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Case series

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Effects of virtual reality exposure therapy in muscle function in women with urinary incontinence: case series

Efeitos da realidade virtual na função muscular em mulheres com incontinência urinária: relatos de caso

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RESUMO | INTRODUÇÃO: A incontinência urinária (IU) é um dos mais constrangedores e estressantes sintomas urinários e a principal disfunção do assoalho pélvico. O tratamento através da realidade virtual tem o objetivo de aumentar a adesão das pacientes ao tratamento de forma lúdica e não invasiva, promovendo a capacidade de contração dos MAP durante as atividades físicas, com potenciais reflexos na melhora da incontinência. **OBJETIVOS:** Avaliar a função muscular do assoalho pélvico e perda de urina de mulheres incontinentes tratadas por meio de um protocolo específico de terapia por exposição à realidade virtual. **METODOLOGIA:** Relato de casos, composto 02 casos de mulheres com diagnóstico médico de IU. Tratadas com realidade virtual através dos jogos do Nintendo Wii Fit PlusTM por 12 sessões de 50 minutos cada, três vezes por semana. Cada sessão compreendeu de 20 minutos de momento educativo, com orientações das ações durante os jogos e treinamento prévio para a contração dos músculos transverso do abdome e assoalho pélvico, seguido de 30 minutos de intervenção com o jogo. O protocolo foi dividido em duas fases de seis sessões cada de acordo com a dificuldade dos jogos, priorizando inicialmente aqueles que exploravam movimentos da pelve no plano frontal (Lotus FocusTM, Penguin SlideTM e Soccer HeadingTM) e, com a evolução, os que permitiam movimentos pélvicos mais globalizados (Penguin SlideTM, Table TiltTM e Balance BubbleTM). A função muscular do assoalho pélvico e a perda urinária foram avaliadas, respectivamente, através do Esquema PERFECT e do pad test de 1 hora, sendo os resultados sumarizados de forma descritiva em tabelas do Excel. **RESULTADOS:** Melhora da perda urinária através do pad test de 1 hora e da função muscular através da palpação digital associada ao Esquema PERFECT das participantes com incontinência urinária após intervenção. **CONCLUSÃO:** O tratamento dos MAP através da realidade virtual demonstrou-se efetivo na melhora da perda urinária e da função muscular do assoalho pélvico nas participantes deste estudo, porém fazem-se necessárias ensaios clínicos para comprovar sua eficácia.

PALAVRAS-CHAVE: Incontinência urinária. Terapia por exposição à realidade virtual. Assoalho pélvico.

ABSTRACT | INTRODUCTION: Urinary incontinence is one of the most embarrassing and stressful urinary symptoms and the main pelvic floor dysfunction. The treatment through virtual reality aims to increase the adherence of patients to treatment in a playful, non-invasive, promoting PFM contraction capacity during physical activities, with potential impacts on the improvement of this incontinence. **OBJECTIVES:** To evaluate the muscle function and loss of urine of the pelvic floor of women incontinent treated with a specific protocol of virtual reality exposure therapy. **METHODOLOGY:** Case report, composed of 02 cases of women with medical diagnosis of UI. Handled with virtual reality through Nintendo Wii Fit Plus ™ games for 12 50-minute sessions each, three times a week. Each session consisted of twenty minutes of educational time, with orientation of the actions during the games and previous training for the contraction of the transverse abdomen and pelvic floor muscles, followed by thirty minutes of intervention with the game. The protocol was divided into two phases of six sessions each according to the difficulty of the games, initially prioritizing those who explored movements of the pelvis in the frontal plane (Lotus FocusTM, Penguin SlideTM and Soccer HeadingTM) and, with evolution, those that allowed global movements (Penguin SlideTM, Table TiltTM and Balance BubbleTM). The pelvic floor muscle function and urinary loss were evaluated, respectively, through the PERFECT scheme and the pad test one hour and the results were descriptive summarized in Excel tables. **RESULTS:** Improved urinary loss through the pad test one hour and improve muscle function by digital palpation associated with the PERFECT scheme of the participants with urinary incontinence after intervention. **CONCLUSION:** The treatment of PFM through virtual reality proved to be effective in improving urinary loss and PF muscle function in this study, but clinical trials are required to prove their efficacy.

