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Title

Using a personalized DVD to prescribe an exercise program to older people post-hip fracture enhances adherence to the exercises – a feasibility study

Abstract

Optimum recovery from hip fracture has been linked to the provision of effective rehabilitation, but levels of adherence vary among older patients. In this feasibility study a novel personalized DVD was designed for four participants, which delivered a 5 week tailored home exercise program (HEP), with the participant being videoed completing their exercises. Treatment fidelity of the DVD HEP was evaluated, including participants' perceptions of and response to the DVD-HEP, which was explored using diaries and interviews and analysed thematically. Secondary outcome measures including exercise adherence and self-efficacy for exercise were analyzed using descriptive statistics. Levels of adherence to the HEP were 1.2 to 3.5 times more than the minimum prescribed dose and participants demonstrated higher levels of self-efficacy for exercise. Adherence was found to be enhanced by physical improvement, positive self-reflection about engagement in the DVD-HEP, the format of the DVD, and increased self-efficacy. Personalized DVDs may be a feasible method of promoting adherence to home exercise programs among older patients.

Introduction

Hip fractures are a substantial public health problem worldwide and result in substantial increased mortality.^{1,2} Older people who fracture their hip have a 5 to almost 8 fold increase in all-cause mortality during the first 3 months after hip fracture and this risk does not return to a pre-fracture mortality rate even after 10 years of follow up.³ Hip fractures also result in functional decline, with up to 50% of patients having a disability in walking at 12 months post fracture,^{4,5} and are also associated with loss of independence⁴ and moving into nursing home care.⁶

There is limited evidence about how to reduce the poor outcomes associated with hip fracture.^{7,8} Optimum recovery has been linked to the provision of effective rehabilitation.^{6,9} Although it is unclear what the ideal rehabilitation program should include, effective exercise programs have included higher exercise dose, muscle strengthening and functional exercises.^{5,7,8,10} However, how to promote adherence to exercise in older people is unclear.¹¹⁻¹³ Previous studies have confirmed that older people, including those with hip fracture, have low levels of adherence to exercise¹⁴⁻¹⁶ and identify perceived barriers to exercise which include lack of knowledge, depression, no interest, low outcome expectation, poor health, and low self-efficacy.^{11,17-21}

Digital video disc (DVD) technology has been used to provide training in adult populations and has shown generally positive effects in increasing adherence to exercises,²²⁻²⁵ although the small number of studies and limitations in trial designs limit conclusive findings. However this approach has not been investigated in older patients after hip fracture. These studies also provided targeted exercise programs which used a single intervention approach applied to a sub-group of a population.²⁶ No studies using DVD technology have designed a tailored or personalized exercise program using video of the patient themselves to construct the content

of the DVD. This has the advantages of addressing specific characteristics of the individual in a tailored manner and may enhance training and self-efficacy by providing visual self-feedback, realistic exercise guidelines and a structured program.^{9,27-29} Tailoring allows for personal and direct content presentation based on elements such as likes or dislikes, needs, and health behaviors and has been shown to have positive outcomes when compared to non-tailored interventions.³⁰

The aim of this pilot study was to investigate the feasibility of providing a home exercise program (HEP) using a personalized DVD on exercise adherence among older people who had previously fractured their hip.

Trial registration

The study was registered with (*blinded for review*).

Methods

Design

A descriptive single group pilot study that provided a personalized DVD-HEP to older patients as part of their rehabilitation following a hip fracture. Pre-test – post-test measures were undertaken (each participant receiving intervention - each participant acting as their own control).

