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ORIGINAL ARTICLE

Effects of conventional physiotherapy and wii therapy on pain and functional capacity of elderly women with knee osteoarthritis*

Efeitos da fisioterapia convencional e da wiiterapia na dor e capacidade funcional de mulheres idosas com osteoartrite de joelho

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ABSTRACT

BACKGROUND AND OBJECTIVES: Osteoarthritis (OA) is one of the most prevalent rheumatic diseases in the elderly, being a frequent cause of incapacity among this population. It is more common in the knee and is characterized by pain, stiffness and function loss. Conventional physiotherapy, through the training of muscle strength, is described as a satisfactory method to improve functional limitations of such individuals. Wii therapy, through the use of Nintendo's wii videogame and the wii fit platform, is being used as therapeutic resource for the rehabilitation of patients with musculoskeletal diseases. This study aimed at comparing the effects of conventional physiotherapy and wii therapy on pain, stiffness, functional incapacity and balance of elderly women with knee OA.

METHODS: Sample was made up of 71 women with knee OA and users of a support group for the elderly from the city of Passo Fundo-RS, being 33 (Group I) submitted to conventional physiotherapy and 38 (Group II) submitted to wii therapy. Evaluated parameters were pain, stiffness and functional incapacity through The Western Ontario and McMaster Osteoarthritis Index (WOMAC) questionnaire, and balance through Berg Balance Scale.

RESULTS: Elderly women submitted to conventional physiotherapy (group I) have presented, as compared to wii therapy (group II), lower pain scores (11.05 ± 8.15 *versus* 19.24 ± 16.96; p = 0.00) and incapacity (12.42 ± 7.91 *versus* 17.42 ± 14.08; p = 0.06) after intervention. Stiffness (25.13 ± 15.99 *versus* 14.39 ± 17.43; p = 0.00) and balance (50.94 ± 1.45 *versus* 53.45 ± 5.16; p = 0.00) scores were better for patients submitted to wii therapy, with statistical significance in both items.

CONCLUSION: Wii therapy was better to improve stiffness and balance in elderly women with osteoarthritis as compared to conventional physiotherapy.

Keywords: Balance, Digital games, Elderly, Physiotherapy.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A osteoartrite (OA) é uma das doenças reumáticas mais prevalentes em idosos, sendo causa frequente de incapacidade nesta população. É mais comum na articulação do joelho e se caracterizam por dor, rigidez e perda da função. A fisioterapia convencional por meio do treinamento de força muscular é descrita como uma forma satisfatória de melhora das limitações funcionais nestes indivíduos. A wiiterapia, por meio da utilização do videogame Nintendo Wii e da plataforma Wii Fit, vem sendo utilizada como recurso terapêutico na reabilitação de portadores de doenças musculoesqueléticas. O objetivo deste estudo foi comparar os efeitos da fisioterapia convencional e da wiiterapia na dor, rigidez, incapacidade funcional e equilíbrio em mulheres idosas com OA de joelho.

MÉTODOS: A amostra foi composta por 71 mulheres portadoras de OA de joelho usuárias de um grupo de convivência para idosos no município de Passo Fundo-RS, sendo 33 no grupo I, submetidas à fisioterapia convencional e 38 no grupo II, que realizaram wiiterapia. Foram avaliados dor, rigidez e incapacidade funcional pelo questionário *The Western Ontario and McMaster Osteoarthritis Index* (WOMAC) e o equilíbrio pela escala de equilíbrio de Berg.

RESULTADOS: As idosas submetidas à fisioterapia convencional (grupo I) apresentaram em relação à wiiterapia (grupo II) menores escores de dor (11,05 ± 8,15 *versus* 19,24 ± 16,96; p = 0,00) e incapacidade (12,42 ± 7,91 *versus* 17,42 ± 14,08; p = 0,06) após a intervenção. Os escores de rigidez (25,13 ± 15,99 *versus* 14,39 ± 17,43; p = 0,00) e equilíbrio (50,94 ± 1,45 *versus* 53,45 ± 5,16; p = 0,00) foram melhores nas pacientes que fizeram wiiterapia, com significância estatística em ambos os itens.

CONCLUSÃO: Foi observada uma superioridade da wiiterapia na melhora da rigidez e equilíbrio em mulheres idosas portadoras de osteoartrite em relação à fisioterapia convencional.