KEY WORDS: Urinary Incontinence. Virtual reality exposure therapy. Pelvic floor.

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Introduction

Urinary incontinence (UI), according to the International Continence Society (ICS), is defined as involuntary loss of urine[1,2], being one of the most embarrassing and stressful urinary symptoms and the main dysfunction of the pelvic floor[3]. It is considered a significant problem to public health and its prevalence in women corresponds to 27.6% and in men around 10.5% on average[4].

There are three main types of UI: stress urinary incontinence (SUI), urge urinary incontinence (UUI) and mixed urinary incontinence (MUI). The SUI consists of involuntary urine loss under stress, UUI refers to the sudden urge to urinate that cannot be postponed and MUI comprises the association of the loss under stress and urge-incontinence[1,2].

Urinary loss can be related to reduction of muscle strength and perception of the pelvic floor[5]. People with these dysfunctions are constantly worried about the availability of toilets, ashamed of urine odour, usage of protectors (absorbent) and more frequent changing of clothes. Altogether, UI can cause significant hygienic and social discomfort and thus negatively influence one' s emotional state[7].

In order to treat urinary loss caused by reduced strength and perception of pelvic floor muscles (PFM), urogynecologic physiotherapy is considered the first indication as a conservative therapy[8]. It includes associated therapeutical approaches, such as vaginal, anal or surface electrostimulation; as well as exercises involving postural corrections, PFM training, behavioural re-education and bladder training[8].

Therefore, PFM training the can be performed through non-immersive virtual reality. Virtual games on Nintendo Wii®[9] console can be used as kinesiotherapy and patients can interact with the challenges of the game through the movements of the own body[10]. It has the objective of increasing patients' adherence to treatment in a playful and non-invasive way, improving the contraction capacity of PFM during physical activities, and thus improving UI.

Virtual reality training has strengthened PFM contractility, increased muscle volume and improved PFM functionality[9]. Furthermore, this program was effective to improve patient's quality of life by reducing symptoms of UI[11].

Despite the aforementioned positive results, protocols are often not detailed[12], hindering their reproducibility. Thus, in this present study we aimed to evaluate the PFM function and the urine loss of incontinent women treated with detailed protocol of virtual exposure therapy based on case reports.

Methods

It is a case report, composed of two cases of women diagnosed with UI, presented through a descriptive approach. The treatment was carried out in Clínica Escola de Fisioterapia da UFBA (CEF-UFBA) located at the Padre Feijó street, 312 Canela and in one of the Physiotherapy Laboratories of UFBA located at the Pavilhão de Aulas do Canela (PAC), between the period from June to September, 2016. The patients were transferred from the Gynecology Service to the Physiotherapy Assistance Service of HUPES complex located at the Ambulatório Magalhães Neto, na Rua Augusto Viana, Canela - Salvador BA - CEP 40110-060, where the evaluations and reassessments were performed. This study is part of he project entitled "Training of pelvic floor muscles in the treatment of stress urinary incontinence", duly approved by the Ethics Committee of Instituto de Ciências da Saúde/ UFBA (CAAE: 49430515.3.3001.0049) under number 1.438.314 (04/03/2016) .

The criteria used to select patients were: women, aged 40 to 60 years with symptoms of urinary incontinence, without urinary tract infection (evaluated by urine and urine culture exams), reading and signing the Free and Informed Consent Form. The criteria used to exclude patients were: virgins (self-referenced), pregnants using hormone replacement therapy (HRT), with urinary loss less than 1.4 grams on pad test[13], pelvic organ prolapse (POP) degrees III and/or IV, absence of PFMs motor response with P0 in the PFM function according to PERFECT assessment scheme (Oxford), Body Mass Index (BMI) greater than 30 kg/m^2, self-reported presence of pelvic tumours, pelvic or abdominal surgery (up to 6 months prior to evaluation), neuropathies or decompensated clinical

diseases, and any previous conservative treatment before the UI.