Participants and Setting

A convenience sample of older adults who had fractured their hip at least 3 months prior to the study were recruited from the outpatient department at (*blinded for review*). The aged care rehabilitation unit admits older patients who have fractured their hip for rehabilitation, immediately after they have had surgical intervention at an acute hospital. All potential participants were visiting their doctor for a medical post hospital appointment and had completed an inpatient and outpatient rehabilitation program, including follow up therapy and medical appointments. Inclusion criteria were: aged between 60-85 years; speaks English as a first language; cognitive ability to engage in a self-directed program [eligible if mini-mental state examination score (MMSE) >23/30;³¹ not currently completing an exercise program; medically stable (as assessed by hospital geriatrician); availability of a DVD player and television at home; finished any active rehabilitation post-hip fracture; below pre-morbid functional level of activity.

Exclusion criteria were sensory deficits that prevented hearing instructions or viewing a DVD on a television at home. Patients with medical diagnoses that were thought to predispose to a high risk of falls in the post discharge period, that could preclude performing a program

safely at home (Parkinson's disease, recent history of stroke, or postural hypotension) were excluded from the study. On viewing the participant's medical record if there was any question about whether the participant would be able to perform a home program safely, they were reviewed by the hospital geriatrician for a final decision on inclusion eligibility.

Intervention

The intervention consisted of a structured five week HEP delivered through a 30 minute DVD. The DVD was constructed by videoing each participant completing exercises which were personally designed and prescribed for them by their physical therapist. Each participant performed initial baseline measures to assess or identify deficits in HRQoL, activity limitations and impairments using assessment tools which were also used as outcome measures. These tests were augmented with individual observation and assessment of the participant by the research physical therapists to gain additional information regarding participant deficits. Exercises that addressed each identified problem were then prescribed to the participant. Even though all participants had fractured their hip, each participant had different comorbidities and different impairments. Therefore each exercise program prescribed was personalized to the participant's impairments by the physical therapist researchers as if undertaking a normal clinical appointment. The impairments treated (targeted with differing intensities for each participant) were strength of the lower limbs, balance exercises, postural control and functional ability such as standing and walking, which are noted to be part of effective training interventions in older patients who have fractured their hip.^{7,10,19} The physical therapist was also shown in the footage providing feedback to the participant as they performed the exercises, and music played as background. The participant subsequently completed their HEP while viewing their DVD. The key parameters of making the DVD are shown in Table 1.

Outcome measures

A range of outcome measures were chosen to determine the feasibility of providing a HEP using a DVD, including strategies that monitored the treatment fidelity.³²

These outcomes measured were:

- i) Ability of the physical therapists to film a patient completing exercises with their therapist while using the outpatient setting of a rehabilitation department.
- ii) Feasibility of producing the exercises onto a DVD to a standardized age friendly format that could be viewed on a home TV setting.
- iii) Time for the exercise program to be recorded with the participant.
- iv) Ability of participants to comprehend both the visual and auditory components of the DVD.

Quantitative outcomes that measured functional changes and self-efficacy for exercise, both of which would be expected to improve if an older person successfully engaged in a structured exercise program were also included. These outcomes measured at baseline and after 5 weeks were:

- i) Demographic characteristics of participants (measured at baseline only): age, gender, time since hip fracture, use of walking aid, assistance received at home
- ii) Exercise adherence of participants measured using a daily exercise diary that was issued to each participant.
- iii) Self-efficacy for exercise measured using the Self Efficacy for Exercise scale [SEE]^{33,34} measured at baseline and five weeks. The SEE scale used in this study was a modified 11 item scale which rates older adults responses to statements about barriers to exercise (scores range from 0 = not very confident to 10 = very confident; with a total possible score of 110).

