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FACULTEIT GENEESKUNDE EN LEVENSWETENSCHAPPEN
master in de revalidatiewetenschappen en de kinesitherapie

Masterproef

The effect of a video-based exercise program in institutionalized elderly suffering from dementia

Promotor :
dr. Joke SPILDOOREN

Copromotor :
Prof. dr. Annick TIMMERMANS

Ine Bertels , Wouter De Wagter

Scriptie ingediend tot het behalen van de graad van master in de revalidatiewetenschappen en de kinesitherapie

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Master in de Revalidatiewetenschappen en Kinesitherapie

Masterproef deel II

The effect of a video-based exercise program in institutionalized elderly suffering from dementia.

Cohort study

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Hasselt, 2016

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We want to thank the people who helped us during the completion of this thesis. First our sincere gratitude to our promotor, Dr. Joke Spildooren for her help and support. Secondly, the staff and residents of the Sint-Elisabeth nursing home deserve our recognition, for participating for six weeks and lastly, the physiotherapists who helped us and made everything possible.

Thank you for all the help.

Diepenbeek, 2016

B.I. en
D.W.W

Research context

This experimental clinical trial was situated in the geriatric research domain. Over the years, the number of older people in our society increases and will continue to do so the years to come (Eurostat. (2016). Population on 1 January by broad age group and sex, http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do). With the increase of the older population, the number of people suffering from dementia will also rise (Berr, Wancata, & Ritchie, 2005).

Scarmeas et al. examined the disabilities in dementia. They noticed that people suffering from dementia not only have cognitive dysfunctions, but also a lot of motor deficits that increase in frequency and severity over time. As a result, the affected subjects also experienced problems in daily life activities (Scarmeas et al., 2004).

Due to these motor signs, older people with dementia need physical therapy to maintain the level of functionality that they possess at the time. According to a study of Blankevoort, physical therapy actually could help to maintain or even improve the physical function (Blankevoort et al., 2010). Therefore, there is a rising demand and need for more and more physical therapists. However, a shortage of health workers - and hence also physical therapists - is present in our current society (World Health Organization. (2015). European database on human and technical resources for health (HlthRes-DB) WHO Regional Office for Europe, Practising physiotherapists, http://data.euro.who.int/HlthResDB/). With technology, this problem may be solved, leading to less physiotherapists that will be necessary for exercise trainings.

Based on the feasibility study of a video-based exercise program, realized by Ite Speetjens (conducted in elderly people affected by dementia), the research paper at hand will focus on the effect of such a program on strength, functionality, gait and balance in people with dementia living in a nursing home (Speetjens, 2015), as improvement of these factors could help older people to maintain their independence and improve their quality of life.

This duo-thesis was written by Ine Bertels and Wouter De Wagter with the help and support of Dr. Joke Spildooren and Prof. Dr. Annick Timmermans. After examining the study of Ite Speetjens, an experimental design was set up by our promotors and ourselves to examine the effects of the exercise program. With the help of Dr. Joke Spildooren and the physiotherapists of the Sint-

Elisabeth nursing home in Hasselt and of the Eyckendael nursing home in Riemst, we recruited our patients. The data-acquisition was conducted by Bertels and De Wagter. With the help of Dr. Joke Spildooren, we were able to thoroughly analyze the acquired data. Finally, the academic writing process was carried out by Bertels and De Wagter as well.

Abstract

Background: Evidence has shown that physical activity has a positive influence on strength, balance, gait and functionality. A feasibility study has recently shown that the use of a video-based exercise program to train mobility, muscle strength, and balance in the elderly with dementia was indeed very much feasible. Further research was necessary to investigate the effects of a video-based exercise program on strength, balance, gait and functionality.

Objectives: Investigate the effects of an additional video-based exercise program on strength, balance, and functionality in elderly with dementia compared to the usual care elderly with dementia receive at the nursing home.

Participants: 19 elderly with a Mini Mental State Examination score (MMSE) under 24 and recruited from 2 nursing homes were included in an intervention group and control group. Randomization was not performed due to practical reasons.

Measurements: Balance (Functional Reach, 4-Stage Balance Test), Strength (M. Biceps Brachii, M. Quadriceps), Gait (Tinetti Gait) and functionality (5 Times Sit-To-Stand Test)

Results: An additional video-based exercise program (six weeks, 3x/week, 30 minutes) showed a trend of significant improvement of quadriceps strength ($p = .06$) and balance (Functional Reach: $p = .06$) in older people with dementia living in a nursing home. No significant changes were found in biceps strength, balance, gait and functionality. This in comparison with the control group who underwent usual care and also did not show significant changes after six weeks of usual care. No significant differences were found between both groups.

