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RESEARCH PAPER

Women with fibromyalgia's experience with three motion-controlled video game consoles and indicators of symptom severity and performance of activities of daily living

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Abstract

Purpose: Little is known of Motion-Controlled Video Games (MCVGs) as an intervention for people with chronic pain. The aim of this study was to explore the experience women with fibromyalgia syndrome (FMS) had, using commercially available MCVGs; and to investigate indicators of symptom severity and performance of activities of daily living (ADL). *Method*: Of 15 female participants diagnosed with FMS, 7 completed a program of five sessions with Nintendo Wii (Wii), five sessions with PlayStation 3 Move (PS3 Move) and five sessions with Microsoft Xbox Kinect (Xbox Kinect). Interviews were conducted at baseline and post-intervention and were supported by data from observation and self-reported assessment. *Results*: Participants experienced play with MCVGs as a way to get distraction from pain symptoms while doing fun and manageable exercise. They enjoyed the slow pace and familiarity of Wii, while some considered PS3 Move to be too fast paced. Xbox Kinect was reported as the best console for exercise. There were no indication of general improvement in symptom severity or performance of ADL. *Conclusion*: This study demonstrated MCVG as an effective healthcare intervention for the women with FMS who completed the program, with regards to temporary pain relief and enjoyable low impact exercise.

➤ Implications for Rehabilitation

- Exercise is recommended in the management of fibromyalgia syndrome (FMS).
- People with FMS often find it counterintuitive to exercise because of pain exacerbation, which may influence adherence to an exercise program.
- Motion-controlled video games may offer temporary pain relief and fun low impact exercise for women with FMS.

Keywords

Assistive technology, chronic pain, distraction, Nintendo Wii, PlayStation 3 Move, qualitative content analysis, virtual reality, Xbox Kinect

History

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Introduction

Fibromyalgia syndrome (FMS) is characterized by widespread chronic pain; often accompanied by symptoms of fatigue, morning stiffness, sleep disorder, headache, anxiety and depression [1]. It has been suggested that pain symptoms may be related to abnormalities in the central nervous system, including central sensitization and inadequate pain inhibition [2]. In a recent study, the estimated prevalence of FMS in five European countries varied from 1.4% to 3.7%, with overrepresentation of women aged >30 years [3]. FMS has a significant impact on performance of activities of daily living (ADL), quality of life and is associated with high healthcare expenses [4]. Pharmacological therapies are often used as short-term symptomatic treatment while a Cochrane review and a meta-analysis indicates that aerobic exercise can be used for long-term improvement of global well-being, physical function and symptom reduction [5,6]. In line with this, evidence-based guidelines for management of FMS suggest a combination of pharmacological and non-pharmacological therapies. The latter consisting of heated pool treatment, cognitive behavioral therapy, physiotherapy and individual tailored exercise programs including aerobic exercise and strength training [7]. People with FMS often find it counterintuitive to exercise because of pain exacerbation for several days following exercise, if the intensity has been too high [2]. Furthermore when a supervised exercise program has been completed, a decline in exercise adherence often occurs [6]. Thus, it may be relevant to find innovative strategies in the treatment of FMS in which a variety of activities is possible; combined with the opportunity for participants to choose exercise intensity [5,8].

According to the Gate Control Theory proposed by Melzack and Wall [9] pain sensations can be controlled, modified and inhibited by distraction. Consistently, Gold et al. recently hypothesized that Virtual Reality (VR) can induce pain distraction through attention on multi modal sensory stimuli and diminish of pain related emotions [10]. Studies, which have used VR for pain

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distraction has shown positive effect on, burn patients, cancer patients and people with regional pain syndrome [11–13]. Motion-Controlled Video Game (MCVG) is a non-immersive variation of VR, which is enhanced by use of gesture recognition [14]. Such MCVGs are commercially available via the game consoles Nintendo Wii (Wii), Sony PlayStation 3 Move (PS3 Move) and Microsoft Xbox Kinect (Xbox Kinect). According to Taylor et al. [15], MCVGs offer new opportunities in therapeutic rehabilitation as they make it possible for people with impairments to participate in simulated sports and game-based activities. Furthermore, it is possible that pain distraction from playing MCVGs can result in a more enjoyable experience and thereby improves adherence with an exercise program [15]. To our knowledge, no published studies have investigated MCVGs as a healthcare intervention for people with FMS. Furthermore, no studies have used Wii, PS3 Move and Xbox Kinect in the same healthcare intervention. The aim of this study was to describe women with FMS' experience with three MCVG consoles and indicators of symptom severity and performance of ADL.