For example item one asks participants: “Would you exercise if you felt tired during or after exercise?”

iv) Outcome expectancy for exercise measured using the Outcome Expectancy for Exercise scale-2 (OEE-2), measured at baseline and five weeks. The OEE-2 scale is a 13 item scale which rates older adults’ responses against statements (both positive and negative) about the benefits of exercising.³⁵ To complete the OEE-2 scale the participant is asked to listen to a statement about exercise and respond using the options: strongly agree (1), agree (2), neither agree nor disagree (3), disagree (4), or strongly disagree (5). For example item one asks participants to respond to the statement: “Exercise makes me feel better physically.”

v) Level of activity: measured using the Community Healthy Activities Model Program for Seniors [CHAMPS].³⁶

vi) Functional mobility measured using the Timed Up and Go [TUG]³⁷

vii) Balance using the Step Test;³⁸

viii) Health-Related Quality of Life [HRQoL] measured using European Quality of Life-5 Dimensions [EQ-5D].³⁹

Finally it was also felt important to evaluate the participants’ response to the program, as perceptions of the HEP DVD such as whether it was enjoyable and easy to complete and would strongly influence an ultimate decision of whether this type of HEP could be successfully provided to older people. Qualitative feedback from participants about their perceptions and beliefs about completing a HEP using the DVD and their ability to adhere to the exercises using a DVD was explored with written participant comments from the exercise diaries, weekly researcher diarized observations and semi-structured telephone and face-to-face interviews (weeks 1-5) and final semi-structured face-to-face interview. The semi-structured interviews followed a format of asking the participant: What has worked well in

the program; what is not working well in the program; what are your thoughts at the moment about the DVD HEP; has the DVD HEP helped you to exercise? Verbatim responses were collected and follow up open questions such as “tell me more about that” were also used where appropriate, to invite participants to speak freely.

Procedure

Results of all baseline measures (TUG, CHAMPS, Step test, EQ5D) were augmented with individual assessment and observation of the participant by the researchers to gain additional information regarding participant deficits. Personalized exercises that addressed key identified problems including balance exercises, lower limb strength exercises and functional tasks such as turning, were then prescribed to the participant. Participants practiced the exercises with the researcher prior to the filming of the exercises, until they demonstrated that they could perform them independently using correct technique. The participant then carried out the exercises while being recorded by a researcher (using a JVC camcorder model: GZ-HM670BAA). Specific considerations were given to designing the intervention which included the filming of each participant completing the exercises and making the subsequent DVD. These are presented in Table 1. The physical therapist researcher was also included within the filming providing ongoing corrections and feedback to the participant.

Due to the length of time required to produce the personalized DVD-HEP, during week one participants performed their exercises using a written list. At the second visit each participant reviewed their personalized DVD-HEP with the researcher, who answered any questions participants had about completing the DVD-HEP. The researchers recommended to participants that they complete their 30 minute HEP at least three times per week (a total of 1.5 hours). Participants were issued an exercise diary to record participation and instruction in its use.

Qualitative data from multiple sources were collected from participants during the study. Participants recorded their HEP participation, thoughts and feelings in an exercise diary throughout the five-week study period. During the weekly face-to-face participant follow-up the researcher observed participant body language, movement and general disposition, and subjectively recorded these in a diary. The researcher telephoned each participant weekly at a convenient time and day, determined by the participant, to conduct semi-structured follow-up interviews. On establishing telephone contact the researcher re-established rapport, checked for participant comfort, and explained interview and recording procedure. Participants were encouraged to speak freely; these conversations were recorded on a digital iPad dictaphone.⁴⁰ On completion these conversations were transcribed by the researcher and checked by a second independent researcher for accuracy. Participants returned to the outpatient physiotherapy department weekly for five weeks, where they were reviewed by the physical therapist researcher using the same interview approach; the exercise prescription was adjusted if required, although the DVD was not altered. At the week five appointment the original outcome measures were repeated and the exercise diaries were collected for analysis.

Statistical analysis

Quantitative data were entered into a Microsoft Excel (2010) spreadsheet [Microsoft Corporation, Washington, USA]. Results were analyzed and presented as descriptive statistics. The mean (SD) score for the SEE and the OEE-2 were calculated by summing the numerical rating for each response and dividing the total score by the number of items on the scale.³³ The OEE-2 scale items were analyzed in two sections, for positive and negative expectations for exercise.