Participants were treated with Exergame Nintendo (Wii Fit Plus™ games). The blood pressure was measured before and at the end of each intervention. The patients only initiated the intervention protocols when they reached the systolic blood pressure < 140mmHg and diastolic < 90mmHg.

On the first day, a physiotherapeutic evaluation assessment was performed containing detailed anamnesis, general physical and urogynecologic examination. Socio-demographic data was also considered: age, sex, body mass index (BMI), marital status, occupation and physical activity. For the anamnesis, the history of the clinical complains was verified in a thorough way aiming to collect relevant data UI characterization. The collected information included: menstrual history, surgical and obstetric history, usage of drugs that could compromise the lower urinary tract (LUT) function, anal and rectal history describing evacuation frequency and emptying sensation, voiding and sexual history. These histories were scored by means of a Verbal Descriptor Scale (VDS) that ranged from zero to ten, with zero (0) no voiding loss or a very poor sex life and 10 (10) a lot of urine loss or optimum sex life, respectively. Physical examination was essential in the evaluation of all participants due to LUT dysfunction. It included abdominal, pelvic and perineal evaluation. The urogynecologic exam evaluated some functions of the internal genital organs, pelvic organs prolapses and the urinary loss under stress.

The bidigital vaginal palpation test for evaluation of muscle function was performed in a reserved place by a single evaluator using procedure gloves and lubricant. Each participant was asked to contract the pelvic floor musculature in order to hold the two fingers of the examiner and avoid their removal. The capacity to contract or not was recorded, together with the calculation of the resistance and the maximum time in which the contraction was maintained, assigning the corresponding values of P (power), E (endurance), R (repetitions) and F (fast) according to the PERFECT Scheme[14].

To objectively quantify the volume of urinary loss, a modified 1-hour pad test was performed. The procedure consisted in the use of an absorbent previously calibrated on a precision scale. After emptying the bladder by spontaneous urination, each patient ingested 500 ml of water at room temperature and sat for 30 (thirty) minutes before starting the test. Each participant placed a pre-weighed absorbent and was then asked to perform the following protocol: sit and stand ten (10) times, perform ten (10) vigorous coughs, run in the same place for one (1) minute, lift a small object from the floor 5 (five) times and wash hands in running water for 1 (one) minute. After the protocol was finished, the absorbent was weighted[4].

The sessions were executed within 4 (four) weeks, with a frequency of 3 (three) sessions per week, comprising 12 (twelve) sessions in total. Each session lasts fifty minutes in total. At the beginning of each session, an orientation and training was conducted. Explanations were given to the patient about the types of games that would be used and the pelvis movements and muscular contractions needed (Transverse Abdomen Muscle and Pelvic Floor Muscles). Next, the patients performed 30 (thirty) minutes of intervention with Nintendo Wii Fit Plus™, in sedestation on the balance board, which was placed on a puff with a chair's seat height. The protocol was divided into two phases according to the difficulty of the games.

In the first phase, which consisted of the first 6 (six) sessions, three (3) games were used: Lotus Focus™, Penguin Slide™ and Soccer Heading™. Two (2) games used pelvic movements on the frontal plane (latero-lateral movements), Lotus Focus™ and Penguin Slide™. Lotus Focus™, which aims to maintain the candle flame steady, stimulates pelvic stabilization and contraction of the Transverse Abdominal Muscle (TAM). It was used 3 (three) times during approximately 6 (six) minutes; Penguin Slide™, which aims to catch the maximum number of fishes, was used 7 (seven) times during approximately 12 (twelve) minutes; and Soccer Heading™, which aims to nod the maximum number of balls and divert from other objects, was used for approximately 8 (eight) matches during 12 (twelve) minutes. The patients were seated on the Nintendo Wii® balance board and had to perform latero-lateral movements of