Method

Research design

This study is the second part of an experimental study questioning the potential use of MCVGs in rehabilitation of patients with FMS [16]. The prior research explored a single game console, i.e. Wii, which was extended in this study to explore the use of two additional consoles, i.e. PS3 Move and Xbox Kinect. Results from the pilot study indicated the potentials that were further explored in this work with increased numbers of participants. The present study used a qualitative description approach supported by quantitative observation measures in description of the primary outcome: participants' experience with MCVGs. Quantitative measures were used in description of the secondary outcome: indicators of pain and fatigue symptom severity and performance of ADL. All data were treated confidentially and to assure anonymity, pseudonyms are used in this article. The Regional Scientific Ethical Committee for Southern Denmark approved the study.

Participants

The study included 15 women recruited from Reumaclinic Denmark during January and February 2011. Inclusion criteria were women aged 18 years or above and diagnosed with FMS using the American College Rheumatology classification criteria [1]. Exclusion criteria were other diagnosed rheumatic diseases, e.g. rheumatoid arthritis. Seven women completed the program (Table 1) and eight women dropped out. Six of the dropouts played between one and six game sessions and two only came for the baseline interview. Self-reported reasons for dropout included pronounced symptom severity at baseline, logistical issues and not enough necessary time.

Procedure

The study took place at SensoramaLab, a research facility at Aalborg University Campus Esbjerg. Interviews with each participant were conducted at baseline and post-intervention and followed a semi-structured interview guide with pre-selected topics [17]. At baseline participants were interviewed about motivation and expectations for ~20 min; and post-intervention, participants were interviewed about the experience of the program for ~45 min. Furthermore, at baseline and post-intervention, information on pain, fatigue and ADL performance were gathered. Each participants completed a program of five consecutive sessions with Wii, five consecutive sessions with PS3 Move and five consecutive sessions with Xbox Kinect; a total of 15 sessions. Participants used MCVG consoles in random order to improve the possibility that consoles were equally remembered at post-intervention interviews (Table 1). Participants played for 30 min at each session and had at least 2 days rest before the next session. During each session, an occupational therapist was present, using an observational tool for assessment of play experience and giving instructions if participants had game difficulties. Time and date of the next session was usually planned from day to day to allow a flexible schedule.

Game consoles

Wii and PS3 Move games are played via one or two motion-sensitive handheld controllers, depending on the game; whereas Xbox Kinect uses range camera technology to track body movement, and thereby does not involve a controller. In most games, a game-character represents the player and a computer opponent is played against. In the present study a sports game package was used for each of the consoles, which included from 6 to 12 different activities, e.g. bowling, table tennis and volleyball. At each session participants were free to choose which games and how many different games on the respective MCVG console to engage with.

Instruments

Test of Playfulness (ToP) was used as an observational tool for assessment of play experience. ToP encompasses four categories: *Intrinsic Motivation*, *Internal Control*, *Suspensions of Reality* and *Framing*. Each category consists of a number of items, e.g. *actively engaged* and *acts self-direct*, which separately have three subcategories: *extent*, *intensity* and *skilfulness*. Subcategories can be answered from 0 (*not/never*) to 3 (*high/always*). Items regarding *Framing* were considered inappropriate in this context as they revolve social aspects of play [18]. Furthermore, items *appears safe* and *actively modifies complexity* were considered inappropriate. Leaving out items did not affect the test psychometrics as items can be scored non-applicable [19]. ToP has proven valid and reliable in observation of children [20,21], but has also shown useful in observation of adults [22].

Table 1. Participant characteristics.

Participant	Age	Living status	Work status	Experience with game consoles	Duration of intervention	Intervention (1st, 2nd and 3rd console)
Astrid	46	Husband and children	Sick leave	Wii	9 weeks	PS3 Move, Xbox Kinect, Wii
Bente	55	Husband	Incapacity benefit	Wii	12 weeks	Wii, PS3 Move, Xbox Kinect
Dorthe	44	Husband and children	Working	None	13 weeks	Wii, PS3 Move, Xbox Kinect
Esther	54	Husband	Job training	Wii	10 weeks	Xbox Kinect, Wii, PS3 Move
Gudrun	47	Alone	Working	Wii	9 weeks	PS3 Move, Xbox Kinect, Wii
Mona	51	Husband and children	Working	Wii	17 weeks	PS3 Move, Xbox Kinect, Wii
Nelly	48	Alone	Incapacity benefit	Wii	15 weeks	PS3 Move, Xbox Kinect, Wii

All names are pseudonyms.