The CHAMPS data were recorded, with activity levels classified into metabolic equivalent of task [MET] levels as either: very light < 2 METS, light > 2 but < 3 METS, moderate > 3 but < 6 METS, or vigorous > 6 METS.³⁶ The mean score of the total hours per week for each activity that was completed was recorded and then cross-referenced against its corresponding MET level).³⁶ The EQ-5D data were analyzed using the Dolan method, which allows a single score to be reliably generated for the categorical items that reflects overall HRQoL and the visual analogue scale [VAS] score,⁴¹ so that any changes over 5 weeks could be easily identified.

Qualitative data were analyzed thematically by coding and then categorizing all responses to identify emergent themes.⁴² The researcher first read through notes from the participant diary, researcher diary and transcripts from the face to face and telephone interview data in order to gain a 'general sense' of the data. The researcher then sorted multiple response items from each data source into individual response items, transposing them onto a master spreadsheet. These data were then hand-coded by examining and then highlighting transcript commonalities. Data were sorted according to identified categories, with comparison of individual coded items to verify whether the categories accurately described the coded data. Individual response items were then re-examined to confirm that all data were coded correctly and that identified categories captured all coded data. Further scrutiny was undertaken to highlight the emergence of subcategories within categories.

Credibility was established by having two independent researchers participate in the qualitative data analysis. This allowed for consensus between researchers, as well as for all appropriate categories to be identified and recorded. All three researchers then examined the categorized data to identify emerging themes. The identified themes were then concept-mapped, using Webspiration PRO™ (Webspiration PRO, 2013; Inspiration Software, Inc Beaverton, Oregon), to determine and clarify possible relationships between them. This

assisted the researchers to achieve consensus in identifying final emergent themes, and relationships. The concept map was then re-examined by all three researchers to evaluate whether the map accurately described the relationships between the identified categories and the emergent themes.

Ethical considerations

Institutional ethics clearance for the study was obtained from human research ethics committees of the university and the local hospital. All participants provided written informed consent to be included in the study.

Results

Recruitment took place between March and April 2013. As this was a feasibility project to test the approach of using a DVD to prescribe exercises, a convenience sample was recruited by the student from patients attending the outpatient clinic once weekly.. Subsequently there were five older people approached of whom three women and one man consented for enrolment and all completed the five weeks of the study. Participants (mean age 79.5, SD 2.5 years) had fractured their hip between four and six months previously. All participants used mobility aids (three used a walking frame and one used a walking stick) at baseline assessment, and three participants received assistance at home with activities of daily living.

Quantitative outcome measures were completed at baseline and at five weeks for all four participants. Changes in self-efficacy for exercise and outcome expectancy for exercise, functional mobility and health related quality of life are presented in Table 2. Participants' self-reported levels of physical activities at baseline were respectively 75, 31, 27 and 50 hours. By week 5 all participants had increased their weekly hours of physical activity by a range of between 7.3 and 23 hours. Cumulatively the amount of very light activities (<2 METS) for all participants increased by 15 hours, the amount of light activities decreased by 15 hours (>2<5 METS), the amount of moderate activities increased by 49 hours and the amount of vigorous activities by 5 hours.

The DVD was successfully completed in the outpatient department using two therapists for all participants using two therapists one of whom was shown in the DVD while the other (the student therapist) filmed the DVD. All participants were able to see and hear the DVD at home utilizing their own DVD player and television. It took approximately one to one and half hours to video the participant and the therapist doing the HEP, and subsequently a minimum of three hours of production and editing time to convert it to DVD format. The

exercises were able to be completed using a standard chair, the wall or bench for hand holds. Wide screen shots of the participant and therapist were able to be combined with close shots to provide the video demonstration and the audio instructions with music were added afterwards.

Adherence to the DVD-HEP is shown in Figure 1. All participants completed between 1.2 to 3.5 times the minimum suggested level of exercise frequency prescribed. Participants' reported high levels of adherence were confirmed by documentation in their exercise diary, weekly follow-up telephone calls, and follow-up visits with the researcher.

