southampton Assessment of Mobility. Scores expressed by points

Table 3. Initial and final scores of the force platform evaluation of the participant in the four experimental conditions

	Initial scores	Final scores
Force platform		
condition 1	0.84	0.67
condition 2	0.85	0.77
condition 3	0.84	0.79
condition 4	1.07	0.78

Values expressed in cm^2 of area

to the patient's acceptance and motivation during sessions, and in spite of it not being so traditional in this country, this very difference may lend some encouragement. Meanwhile it is important that the professional who performs this type of intervention have specialized training in order to proceed in the best possible way.

Keeping in mind the benefits observed in this study, larger studies in the future will likely reinforce and point out other findings that may indicate that the practice of karate for this population can be a good option to slow the progress of a prognosis of dementia.

It is important to point out that at, the end of the protocol, the participant went through a practical evaluation with the delegate from the 4th region of the Paulista Karate Federation (Antonio Roberto Bendillati), demonstrating the movements he learned during the training and graduating with the 6th Kyu; in other words, he went from a white belt to a yellow belt.

CONCLUSION

This study showed that a systematized, adapted karate training contributed positively to the cognitive and neuromotor functions of an individual with mixed dementia. This therefore gave him greater independence and functionality in his daily life activities.

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