Visual Analogue Scale (VAS) was used for assessment of pain. It is a straight line of 100 millimetres with anchors representing the extremes of pain sensation; 0 (*no pain*) and 10 (*pain as bad as it can be*). VAS has proven to be a valid and reliable instrument [23] and is the preferred pain assessment instrument for people with FMS [7].

Brief Fatigue Inventory (BFI) was used for assessment of fatigue. Three items assess severity of fatigue during the past week at *worst, usual* and *now*; with 0 (*no fatigue*) and 10 (*as bad as you can imagine*). Six items assess how much fatigue has interfered with different aspects of life during the past week; with 0 (*does not interfere*) and 10 (*completely interferes*) [24]. BFI has shown high reliability in fatigue assessment of cancer patients [24] and has been used in fatigue assessment of cancer comorbidities such as FMS [25].

ADL Questionnaire (ADL-Q) was used for assessment of ADL performance [26]. It consists of seven daily activity domains, e.g. *grooming* and *dressing* and five weekly activity domains, e.g. *cooking* and *cleaning*. Each domain contains from two to six actions, e.g. *dressing upper trunk* and *dressing lower trunk*; a total of 47 actions. Actions can be separately answered with 0 (*cannot perform*) to 6 (*performs without assistance*). ADL-Q is validated on women with FMS [26].

Data analysis

Interviews were transcribed verbatim and analyzed using inductive qualitative content analysis [27]. The process began with open coding, wherein every statement was given a number of headings until all aspects of the content were described. Headings were then collected under one or several content specific subcategories [27]. Authors one and two did the process separately and afterwards coding and categorization were compared between authors and discussed until consensus could be reached. The process resulted in eight subcategories, e.g. *enjoyment of playing* and *manageable exercise*. Subcategories were collapsed in three main categories: *Reasons for participation*, *Playing MCVGs* and *Thoughts and reflections after the program.* Main categories were chosen to establish a chronological timeline in the results section. Quotes were translated from Danish and validated by a co-author.

Method triangulation was used to have independent data sources support each other [28]. Consequently, in the results section *Playing MCVGs;* experiences based on statements are supplemented by data from quantitative observation measures. This is marked with a reference to Table 2, combined with a number of * correlating with the ToP reference. Similar ways to present results has been suggested in several other studies [29,30]. Analysis of ToP was carried out by comparison of mean ToP scores from sessions 11 to 15 with mean ToP scores from sessions 1 to 5. In a few cases, the mean ToP was based on four scores instead of five, because of missing values. For analysis of the secondary outcome, baseline- and post-intervention scores on VAS, BFI and ADL-Q were compared. All scores were analyzed with Wilcoxon sign-rank test in STATA version 12/IC.

Results

Reasons for participation

Difficulties in daily living

All participants expressed that performance of ADL was decreased because of symptoms. Most reported difficulties were in housework activities such as cooking and cleaning, but difficulties were also reported in leisure activities. Participants mentioned that they no longer had the energy to perform leisure activities. Fatigue was a major concern in daily living; due to lack of energy, participants had to structure the day to get enough rest.

Treatment alternative

The opportunity to overcome obstacles in daily living was a great motivator to participate in the program and so was the frustration of no optimal treatment of FMS. Most participants considered the program as an opportunity to start exercise, lose weight and/or reduce the use of pharmacological therapies.

Playing MCVGs

Enjoyment of playing

All participants stated that they enjoyed playing MCVGs and were distracted from pain sensations while playing. Astrid said, ''Because I think it's fun and when you're having fun you forget or drive the pain away (...) even football was fun''. The competition against the computer opponents increased engagement and several participants mentioned the feeling of satisfaction they got when they performed well. Mona explained, ''I've felt it as a victory, when I've scored maximum points in bowling''. Furthermore, some participants related play on MCVGs with real life activities. Dorthe stated, ''If I went in to a bowling alley or a volleyball court now, I wouldn't be able to do it. So it's kind of fun that you can do stuff, that you know is off limit in the real world''. Bente could even see some advantages playing simulated games ''Volleyball, which I often used to play, I always strained my thumb (...) you don't do that here''. At baseline most participants seemed uncertain how to play the games and operate the handheld controllers, but as the program progressed, they became more in control of the situation and acted self-direct within the game environment (Table 2,*). They also became more unrestrained in the game situation, which could be seen with the intensity in which they joked and engaged in mischief (Table 2,**).