Conclusion: A video-based exercise program of six weeks may have a beneficial effect to improve quadriceps strength and balance in older people with dementia living in a nursing home. Further research is needed to confirm these findings.

Keywords: elderly, group therapy, video-based exercise training, dementia

Introduction

The number of Belgian residents increases every year. In 2006, Belgium counted 10 511 382 inhabitants, in 2015 this number went up to 11 258 434 inhabitants and is expected to rise up to 13 million by 2060. Many of these people are 65 years or older. In 2006, that particular age group contained 1 809 017 people, while in 2015 the number increased up to 2 031 122 and it will continue to do so (Eurostat. (2016). Population on 1 January by broad age group and sex, http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do). This is a direct consequence of the continuing increase in the Belgian population's life expectancy. As a result of the ageing population, more people suffer from dementia. In the age class of 65 to 74 years, dementia rates in Europe varied between 1.2% and 4.7% and between 75 and 84 years, the rates varied between 4.5% and 18.3%. In people older than 85 years, the rates varied between 11.5% and 39% (Berr et al., 2005).

Scarmeas et al. suggested that Alzheimer disease (AD) is characterized by several motor deficits that increase in frequency and severity over time and are a result of underlying mechanisms. A total of 474 participants suffering from AD with a MMSE-score of 16 or more were followed over 13 years with an interval visit every six months and an evaluation for motor deficits every year. These motor deficits included speech and facial expression, tremor, rigidity, posture and gait and bradykinesia. The prevalence of any motor sign per year increased as disease chronicity increased: first year 18%, second year 19%, third year 25%, fourth year 33%, fifth year 46%, sixth year 41%, seventh year 39%, eighth year 47%, ninth year 90%, tenth year 67%, eleventh year 62%, twelfth year 64% and thirteenth year 71%. The incidence rates were of roughly the same magnitude for all the domains of motor deficits except for the resting tremor. The study concluded that at the initial stage of AD, motor deficits are not very common but their prevalence increased as the disease progressed (Scarmeas et al., 2004).

It would seem that physical activity could stabilize motor ability and/or improve motor deficits. Blankevoort et al. researched the effects of physical activity on strength, balance, mobility and activity of daily living performance in elderly with dementia. The result of this review was that physical activity interventions (multicomponent interventions or progressive resistance training) in elderly with dementia lead to an improvement in physical performances like gait speed, functional mobility, balance, endurance and strength (Blankevoort et al., 2010).

However, most patients with dementia are living in a nursing home. Since 1995, the number of nursing and elderly home beds in Belgium has increased from 106 525 in 1995 to 137 069 in 2012 (World Health Organization. (2015). European database on human and technical resources for health (HlthRes-DB) WHO Regional Office for Europe, Beds in nursing and residential care facilities, http://data.euro.who.int/HlthResDB/tables/tableA.php?w=1600&h=900). Along with more elderly home beds comes the fact that more health workers are needed. The WHO states that there is a global shortage of health workers. In the European database on human and technical resources for health we saw that in 1995, Belgium had 23347 practicing physiotherapists. This number increased until 1999, then it decreased to 19201 practicing physiotherapists in 2013 (World Health Organization. (2015). European database on human and technical resources for health (HlthRes-DB) WHO Regional Office for Europe, Practising physiotherapists, http://data.euro.who.int/HlthResDB/tables/tableA.php?w=1600&h=900). Due to the shortage of physical therapists, providing individual therapy is a challenge in nursing homes. That is why group therapy could be a good alternative. Graessel et al. demonstrated that group therapy could postpone a decline in the ability to carry out activities of daily living (Graessel et al., 2011).

However, sometimes it is hard for older people with dementia to remain focused for 30 minutes or more in group. Mathews et al. have found that music increases the focus and the participation of older people with dementia in a group exercise program (Mathews, Clair, & Kosloski, 2001).

In the feasibility study of Ite Speetjens, the researchers concluded that a video-based exercise program is feasible in elderly with dementia, but that the subjects stopped doing the exercises when the music stopped (even though the exercises were still projected on the television-screen) (Speetjens, 2015).

The exercise program of Ite Speetjens was adapted, so that the music continued to play during 30 minutes without interruption. With the exercise program and music playing in the background, we wanted to prove in this current study that a video-based exercise program has a positive influence on physical function. The program was led by one therapist. The research question that could be formulated is: ‘What is the effect of a video-based exercise program on strength, functionality, gait and balance in older people suffering from dementia?'