All participants described how they "found time" and "overcame barriers" to complete their DVD-HEP. While some were tired, they still found time to do their exercises "...I have been busy and tired this week, but I'm still doing my exercises..." and "...I don't care what time I do the exercises, just as long as I do them..." (participant comments during follow-up interview). Participants were also able to overcome barriers of lack of confidence and low self-esteem through exercising with the DVD-HEP "...I'm feeling better – it's making me do more..." (telephone call with participant).

Participants' motivation for adhering to the DVD-HEP

Three main categories that explained participants' motivation and reasons for their high levels of adherence were initially identified from the coded data, although much of the data coded represented multiple categories. These were participants' "*Physical Improvement*", "*Perceived self-efficacy*" and "*The DVD-HEP format*."

Physical Improvement

Physical improvement was the most frequent category identified as promoting adherence, with the most comments provided by participants in all weeks. Sub-categories of this

category identified that physical improvement was described in terms of “Functional strength”, “Cardiovascular fitness” and “Balance”. Participants and their family members also described the physical improvement as mental alertness or sharpness.

Participants described changes in functional strength as they completed the program: “...Now I am able to take my full weight on my right leg (fractured side) - I couldn’t do that before...” (participant comment during follow-up interview), “...I don’t have to pull (my spouse) out of their chair anymore...” (observation of family member). Changes were also reported in cardiovascular fitness: “...to walk around this block is something I have not done for... I don’t know how long now, because it’s very uneven and I’m now able to...” (telephone call with participant). All participants perceived that their balance had improved “...I have mainly improved in balance - I’m not frightened to go into open space like I use to be...” (participant comment during follow-up interview)

Perceived self efficacy

During the study participants reported changes that were related to increased self-efficacy, including mastery of experiences and task mastery. Participants reported they would check on their improvement to determine their success “...I keep looking at the DVD to see if I’m improving...” (participant comment during follow-up interview). Participants described the use of self-reflection when viewing the DVD-HEP to see what they “Used to be like” to what they were able to accomplish “Now”. Participants perceived that they were achieving an improved level of functioning: “...I have noticed the changes from the DVD to now... now I don’t look as old as I did in the DVD...” (telephone call with participant), “...I use to be very lazy before- I’m changed now I can really see the difference...” (participant comment during follow-up interview). Some participants’ self-reflections of what they “used to be like” and how they were “now” identified pivotal themes in their lived experience: “...when you have

your independence, you don't feel so down, when you lose it you feel like life isn't worth it... I now have my independence back..." (participant comment during follow-up interview).

The DVD format for delivering the HEP

Participants reported that the DVD format provided "Enjoyment" and was a "Motivator" for them to keep doing the HEP: "...makes you keener to do it..." (participant comment during follow-up interview), "..... "I'm really happy with it, I really am" (telephone call with participant), "...I can do the exercises as much as I do because of the DVD... I don't get bored of it..." (participant comment during follow-up interview). Music was identified as being a motivator for exercise: "...My spouse and I love the music, we want to dance to it and we get in the rhythm ..." (participant comment during follow-up interview). The DVD format was also perceived as being "Informative." Learning was perceived as being visual (visual feedback) from the DVD demonstration as well as voice over instructions (auditory feedback) on how to perform exercises correctly with good technique. Participants reported that the visual and auditory feedback portrayed through the DVD enabled them to correct their performance: "...I can see what I need to fix when I watch the DVD and then do it..." (participant comment during follow-up interview), "...The DVD lets me know what I'm doing wrong, cos I can see how to do it right..." (participant comment during follow-up interview).

Emergent themes of Wellness, Life goals and Positive impact

When these categories were further reviewed there were three emergent themes: "*Wellness*," "*Life goals*" and "*Positive impact*." Participants identified achieving life goals, felt a sense of wellness, and perceived that the program was having a positive impact on their lived

experience. These emerging themes and categories were then concept mapped to show their relationship to each other. The concept map (Figure 2) visually demonstrates and explains how the DVD facilitated adherence to the DVD-HEP.