Descritores: Equilíbrio, Fisioterapia, Idosos, Jogos digitais.

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INTRODUCTION

Brazilian people are rapidly aging thus leading to higher prevalence of chronic-degenerative diseases, among them osteoarthritis (OA)[1] which is a disease characterized by changes in joint cartilage and subcondral bone integrity, with insidious onset and which may lead to severe functional loss[2,3]. It is estimated that at 70 years of age, 85% of population will have clinically diagnosed OA and 100% will have radiological changes compatible with this disease[4]. Crepitation and movement amplitude limitation (MA) are also common complaints[5].

Functional capacity is defined as the ability to carry out daily life activities (DLA) in an independent and autonomous way, including movement, self-care and participation in leisure and educational activities, that is, the ability to maintain physical and mental skills for a "good life", including adequate sleep[6].

It is also worth stressing the importance of balance, which depends on the interaction of vision, vestibular and peripheral sensation, on central commands and neuromuscular responses, especially muscle strength and reaction time[7].

It is estimated that the prevalence of balance complaints among people above 65 years of age is 85%, being associated to several etiologies, such as: vestibular system degeneration, decreased visual acuity, decreased capacity to accommodate vision, proprioceptive changes, musculoskeletal deficits (sarcopenia), postural hypotension, cerebellar atrophy, decreased attention mechanism and reaction time to stimuli[8,9].

Physiotherapy associated to medical care may prevent OA of inducing major injuries leading to functional limitation. So, physiotherapy intervention should have several objectives, such as: pain relief, prevention of trophism and muscle strength loss, and improved movement amplitude. In addition, other benefits such as improved functional capacity and quality of life (QL) may be reached by means of adequate therapeutic schedule[10].

Currently, new technological resources have been used, where there is interface between individual and machine, interacting videogame components and motor sensory channels, generating simulation of a real environment. The benefits of these methods described by the literature include balance and posture correction, improved locomotion, upper and lower limbs functionality, in addition to helping patients' motivation[11]. As from these data, it is supposed that the use of this resource may help the rehabilitation of patients with knee OA.

This study aimed at evaluating the effects of conventional physiotherapy and of wii therapy on pain, stiffness, functional incapacity and balance changes in elderly people with knee OA.

METHODS

Sample was made up of 71 elderly women aged 60 years or above, with diagnosis of knee OA, with joint pain and users of a support group for the elderly in the city of Passo Fundo/RS, Brazil, being 33 allocated to group I, submitted to intervention through conventional physiotherapy and 38 to group II, submitted to wii therapy. All participants have signed the Free and Informed Consent Term (FICT).

Initially an evaluation questionnaire was filled with identification data, sociodemographic and clinical indicators, and one question about the presence or not of joint pain. After this stage, the Western Ontario and McMaster Osteoarthritis Index (WOMAC) questionnaire was applied in its translated and validated version for Brazil through assisted interview[12]. Pain intensity, stiffness and functional incapacity were represented by scores in questionnaire sections, in levels: *no, mild, moderate, severe and very severe pain.* For data analysis, these levels were represented respectively by 0, 25, 50, 75 and 100. The questionnaire is divided in three domains: pain, stiffness and incapacity.

Balance was evaluated by the Berg balance scale[13]. Evaluators were previously trained to apply the tools, thus minimizing possible biases.

Conventional physiotherapy was performed in the physiotherapy clinic of the University of Passo Fundo. Exercises were linked to lower limbs balance and muscle strength of a cohort of elderly patients. A physiotherapeutic treatment plan was developed with two weekly sessions, being that conventional physiotherapy sessions would last 50 minutes and wii therapy sessions 30 minutes (which is the recommended time to perform exercises, since they are performed standing up), for a three-month period.

Physiotherapeutic dynamics with videogame Nintendo Wii of the Wii Fit platform consisted of the following exercises: yoga, respiratory exercises, balance games – balance and proprioception, Penguin Slide, Ski Slalom, Soccer Heading (where one should hit balls with the head), tightropewalk (where the aim is to walk on a tightrope), exercises with multidirectional shifts, such as Table Tilt, where one tries to insert balls in a hole, being that each exercise was performed in three series of 10 repetitions for each individual.