Methods

Study design

This study is a clinical trial to investigate the effect of a video-based exercise program on strength, endurance and balance in institutionalized elderly suffering from dementia. Dementia was seen as an MMSE with a score below 24/30. The amendment of the study of Ite Speetjens was approved by the ethical committee of Leuven on the seventh of January 2016. All measurements and exercises were performed at the residential nursing home Sint-Elisabeth in Hasselt and the residential nursing home Eyckendael in Riemst.

Participants

To start with the recruitment of all participants, a prior meeting was agreed upon with the local physiotherapists of the residential nursing homes Eyckendael in Riemst and Sint-Elisabeth in Hasselt. In consultation with these physiotherapists, residents were screened whether or not they could participate in this study. The residents eligible for the study design were given verbal and written information about the study, and after being fully informed, were asked to sign a consent form. 19 elderly were recruited from two nursing homes (i.e. the residential nursing home Sint-Elisabeth in Hasselt and the residential nursing home Eyckendael in Riemst). Participants recruited in Sint-Elisabeth were included in the intervention cohort (IG) whereas participants recruited in Eyckendael were included in the control cohort (CG). As such, IG and CG consisted of 10 and 9 participants respectively. Randomization was not possible due to practical reasons. The investigators were not able to be present three times a week for six weeks in total in Eyckendael as well as Sint-Elisabeth due to the distance to these nursing homes.

Participants who met the inclusion criteria were: a) 65 years or older, and b) had a MMSE of less than 24. Participants were not recruited if they a) stayed less than three months in the residential nursing home, b) were wheelchair bounded, c) still received rehabilitation therapy for a neurological (stroke, MS, Parkinson's, …), an orthopedic or a psychiatric history who could influence the functional mobility, d) had serious visual or hearing restrictions of such nature that watching and listening to the television was impossible, and e) did not spoke Dutch.

Intervention group

The IG existed of all participants recruited in the residential nursing home Sint-Elisabeth in Hasselt. They received a video-based exercise program in addition to the usual care. The exercises were performed in 2 groups of five participants: this was to reassure providing full attention to the participants by the therapists but also as a result of space limitations at the location of therapy. This video-based exercise program consisted of 18 sessions divided over six weeks. The program was based on a previous feasibility study of Ite Speetjens and performed three times per week, consisting of approximately 30 minutes exercises based on video exercises performed by an older person. All digital recordings used for the intervention were the exact same recordings of the feasibility study of Ite Speetjens (Speetjens, 2015). The participants sat down or stood up in front of a 54-inch flat screen TV that was present in the gym room of the nursing home. There was a large array of exercises: they consisted of warm-up exercises, followed by strengthening exercises, static balance exercises, dynamic balance exercises, functional exercises (such as cycling movements of the legs), endurance exercises and finally as cooling down flexibility exercises. These exercises were accompanied by music, specifically selected to have a stimulating effect on the participants. This music consisted of tunes from their younger years, bringing back memories of joy and increasing the arousal. The music played consistently throughout each session. Music could be an interesting factor during therapy sessions, as Guétin et al. have shown: music has a significant effect on anxiety and depression in institutionalized elderly. These effects were found from week four until week twenty-four (i.e. eight weeks after the intervention) (Guetin et al., 2009).

The sessions were divided into three degrees of difficulty: week one consisted of exercises at a mild intensity. Every week, the intensity and/or difficulty increased. The present study was held during six weeks, compared to three weeks in the feasibility study by Ite Speetjens. As such, from week four to week six, the highest difficulty level and Speetjens' video of week three were continued.

As previously mentioned, all sessions consisted of balance, strength, endurance, functional and flexibility exercises. During the first week, a larger array of exercises were offered compared to the following weeks. The following weeks, a larger amount of repetitions were performed with a smaller array of exercises. At first, all strength exercises were performed sitting. The second week,

all strength exercises were performed standing and the third week half of all the exercises were performed sitting. Strength exercises were focused on lower and upper body strength. Balance exercises consisted of static and dynamic balance exercises. The first week, support was allowed by holding on to the chair in front of the participants. The following weeks, holding on to the chair was gradually reduced. Functional exercises were meant to be as useful as possible; for example, an important exercise for elderly females is to still be able to comb up their hair. Endurance exercises consisted of a stepping exercise (prolonged walking), combined with occasional acceleration. Flexibility exercises were included to maintain the mobility of upper and lower body, head and trunk.

The participants also continued to receive the usual care in the nursing home.

Control group

The control group received usual care as prescribed by a doctor in the residential nursing home Eyckendael in Riemst.