Wellness was framed by participants as new abilities "...I could not do that before..." and (I am able to do that) "now." Participants reported taking on roles that they previously had to cease due to functional inability, illness or lack of confidence, "...I'm doing weeding and gardening now... but I couldn't do that before..." (participant comment during follow-up interview). Wellness was also perceived emotionally by participants: "...thank you... I can't thank you enough for making me positive rather than how I was feeling... I was feeling that I wanted to lay down and die..." (telephone call with participant).

Participants identified that they were achieving more of their own goals in life as a result of their improvement. "...It has got me out and about, I have now got my footwear built up like I needed to (participant comment during follow-up interview).

Participants reflected that the DVD-HEP had made a positive impact on their lives. They described a sense of achievement in overcoming other barriers that had previously existed in their lives. Feelings of wellness and achieving life goals were viewed by participants as contributing to feelings of life being "worth living."

"I'm very, very grateful... I've never felt as well to be honest... I think in me myself I'm more positive... Cos I was so down on myself I thought you know I'm finished..., now I feel positive I don't feel like that anymore..." (telephone call with participant).

Discussion

This study, to the authors' knowledge, is the first to provide a HEP for older people after hip fracture using a personalized DVD. Participants reported high levels of exercise adherence. These results were supported by participants making quantifiable physical improvements in functional strength and balance, which assist in performing daily living activities.^{19,43} Participants also reported an improved sense of wellness and perceived that the DVD-HEP led to positive impacts in their lived experience.

The exercises were able to be filmed successfully using a standard series of video shots and within a busy outpatient department. Participants were highly positive in their feedback about being able to "see themselves doing it right." The DVD sequencing also meant that the speed and frequency of the exercises was able to be practiced by patients with a high degree of fidelity. Making the DVD was not possible on the day of therapy due to time constraints, however this should not impact on feasibility as patients would then have it available for use in the long term. However as patients improved even in our short time period, re-videoing to modify exercises might be necessary. Therefore subsequent video sessions would need to be incorporated into the program. The DVD production used two therapists as one therapist was required to be in the video, while the other assisted to tailor the exercise regime while filming. While it appeared a feasible to deliver a home program in this manner it would require rehabilitation providers to have more technology support and to re-organize their delivery of patient exercise programs. However it could be that a therapy assistant or trained medical video technician could be used if a therapy department could organize those resources. It was also noted that older people required a DVD to use on their television at home and were not able to view an online version as not all had computers. Although small handheld devices can provide video instruction for a patient, older people may have visual or auditory requirements for a TV or computer screen to be sizeable and may not be able to

follow an exercise program on a small handheld device. However this pilot study showed promising results and larger studies that evaluate this type of intervention could provide a variety of access, including online streaming, which would substantially reduce the time and effort required to use video format as a clinical tool.

Participants reflected on what I “Used to be like” and compared this with how I am “Now” which suggests that viewing themselves on the DVD-HEP may have influenced their self-perceived evaluation of their life. The DVD-HEP directly targeted known barriers to exercise among older people, such as low self efficacy and no interest,^{14,18,20} by providing an enjoyable format and allowing participants to view themselves actually completing the exercises. Additionally participants could see and hear the therapist providing individualized guidance and personalized feedback each time they viewed the DVD at home. Visual cues and individualized guidance have been shown to help older people after hip fracture to maintain adherence to exercise.⁴⁴

Participants presented with low levels of outcome expectancy for exercise at the study commencement. However all participants identified increased self-efficacy for exercise and also in subsequent weeks of the study an increase in activity levels. Higher levels of self-efficacy have been demonstrated to improve adherence and belief in exercise capability,¹⁸ whereas low self-efficacy among older people is a strong barrier to performing exercises.^{14,20,21} Participants’ positive reflections about the DVD format also suggested they viewed the DVD format as assisting motivation, which can reinforce the individual’s capability and generate behavioral validation.^{44, 45}

Previous works have identified DVDs as a promising method of improving adherence to exercise^{23,25} and our results support these findings. However these earlier studies used standardized format and hence provided targeted but not individualized interventions.