the trunk and pelvis while playing these games. Associated with these movements, they also had to maintain the TAM contracted throughout every match and contract the PFM upon verbal command of the researcher. During Lotus Focus™ game (played 3 times), patients were asked to contract only the TAM. During Penguin Slide™ game, contraction of PFM was asked lasting for 3 (three) seconds and followed by relaxation for 6 (six) seconds. This cycle was repeated 5 (five) in each game ming to train as phasic fibers. In Soccer HeadingTM, the contractions of the PFMs lasted (1) second followed by 3 (three) seconds of relaxation. This cycle was repeated 5 (five) times each game and was also aimed to train the phasic fibers.

In the second phase, 3 (three) other games were used comprising the last 6 (six) sessions. This phase required globalized pelvic movements (retroversion, anteversion, latero-lateral inclination and circular movements). The games used in this phase were: Penguin Slide™, Table Tilt™ and Balance Bubble™. In this phase, Penguin Slide™ was used 7 (seven) times during approximately 10 (ten) minutes; Table Tilt™, which the goal of the game is to fit the ball into a hole of a tray, was used for 10 (ten) minutes; and Balance Bubble™, which the game goal is to move down in a stream without touching its banks, for 10 (ten) minutes. In the Table Tilt™ and Balance Bubble™, patients performed pelvic movements on three planes (sagittal, frontal and transverse) while sitting on the swing platform of the Nintendo Wii®. In the Table Tilt™, the patients had to perform the pelvic movements while maintaining isometric contraction of TAM and contracting PFM on command. It was requested 10 contractions of the PFM of 1 (one) second and followed by relaxation with duration of 3 (three) seconds. This cycle was repeated 3 (three) times in order to train the phasic fibers. In the Balance Bubble™, 10 contractions of 6 (six) seconds were requested followed by 12 (twelve) seconds of PFM relaxation concomitant with the contraction of the TAM in order to strengthen the tonics fibers. In Penguin SlideTM, pelvic muscle was contracted for 3 (three) seconds, followed by a 6 (six) seconds relaxation. This cycle was repeated 5 (five) times in each game in order to strengthen phasic muscle fibers.

Before each session, the patients were oriented about how to properly contract the muscles. The verbal commands for contraction of the PFMs explored the mental image of "carry the belly button to the back" to optimize the activation of the TAM and the "hold the urine", without the adduction of the thighs, to avoid the co-contraction of the adductors and to facilitate the action of PFMs. The corporal and pelvic posture and inappropriate muscular activities were corrected by the physiotherapist during each game. It was used tactile stimulus to correct the movements of the pelvis and verbal command for the movements and contractions of PFM and TAM.

Case 01

The participant 01 is 44 years old, female, 1.59m tall, 63kg, BMI 24.91kg / m2, single, nutrition technician, with nosological diagnosis of stress urinary incontinence. On the gynecological/obstetric history, the participant reported 1 (one) gestation and 1 (one) vaginal delivery (height of 50 cm and a weight of 3.8 kg) and performed perineoplasty 12 years ago. On the sexual history, there was no change in her life style due to urinary losses and she scored her sexual life, at the time of this study, as 10 (ten) by means of VDS. On the rectal history, the participant presents an evacuation frequency of 7 (seven) times a week with a daily frequency of one (1) time and most often with a sensation of incomplete emptying.

During the physiotherapeutical evaluation, a recurrent urinary tract infection (UTI) was identified. However, during the virtual reality treatment period, it was not observed UTI, incomplete emptying feeling, haematuria, post-voiding drip, incapacity to interrupt urine stream, capacity to make it weaker or stronger and inability to control urination in case of a strong urge to urinate. Conversely, the patient reported loss of urine when coughing, crouching, running, smiling, sneezing or in contact with water. These urine losses happened with full or empty bladder and the patient lost it without realizing. The quantified volume of these urine losses is scored 6 (six) by VDS, corresponding to a moderate loss.