Table 2. Observed experience of play with motion-controlled video games; using the Test of Playfulness (ToP).

	Intrinsic motivation			Internal control			Suspension of reality	
Participants	EXT	INT	SKILL	EXT	INT	SKILL	EXT	INT
Astrid	−0.12	0.07	−0.40	0.53	0.20	−0.33	−0.05	0.25
Bente	0.25	−0.07	−0.20	0.13	0.60	−0.30	0.10	0.55
Dorthe	0.13	−0.20	−0.40	0.13	−0.20	−0.05	−0.10	0.25
Esther	0.19	−0.33	−0.40	0.13	−0.20	0.38	0.10	−0.20
Gudrun	0.72	0.53	0.20	0.60	0.80	0.78	0.55	0.45
Mona	0.68	0.20	0.20	0.60	0.60	0.70	0.40	0.28
Nelly	0.30	−0.20	0.05	0.00	0.60	0.46	0.45	0.40
Wilcoxon sign-rank	$p = 0.03$***	$p = 0.80$	$p = 0.23$	$p = 0.02$*	$p = 0.09$	$p = 0.18$	$p = 0.08$	$p = 0.03$**

All names are pseudonyms. Δmean = (session 11–15 mean) − (session 1–5 mean). EXT, extent; INT, intensity; SKILL, skilfulness.

Manageable exercise

Most participants had, for a long time, searched for ways to do exercise that they could manage. Nelly expressed a general paradox among the participants stating, ''The only way you can get more energy is by doing exercise (...) yes, thank you, I don't have the energy to exercise''. Participants reported that MCVGs was a manageable exercise, even though some of them felt pain exacerbation after playing. Mona stated, ''for me this would be what you call exercise, even though it may sound trivial'' and Nelly stated, ''It's a way of doing exercise that I can actually do in the long run (...) just don't tell people it's exercise''.

Challenges and obstacles

Especially table tennis and beach volley on PS3 Move were challenging because they were very lifelike and hence the pace was very fast; being a source of frustration for some of the participants. Some also mentioned a general frustration from not being able to perform as well as they wanted. Bente said, ''well, I want to do more and do better than I do (...) I lose my concentration''. Still, all participants were persistent, and motivation kept them from quitting a difficult game. This tendency got more prominent through the program (Table 2,***). A challenge with Xbox Kinect was that the gesture recognition sensor could not process movement when participants were sitting[1]. This caused a problem to Nelly, because she usually walked with a cane due to pain and fatigue, and had difficulties standing for >5 min. However, it was possible to cheat the sensor with a very high chair, giving the illusion that she was standing.

Thoughts and reflections after the program

Long-term benefits

Several participants reported that their body had become stronger during the program period and some reported that they had gained more body awareness. Astrid wanted to have the energy to spend more time with her children and achieved this by playing MCVGs, ''they were really surprised when, one night I wanted to join them (...) but, really, it was so much fun and we laughed and had a good time (...) I also explained that this was the purpose of my participation (...) to have the energy to be together with the kids, and this is actually a good way to achieve this''. Participants in general considered playing with MCVGs as a good way to keep motivation and be physical active without overstraining themselves.

Game console evaluation

Most participants had tried Wii before the program (Table 1) and enjoyed the slow pace and familiarity of the games, which were considered important factors. On the other hand some mentioned that the Wii sensor did not detect all motions and having seen games on PS3 Move and Xbox Kinect they were not that impressed with graphics on the Wii console; some participants referred to Wii as children's games. Participants enjoyed games on Wii and PS3 Move, but mentioned that they got the most exercise from Xbox Kinect. However, some participants reported that Xbox Kinect was too hard physically because of full body involvement. Dorthe said, ''I tried football a single day, uh! That was hard. You really had to be fit to do that''. Because of this, some preferred to play with a handheld controller, simply because they felt that it was less physically demanding. Games like bowling, volleyball, table tennis and golf were the most popular games. Fighting games, on the other hand, were rarely played; not because of physical demands, but because the gameplay did not appeal to most participants.