Standardized formats of exercises enable DVDs to be reproduced quickly. However, personalized DVDs may be potentially more powerful in their influence on the older person, because they influence self-efficacy when the older person views themselves performing the task. It is known that adherence to exercise is enhanced in older people who receive individually tailored, rather than standardized, targeted exercise.⁴⁶ Only a personalized DVD can provide participants with a completely individualized program tailored for them by their physical therapist for their own particular needs.

This was a small study which aimed to investigate the feasibility of successfully prescribing HEP through a DVD, therefore we only followed participants for a short period to ensure that the DVD was able to be used at home and to allow enough time to observe physical and self-efficacy improvements. Larger studies are required to test both feasibility of constructing DVD-HEPs for a larger group of patients in a clinical setting as well as to test for their effect on adherence over a longer period.

Conclusions

Providing a personalized DVD was a feasible means to prescribe a HEP and enhanced exercise adherence among older people with hip fracture. Participants responded positively to the DVD-HEP and demonstrated increased levels of self-efficacy for exercise. Researchers designing exercise programs for older people should consider evaluating if it is feasible to construct personalized DVD-HEPs in their own settings, to promote adherence to exercise. Further studies should also compare the effect on adherence to exercise using type of program compared to written HEPs and standardized DVD-HEPs. Additionally larger trials should follow participants over sustained periods to examine whether adherence to exercise using DVD HEPs can be maintained in the long term.

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Table 1. Fidelity and feasibility considerations in designing the DVD intervention

Intervention design	Technique used	Consideration
Exercises	Individually tailored for each participant	Program aimed to be as personally tailored - participant was given an individual exercise program from a therapist
Exercise practice	Participant practiced exercises	Participant practiced exercises first, technique then corrected with therapist before being recorded
Exercises	8 to 10 exercises for each participant, warm up, main exercises and cool down	Exercises follow evidence based guidelines for completing an exercise program
Environment	Use of chairs, wall, simple equipment (sturdy surface, portable resistance bands)	Replicate equipment that would be readily available in home environment
Physical therapist in video	Shown gesturing, with hands on key body points as necessary, to facilitate correct	Therapist using clinical judgement about how best to guide the correct movement

movement

Verbal cueing	Voice over cues and information to help identify the correct technique in the video	Ensure that the patient is able to both see the correct technique on the video and hear it also as it is being shown on the DVD
Length of time to video	Whole appointment completed in approximately 1 hour (30 minutes preceding for enrolment and administration)	Complete DVD filming in what would be a normal first clinical appointment and also not to fatigue participant
Video procedure	Physiotherapist researcher filmed with student assistant, tripod set up for filming	Completed in Outpatient department needed to be filmed with other areas in use –loudness and space considerations
Visual feedback	Complete footage of three repetitions of the complete exercise from start to finish	Shown from close angle to relevant exercise and then from a whole body shot
Music	Chosen by participant then entered into the format after the video footage was cut	To facilitate enjoyment and retain individual nature of DVD

DVD Format	Title and introduction in stills, section headings with exercise numbers burnt on to DVD format	Large print used, plain black on white background, slow change of still instructions, time to read
Effective use of time	Film rendered onto DVD after participant left	The patient did not need to be there after recording had been completed
Video rendering	Footage edited with voice over corrections and applied to a standard DVD format in iMovie (iMovie '11 [Version 9.0] for Mac, 2010 Apple.Inc, Cupertino, California). DVD rendering techniques for both visual and audio data.	Ensure highest possible quality available on the DVD format to ensure participant enjoyment, able to be viewed on standard TV/ DVD player