In the clinical examination, according to the PERFECT scheme, the patient presented P4 (Oxford). It corresponds to the presence of contraction with moderate opposite resistance, maintenance of E4 (four seconds) and R15 (fifteen repetitions) contractions without fatigue. Furthermore, the patient performed 10 (ten) fast contractions after 1 (one) minute of rest (F10) but this was done using TAM.

In the palpation exam and perineal inspection, the patient presents episiotomy without adhesions, presence of posterior and anterior wall prolapses and trigger points on the anterior left region. During the stress incontinence test, patient lost urine by coughing while sitting, switching from seated to orthostasis and coughing on orthostatic position. In the 1 hour pad test, the participant presented three (3) grams of urine loss.

Case 02

The participant 02 is 58 years old, female, 1.51m tall, 55kg, BMI 24.12kg / m2, divorced, sales consultant and presented nosological diagnosis of stress urinary incontinence. In the gynecological/ obstetric history, the participant reported 1 (one) gestation and 1 (one) vaginal delivery (height of 53cm and the weight of 3.8kg). In the sexual history, the participant does not present an active sexual life. In the historical rectal history, the participant presents an evacuation frequency of 7 (seven) times a week with a frequency of 1 (once) a day and often presents a sensation of incomplete emptying.

During the physiotherapeutical evaluation, a recurrent urinary tract infection (UTI) was observed. However no UTI was observed during the period of treatment by virtual reality, urge to urinate, feeling of weight in the womb, sensation of incomplete emptying, hesitancy, post-voiding drip, ability to stop the urine stream, to make it weaker or stronger, and to control urination in case of a strong urge to urinate. On the other hand, the patient reported loss of urine when coughing, running, smiling, sneezing, in contact with water. These losses occurred only when her bladder was full. The volume of losses scored by EVD was 8 (eight) by, corresponding to a significant loss.

In the clinical examination, according to the PERFECT scheme, the patient presented P1. It corresponds to the presence of slight contraction without movement, without maintaining contraction (E0) and presented 6 (six) contraction sketches (R6). In addition, the patient was unable to perform rapid contractions after 1 (one) minute of rest (F0). In the palpation exam and perineal inspection, the patient showed hypotrophic pelvic floor, episiotomy without adhesions, hemorrhoids and pelvic organ prolapse (anterior wall prolapse grade 1). During the stress-loss test, the patient lost urine switching from seated to orthostasis and when coughing in the orthostatic position. In the 1-hour pad, the participant lost 3 (three) grams.

Results

The two participants performed 12 (twelve) sessions that were divided into two stages. Participant 01 understood and performed better the necessary movements during the games than the participant 02. In the first stage, with the Lotus Lotus Focus™, Penguin Slide™ and Soccer Heading™ games, the participant 01 was more comfortable in the former game and the participant 02 had more difficulties to understand and execute it. In the second phase, with Penguin Slide™, Table Tilt™ and Balance Bubble™, participant 01 showed good comprehension and execution in all games after the second session of this stage. Despite this, both participants managed to advance well in all games during the sessions.

The data referring to the sociodemographic characteristics of the participants with UI are shown in table 1 and the urinary, proctological and urogynecological symptoms are shown in table 2.

Table1. Sociodemographic characteristics of women with UTI treated with Virtual Reality. CEF-UFBA, Salvador/BA, 2016

Variables	Participant 01	Participant 02
Age	44 years	58 years
BMI	24,91kg/m²	24,12kg/m²
marital status	Single	Divorced
Profession	Nutrition technician	Sales consultant
Physical Activity	Hike	Hike

UI: Urinary incontinency; BMI: Body mass index

Table 2. Assessment of urinary, proctological and urogynecological symptoms of women with UI treated with Virtual Reality. CEF-UFBA, Salvador/BA, 2016

Variables	Participant 01	Participant 02
Number of pregnancies	1	1
Vaginal delivery route	1	1
Fecal incontinence	Absent	Absent
Evacuation frequency	>3x per week	>3x per week
Sexual Activity	Present	Absent
Start of urine loss	> 5 years	< 5 years
Use of protectors daily	No	No

UI: Urinary incontinency

Regarding the PFM assessment through PERFECT Scheme (Table 3), it was observed that the participant 01 evolved from a contraction with a moderate opposing resistance to a contraction with strong opposing resistance based on the evaluation of graded muscle contractility 0 (zero) to 5 (five). The participant 02 presented a pelvic floor with a fibrillation felt (finger examination) that had initially P1 and after 12 (twelve) sessions, presented a contraction with P3.