Home-based training

When asked, five of seven participants would continue with the program if the opportunity were given. Some wanted to continue because they thought it was a good opportunity to get out of the house and do enjoyable exercise; others mainly because they wanted to support research. Two participants stated that they would rather play at home because of logistics. Since the program did not continue, participants were motivated to buy a MCVG console and play at home, if they did not have access to one already. Gudrun said, ''I didn't get more pain by doing this than I would have by doing other stuff (...) so – I might as well do it and get some exercise (...) you can look at it from the other side, in these 30 min you forget the pain''. Most participants considered MCVGs as a good social activity to play with family.

Symptom severity and performance of ADL

Although participants reported benefits from the program, self-reported assessment showed no statistically significant indication of improvement in pain and fatigue symptom severity or performance of ADL (Table 3).

Discussion

Participants stated that they were distracted from pain symptoms while playing MCVGs and that it was a fun and manageable exercise. Furthermore, several related MCVGs with real-life leisure activities. Participants enjoyed the slow pace and familiarity of Wii while some considered PS3 Move to be too fast paced. Xbox Kinect was reported as the best MCVG console for exercise.

Results, which suggest that playing MCVGs can be used as a pain distractor, can be seen in the light of psychological pain mechanisms, proposed by Gold et al. [10]. Here, it is stated that multi modal sensory stimuli may draw attention away from pain sensations and reduce pain-related emotions. In the present study, statements and observations suggest that participants were too focused on playing to take notice of pain sensations. Additionally participants did not seem affected by negative emotions related with pain sensations as they mostly expressed obvious exuberance while playing. These results are consistent with a study by Hoffman et al. [31], which used functional magnetic resonance imaging and self-reporting rating on pain sensation during VR gameplay on healthy adults. Findings from this study indicate that VR changes the way people interpret incoming pain signals and reduce the amount of pain-related brain activity. Taking these results into consideration, it is likely that playing MCVGs can break the negative spiral of pain related emotions and thereby has the potential of being a good pain distractor. As reported though, pain relief was only temporary. Considering that FMS may be related to inadequate pain inhibition, which causes pain exacerbation after exercise [2], this result is not surprising.

Participants reported increased strength and body awareness, but there was no indication of general improvement in symptom severity. These results are in line with a Cochrane review, which concluded that aerobic exercise might improve global well-being and physical function, but that evidence of general symptom reduction is limited [6]. A meta-analysis, on the other hand, found that low to moderate intensity aerobic exercise might reduce pain symptoms [5]. However, studies included in the analysis used aerobic exercise combined with strength training and/or stretching, and more than half of the studies had an intervention of more

[1]This issue is addressed in the latest Kinect for PC that evolved from the original Xbox Kinect used in this study.

Table 3. Self-reported symptom severity and performance of activities of daily living; using Visual Analogue Scale (VAS), Brief Fatigue Inventory (BFI) and ADL Questionnaire (ADL-Q).

	VAS			BFI*			ADL-Q**	
Participants	Baseline	Post	Difference	Baseline	Post	Difference	Daily actions	Weekly actions
Astrid	7	8	1	7.6	6.4	−1.2	...	...
Bente	8	6	−2	7.2	7.1	−0.1	...	...
Dorthe	8	4	−4	7.1	7.3	0.2	...	...
Esther	6	5	−1	5.3	6.1	0.8	...	...
Gudrun	9	5	−4	5.3	7.1	1.8	...	...
Mona	4	5	1	4.8	7.4	2.6	...	...
Nelly	7	9	2	6.6	7.3	0.7	...	...
Wilcoxon sign-rank		$p = 0.35$			$p = 0.18$		$p > 0.05$	

Post, post-intervention.
*Mean score.
**Separate analyses of 31 daily and 16 weekly actions (data not shown).

than 1000 min; whereas the present study only had an intervention of 450 min. In a study by Jones et al. it is claimed that there is a narrow therapeutic window when making exercise programs for people with FMS, in which too much exercise result in increased symptom severity and too little exercise fail to yield any benefits [32]. In the present study there were no fixed schedule as too how many days should pass between sessions, due to participants' symptom severity and logistical issues. Thus, it is likely that the program contributed with too little exercise to yield improvement in symptom severity or performance of ADL.