Conventional physiotherapy was based on breathing technique with body flexion associated to expiration and body extension associated to inspiration; gluteus and lower limb strengthening exercises using anklet with resistance (initial weight = 500 g), latero-lateral shift with open eyes evolving to closed eyes; and sitting on a Swiss ball, multidirectional shift using the Swiss ball; gait training exercises where individuals have to walk over a marked straight line, with open eyes evolving to closed eyes; step exercises simulating going up and down steps, exercise of going up and down stairs using anklet with resistance, exercises simulating going up and down slopes. Slow and gradual load increase may occur according to individual responses, respecting criteria such as: no discomfort, free breathing and constant movement speed, both in the eccentric and the concentric stage.

Analysis of Variance (ANOVA) was used to compare effects of both interventions in the pre and postoperative periods.

This study was approved by the Research and Ethic Com-

mittee of the São Lucas Hospital, Catholic University of Rio Grande do Sul, under registration 011/5338.

RESULTS

Total sample was made up of 71 females with mean age of 66.7 ± 7.85 years, varying from 60 to 87 years of age, with knee OA and pain as primary symptom. From them, 33 elderly women (group I) have performed conventional therapy and 38 elderly women (group II) have performed wii therapy.

With regard to associated osteoarticular diseases in group I, osteoporosis was the most prevalent with 10 (30.3%) individuals, followed by rheumatoid arthritis with 7 (21.2%) cases and 4 (12.1%) with different osteoarticular disease, being that hip was the most affected joint in 12 (36.4%) individuals, followed by shoulder with 5 (15.2%), other joints with 8 (24.2%) and ankle with 2 (6.1%). With regard to pain site, hip was the most affected joint in 12 (36.4%) individuals, followed by other joint in 7 (21.2%) individuals, 3 (9.1%) have referred shoulder and 2 elderly women (6.1%) ankle.

Associated osteoarticular diseases in group II were osteoporosis (more prevalent) in 3 (7.9%) individuals, being hip the most affected joint in 6 (15.8%), followed by ankle and shoulder in 1 (2.6%). With regard to pain site, hip had 8 (21.1%) followed by other joint in 12 (34.2%), shoulder in 3 (7.9%) and ankle in 1 (2.6%).

During pre-intervention evaluation, it was observed that group I individuals had lower scores in pain and functional incapacity. In post-intervention domain there have been lower scores also in group I with significant difference (p = 0.00). With regard to incapacity, there has been statistically significant difference between groups; however, after intervention this difference was no longer observed, making groups similar from the statistical point of view (p = 0.06). With regard to stiffness, it was observed that groups were similar before intervention, but in post-intervention, group II had better results (p = 0.00). As to balance, group I individuals had lower scores both in pre and post-intervention, with statistical difference (p = 0.00) (Table 1).

DISCUSSION

Physical exercises to increase flexor and extensor muscles resistance in general decrease pain and incapacity improving joint function in osteoarthritis patients[12]. These results were observed in our study in the conventional physiotherapy group.

Pain, when affecting body weight unload joints, especially the knee, leads to more marked decrease in muscle function and, as a consequence, to decreased balance, gait changes and/or loss of functional independence[13]. OA-induced physical incapacity is result of a complex interaction between worsening of disease, pain and associated comorbidities, of psychological and social factors, with decreased aerobic work capacity and lower limbs muscle weakness[14].

Generalized muscle pain was studied to check whether it negatively impacted functional capacity of 1,002 elderly women aged above 65 years, with OA and some degree of functional impairment and who were part of a larger study, the Women's Health and Aging Study. After the initial evaluation, authors carried out a three-year follow up with biannual evaluations. Women with generalized pain had 2.5 to 3.5 times more probability of having difficulties with daily life activities as compared to the moderate pain group. Results have suggested that pain related to difficulties to perform daily activities is also related to functional skills and risk of falls and that major difficulties to perform daily activities were due to muscle weakness developed by avoiding performing tasks inducing pain, such as climbing stairs or walking longer distances. So, generalized pain, common among elderly people with OA, may predict incapacity[15].

A randomized, prospective and blind study has treated 25 individuals of both genders with primary knee OA and mean age of 67.5 years. Participants were divided in three intervention groups. Group A: kinesiotherapy and short waves (n = 9); group B: kinesiotherapy and ice (n = 6); and group C: kinesiotherapy (control group). This study has reported the scarcity of randomized clinical trials about the application of heat and cold to improve musculoskeletal conditions of OA patients and has shown that treatment with kinesiotherapy alone was not beneficial for pain, however it had positive re-

Table 1 – Pre and post-intervention results of both groups evaluated by the WOMAC questionnaire and Berg scale.