The patient 01 performed more contractions on the initial evaluation based on the evaluation of fast-twitch muscle fibers after 1 (one) minute rest from the Repetitions (R). However, in the first evaluation the participant recruited TAM and in the final evaluation the contraction of the PFM was more isolated. We observed the evolution of the participant 02, which from the 15th (fifteenth) contraction, began performing more slowly the relaxation phase but could do 27 (twenty seven) contractions.

Table 3. Muscle function summary of women with UI treated with Virtual Reality (PERFECT Scheme). CEF-UFBA, Salvador/BA, 2016

Participant	Evaluation	*Power* (P)	*Endurance* (E)	*Repetitions* (R)	*Fast* (F)
01	Initial	4	4s	15	10
	Final	5	4s	40	10
02	Initial	1	0s	6	0
	Final	3	5s	4	10

UI: Urinary incontinency

In the evaluation of urinary loss through the 1 hour pad test presented in Table 4, the absorbent was weighed before and after the test. Participant 01 reported that the loss in the initial evaluation occurred in the squatting phase to catch the weight on the ground. The participant 02 reported that the two losses, both in the initial evaluation and in the final evaluation, occurred when coughing in orthostatic position. According to the descriptive verbal scale (DVS) for patients to quantify their urinary loss from 0 to 10, consider 0 nothing and 10 much, there was improvement after the intervention, Table 4.

Table 4. Urinary loss assessment by the pad test and DVS of women with UI treated with Virtual Reality. CEF-UFBA, Salvador/BA, 2016

Participant	Evaluation	Weight before (g)	Weight after (g)	Difference (g)	DVS
01	Initial	7	10	3	6
	Final	6	6	0	3
02	Initial	7	10	3	8
	Final	6	7	1	6

UI: Urinary incontinency

Discussion

Improvement of urinary loss and muscle function was observed in participants with urinary incontinence based on pad test and digital palpation, respectively, associated with the PERFECT Scheme. The patients were treated with virtual reality therapy with the Nitendo Wii® console and with Wii Fit Plus™ games. A similar result was found in the study by Martinho (2014)[9] who, unlike this study, performed a protocol in 10 (ten) sessions during 5 (five) weeks; as well as in the study by Fraser et. al. (2014)[15] and Elliott et. al. (2015)[11], who performed the intervention in 24 (twenty four) sessions during 12 (twelve) weeks. Regardless the treatment duration, it was observed that Virtual Reality Exposure Therapy (VRET) can be a complementary therapy in the treatment of UI, it is clinically feasible, safe, potentially effective for the improvement of PFM function (strength and resistance) and control of urinary loss.

Martinho (2014)[9] observed a significant correlation between digital palpation and vaginal dynamometry both in the pre- and post-treatment period. However, he pointed out that the last method was not performed by all participants, since it caused discomfort/pain when the equipment was introduced decreasing vaginal elasticity, characteristic of the postmenopausal period. This evidences that the digital palpation is a good method to evaluate the general perception and dynamic force of the pelvic floor, justifying its use in this present research.

The study by Martinho (2014)[9], composed of 47 participants, also evaluated muscle contractility in postmenopausal women through digital palpation with the Oxford Modified Scale. The author performed PFM training dividing two groups, kinesiotherapy and virtual reality (Wii Fit PlusTM). After intervention, there was improvement in the PFM contraction without significant difference between

the groups. Similar results were found in the study by Silva (2015)[16], performed with 47 nulliparous and continent women, where an increase in the muscular strength of the PFMs was observed after intervention, both in kinesiotherapy and in virtual reality, with no significant difference between the groups. Although the aforementioned studies compare kinesiotherapy and virtual reality, their results corroborate the present case report as they obtained favourable results regarding the improvement of the PFM strength using the same method of evaluation by digital palpation.