Although no general improvement in symptom severity was attained, participants did see play on MCVGs as a good way of doing exercise. Most participants related exercise with pain exacerbation, but playing MCVGs they managed to be physical active and enjoyed it. A reason for this could be that it was not being perceived as exercise but as play, which may have increased motivation [33]. Even though play on MCVGs was not perceived as regular exercise it offers benefits of low impact exercise, which is one of the exercise prescription principles for people with FMS [32]. A review by Taylor et al. showed that energy expenditure when playing Wii could be compared with walking, but not actual sports [15]. This may be a reason why participants could endure play on MCVGs. Most of them had given up on sports activities but found that play on MCVGs was a manageable exercise. However, to some participants Xbox Kinect was too demanding, which can be explained by a recently published study by Donovan et al. Results from this study showed that energy expenditure was higher when playing Xbox Kinect than playing Wii [34]. A possible explanation for this could be the need of full body involvement with Xbox Kinect, which is not a necessity with Wii or PS3 Move.

Most reported difficulties in ADL performance were related to housework, but difficulties in leisure activities were also reported; which is consistent with results from other studies [35,36]. According to the Canadian Model of Occupational Performance and Engagement (CMOP-E) [37] difficulties in ADL performance can create disharmony in the dynamic interaction between individual, occupation and environment, and limit the ability to engage in meaningful activities. Thus, it may be relevant to find alternatives for lost activities. Several participants who had given up on sports activities implied that MCVGs like bowling and volleyball could be a potential substitute leisure activity. This indicates that MCVGs provided a possibility of an occupational transition to new meaningful activities. The experience of meaningfulness especially appeared when participants overcame challenges, e.g. when winning; participants became more engaged with game-play, which was expressed through increased confidence and self-praise. Several studies have shown the importance of social support in rehabilitation of people with FMS [38,39]. Participants perceived MCVGs as a good social activity, which allowed them to share common experiences with family. This finding is supported by studies, which suggest that MCVGs can be used to help reconnect patients with their social environment by restoring lost communication and provide a new topic of conversation. Additionally, physical presence is not required as people can play against each other using an Internet connection [40,41].

Strengths and limitations

The program was for participants to complete 15 sessions, to offer suitable experience of each MCVG console and to give indication of any change in symptom severity and performance of ADL. However, to achieve this, participants had to be committed to the program for at least 7 weeks, which may have influenced adherence. Of 15 participants, 8 did not complete the program. This is consistent with the Cochrane review, which found that people with FMS might have difficulty with adherence to exercise programs [6]. In the present study, dropouts did not differ from participants with regards to age with median 41 (23–58) (except for one young outlier), work status, living status and previous experience with MCVGs. Furthermore, at baseline neither VAS score for dropouts with median 7.5 (5–8), nor BFI score for dropouts with median 7.9 (4.8–9), differed from baseline symptom severity of participants. The intervention itself may have influenced leaving the program, except for the two dropouts who did not play. Three dropouts began the program with Xbox Kinect, which was considered the most physical demanding game console; thus, pain exacerbation after playing could be a potential contributing factor for leaving the program [6].

There is a risk that authors pre-understanding may have influenced data interpretation [17]. This issue was dealt with by having statements validated by asking clarifying questions during interviews and by using researcher triangulation in the analysis [28]. Furthermore, it is well known that people with FMS may have memory deficits [35], which could cause recall bias at post-intervention interviews; but because interviewers also acted as gameplay moderators, statements about gameplay experience could often be verified and in some cases falsified. In validation of ADL-Q it was concluded that people with FMS tend to overestimate ADL performance when using the self-administered questionnaire compared with observed ADL performance [26]. This could also be the case in the present study, but given that the investigated outcome was change in ADL performance, this issue was not seen as a major concern.

To our knowledge this was the first study to investigate the three most popular commercial available MCVG consoles in the

same rehabilitation intervention. An outline of pros and cons of each console has been given, which is anticipated to offer valuable knowledge in design of future studies using MCVGs as a healthcare intervention.

Conclusion

This study demonstrated MCVG as an effective healthcare intervention for the women with FMS who completed the program, with regards to temporary pain relief and enjoyable low impact exercise. Participants enjoyed the slow pace and familiarity of Wii, while some considered PS3 Move to be too fast paced. Xbox Kinect was reported as the best console for exercise because of full body involvement, but was almost too demanding for some of the participants. Pain exacerbation from playing may have influenced adherence to the program. Future research should investigate interventions with MCVGs on people with FMS or related conditions as home-based training.

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Declaration of interest

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