Variables		Group I n= 38 Mean and Standard deviation	Group II n= 33 Mean and Standard deviation	p value
Pain	Pre-intervention	12.63 ± 8.28	36.51 ± 23.09	0.01*
	Post-intervention	11.05 ± 8.15	19.24 ± 16.96	0.00*
Stiffness	Pre-intervention	33.55 ± 20.97	31.81 ± 24.02	0.07
	Post-intervention	25.13 ± 15.99	14.39 ± 17.43	0.00*
Incapacity	Pre-intervention	14.46 ± 8.55	36.36 ± 23.91	0.00*
	Post-intervention	12.42 ± 7.91	17.42 ± 14.08	0.06
Balance	Pre-intervention	46.76 ± 2.66	51.11 ± 8.18	0.00*
	Post-intervention	50.94 ± 1.45	53.45 ± 5.16	0.00*

*statistical significance.

sults to improve functional capacity, movement amplitude and muscle strength gain.

The study has concluded that the most adequate protocol to relieve pain was that involving ice and kinesiotherapy, and that movement amplitude, flexibility and muscle strength gains are not related to deep thermotherapy[16].

Progressive resistance training prevents loss of muscle strength and mass and may also improve such parameters, which helps in the acquisition of better balance[17]. A study has evaluated the effects of virtual reality on balance, showing its benefits for posture and balance gain in healthy adults[18]. These findings are in line with our study, which, after strength, proprioception and balance training, has also found better balance scores in individuals under wii therapy. Authors have observed that individuals participating in multisensory activities, with focus on proprioceptive stimulation, have shown better stability and postural control as compared to a control group[19,20].

A major fact mentioned by the literature is the increasing use of the videogame Nintendo Wii for rehabilitation of patients with neurological disorder sequelae, because the use of acquired applications, such as interactive games and accessories of the videogame itself (platforms, controls), may help different types of training, such as static and dynamic balance training, isotonic exercises to strengthen muscles, aerobic and anaerobic exercises, in addition to providing better cardiovascular fitness[21,22].

Studies have shown that postural balance is maintained by different mechanisms, including muscle viscoelastic properties, postural adjustments triggered by visual sensory, vestibular and somatosensory information, being proprioception a sensory source which seems to be more expressive in postural control ability[21]. In the elderly, in general, there is decreased postural control ability, increasing pressure center (PC) oscillation speed when in the vertical position[23]. Rehabilitation programs aim at developing physical, mental and sensory potentials and, as a consequence, at decreasing individuals' limitations by different software techniques[22].

In a Cochrane base systematic review about exercises to improve elderly people's balance, 34 studies involving 2,883 participants were evaluated. Authors have concluded that exercises involving gait, sensory exercises (balance), coordination, functional exercises, strength exercises and multiple exercises seem to have major impact on balance measures, however, exercises involving sensory stimulation seem to be more effective as compared to usual exercises, but such protocols and methodologies are not clearly reported, in addition to the lack of evidences of long-lasting effects[24].

Some authors have observed that, to improve balance control, it is necessary to perform exercises in the orthostatic position so that individuals have to control major changes in body mass center[29,30], which is in line with wii therapy which has always trained individuals in the orthostatic position and using the Wii Fit platform. Improved stiffness in patients practicing such technique further confirms such results of better balance and orthostatic posture control.

An interventionist study in a community with risk of falls, with sample made up of 15 elderly people with mean age of 76.0 ± 5.2 years, rehabilitation exercises were carried out under supervision of a physiotherapist with Wii Fit and using the following games: Table Tilt, Soccer Heading, Ski Slalom, Jogging, Hula Hoop, and Ski Jump, individually, twice a week for 12 weeks. In four weeks, Berg's balance has significantly improved ($p = 0.02$), considering Wii Fit as an acceptable exercise method for the elderly[25].

CONCLUSION

Our study has shown that wii therapy is better for joint stiffness and balance of OA women, suggesting the new studies should be carried out with this technique to improve its understanding, applicability and evidence in the approach of this painful syndrome.

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