In the present study, it was also emphasized in the treatment protocol the activation of TAM concomitant with the contraction of PFM. However, it is not possible to state that there was such activation of the TAM since we did not verified it. It could be possibly verified using a technology such as electromyography. Martinho (2014)[9] discusses that his results on the PFM function, obtained with virtual reality, can be explained by the maintenance of the sustained contraction of the TAM that possibly favoured the contraction of PFM. However, the study by Andrade et. al. (2014)[17] shows that the contraction of the abdominal muscles promotes an activation of the PFMs by the abdominal-pelvic synergy but it is not enough to promote a significant increase in muscle strength in nulliparous women and without voiding complaints.

In this report it was observed that one of the participants maintained the same pre- and post-treatment results in the endurance domain (E) of the PERFECT Scheme but she improved the contractions quantity and quality. To better characterize these changes, a histological analysis would be necessary. However, as explained by Martinho (2014)[9], the data collected in his research was obtained indirectly because there was no histological analysis of muscle fibers of the pelvic floor after training that would be ideal to directly evaluate muscle fiber alterations.

Regarding the improvement of urinary loss in the patients evaluated in this study, the findings corroborate the study by Fraser et al. (2014)[15]. These authors performed a 12-week intervention that included education on UI, pelvic floor training in various positions, functional training with another game called "Step Mania" and home guidance in 23 (twenty-three) participants. 13 participants demonstrated a clinically significant improvement in the pad test, which is the improvement of the urinary loss.

Regarding the ease of understanding and execution of the Wii Fit PlusTM games, the participant 01 presented greater ease in the games when compared to the participant 02, as described in the results session of the present study. Possibly this fact is due to the good level of education inferred when considering the profession (nutrition technique) of this participant, since the variable schooling was not collected during the evaluation. Another factor may also be age related, since the participants are from different generations the approach with electronic games may have happened in a different ways and intensity for each of them due to the advances and exposure to the technological changes that happen at each moment of the life cycle. Despite this, it was considered that the two participants managed to advance well in all games during the sessions.

As an advantage of this research, we can cite the detailed protocol with satisfactory results and clinical feasibility to use Wii Fit PlusTM games in the treatment of PFM function and urinary loss that allow faithful replication in experimental future studies. In addition, the inclusion of the contraction of the TAM associated with the PFM, as used in this study, may enhance the gain of strength and function of the PFMs by the abdominal-pelvic synergy, although it is not possible to state that there was activation of TAM without verify it by electromyography.

The type of this study is considered does not allow to generalize the results and is considered a limitation. Moreover, the positive results obtained with the limited number of sessions (12 for the present study) may not be sustained in the long term, since the force gain demands time, frequency and intensity[9] and lack of blinding in the evaluation. Therefore, more research is necessary, with randomized clinical trials, blind, with follow-up and guidance for home exercises, in order to verify therapeutic efficacy.

Conclusion

The protocol proposed in this study with virtual reality therapy using Nintendo Wii Fit PlusTM was shown to be effective in improving the PFM function, through digital palpation associated with the PERFECT Scheme, and of urinary loss based on in the pad test, of the participants.

Contributions of the authors

Peixinho TAM participated in the conception, design, evaluation and care of the patients, search and analysis of articles included in the research, article writing and referral for publication. Saraiva A participated in the search for articles for research and interpretation of data. Trippo KV participated in the conception, design, search of articles, interpretation of collected data and writing of the scientific article.

Conflicts of interests

No financial, legal or political conflict involving third parties (government, business and private foundations, etc.) was declared for any aspect of the work submitted (including but not limited to grants and funding, advisory board, study design, manuscript preparation , statistical analysis, etc.).

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