Table 2. Participants' functional outcomes and self-efficacy for exercise measured at baseline and at 5 weeks after completing the DVD-HEP

	Baseline, mean (SD)	Follow –up, mean (SD)
TUG test ^a ,	18.4 (5.0)	13.6 (2.3)
Step test ^b		
L leg	11.8 (4.3)	10.8(1.7)
R leg	9.2 (2.4)	11.5 (2.1)
EQ5D ^c	0.6 (0.06)	0.8 (0.1)
EQ 5D VAS ^d	57.5 (9.6)	78.8 (10.3)
SEE ^e	6.9 (1.6)	9.6 (0.8)
OEE		
Negative ^f	3.0 (0.6)	2.6 (0.4)
Positive ^g	4.0 (0.1)	4.8 (0.3)

^aTimed up and go test measured in seconds, less time indicates better mobility

^bNumber of steps completed in 15 secs for right and left leg, higher score indicates better balance

^cDolan score range 0=1, higher score indicates better health related quality of life

^dVisual analogue scale 0-100, where 0 is worse imaginable health state and 100 is best imaginable health state

^eSelf-efficacy for exercise, maximum score possible=11, higher score indicates better self efficacy

^fNegative outcome expectancy for exercise, maximum score possible=8, lower score indicates better outcome expectancy

^gPositive outcome expectancy for exercise, maximum score possible=5, higher score indicates better outcome expectancy

Figure 1.

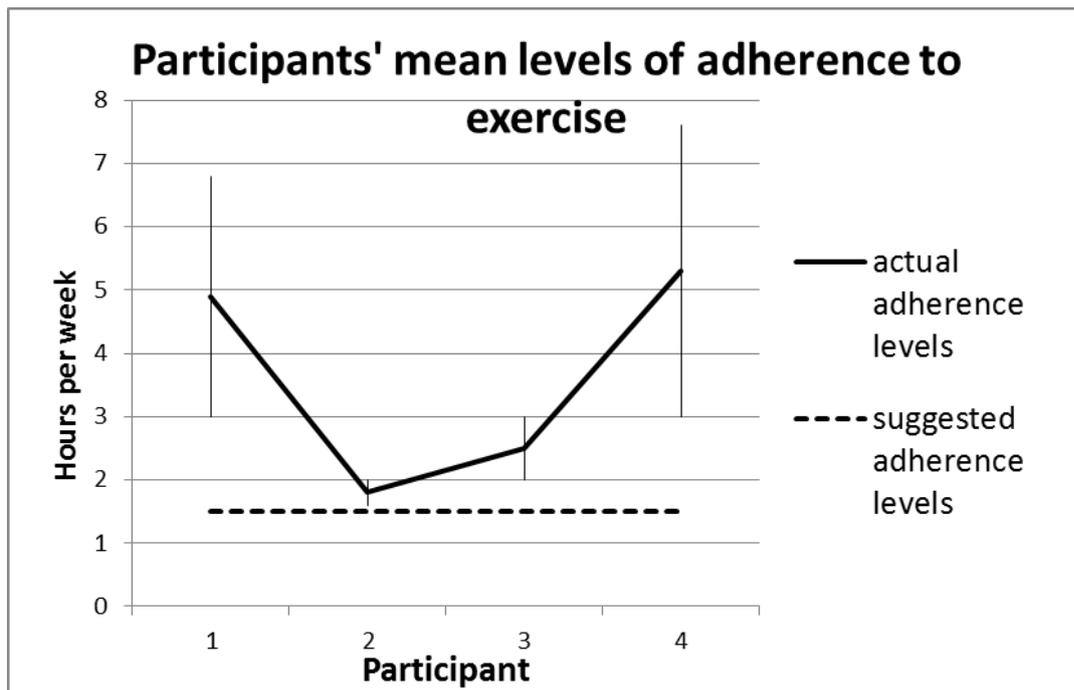


Figure 2.