Outcome measures

At first, to include the participants, the MMSE was administered of every participant of every group (Folstein, Folstein, & McHugh, 1975). Primary outcomes were balance, strength, gait and functionality. Balance was measured by the 4-Stage Balance Test and the Functional Reach (FR). The strength was measured by using the MicroFET 2. The strength of the biceps brachii and the quadriceps muscle of each participant was evaluated. Gait characteristics were measured by using the second section (i.e. gait) of the Tinetti test. Functionality was tested using the Five Times Sit-To-Stand Test (FTSST), this concludes a measurement of time of a series of five times standing up and sitting down again. A secondary outcome was the compliance rate. These measurements are discussed below.

Functional Reach

The FR was performed standing close to a wall with their shoulder in 90° flexion. Participants were asked to maximally reach forward, parallel to a measuring tape. The participants were asked to reach without touching the wall and moving their feet or stepping. No recording was performed of the used movement strategy. The distance was measured in cm. (Duncan, Weiner, Chandler, & Studenski, 1990)

4-Stage Balance Test

This test concludes four progressively more difficult stages. Participants were not allowed to use an assistive device. Each of the four positions were described and demonstrated by the researcher. The researcher was allowed to stand next to the patient, and help the patient to change from position. Participants were expected to be able to maintain these four positions for ten seconds each. The researcher had to maintain his/her attention to the patient, to be able to intervene if the patient lost his/her balance. As soon as one position couldn't be maintained for ten seconds, the test stopped. The maximum score was 4 points, one point for each position able to maintain for ten seconds. Figure 1 shows the four positions (Rossiter-Fornoff, Wolf, Wolfson, & Buchner, 1995).

Tinetti Gait

The researcher stood with the patient and walked across the room with a normal pace, and a faster pace. The researcher evaluated the performance of gait of the patient according to a list of 8 items i.e. step length and height, foot clearance, step symmetry, step continuity. A maximum score of 12 points could be awarded on gait (Tinetti, Williams, & Mayewski, 1986).

Five Times Sit-To-Stand

The patients were seated with their back against a chair. A standard chair was used with arms and a sitting height between 43 and 45cm. The chair may not be positioned against a wall or mat. The patient was instructed to stand up five times as quick as possible and sit down. It was important to fully sit down. The time was started as soon as the researcher said go and ended as soon as the buttocks touched the chair after the fifth repetition. Normally, the use of assistance or upper extremity support was not allowed, but because the participants could not stand up without the use of the arms of the chair, we used a modified version of the test. (Csuka & McCarty, 1985)

MicroFET 2

The participants were seated in a standard chair with armrests and were allowed to grasp these armrests.

Isometric strength was measured for the M. Quadriceps with the MicroFET 2 placed perpendicular to the tibia, just above the malleoli. The participants sat with their knee in 90°

flexion. The participants were asked to extend their leg with maximal effort against the MicroFET 2 until the researcher said stop. The force was recorded in Newton.

Isometric strength was measured for the M. Biceps Brachii with the MicroFET 2 placed perpendicular with the ulna and radius, just above the wrist on the palmar side. The arm was next to the participant, with the elbow in 90° and the arm in supinated position. The participant was asked to flex his/her elbow with maximal strength until the researcher said stop. The force was recorded in Newton.

The method 'break-testing' was used: the participant pushes with maximal effort against the MicroFET 2, until movement appears (Hsieh & Phillips, 1990).

Secondary outcome measures

For every participant, the presence at each exercise session was marked on a list. The amount of participated sessions have been compared with the total amount of sessions for each participant. The total percentage of all participants together was calculated as well.

Statistical analyses

JMP Pro 12 was used for the analyses of the data. As a result of a small sample size we decided to perform non-parametric tests. Multiple single comparisons were made: we used the Wilcoxon/Kruskal-Wallis Exact Test to test any significant changes between IG and CG in pre-test as well as differences in the post-test. Statistical analyses to investigate the effect over time, the comparison of pre-test with post-test singularly executed in IG as well as CG, was performed by the Wilcoxon Signed Rank test for matched pairs. The Wilcoxon/Kruskal-Wallis Exact Test was also used to test possible significant changes in the group x time interaction effect. The interaction effect was evaluated by the subtraction of pre-test scores with the post-test scores. All effects were tested 2-sided. The preset level of significance for all testings was $\alpha=0.05$.

Results

A total of ten participants were recruited in Sint-Elisabeth in Hasselt and were included in the intervention group, while nine participants were recruited in Eyckendael in Riemst and were included in the control group. The median (Q1, Q3) of the age of the intervention and control group was respectively 88.5 (83, 93) and 84 (80.5, 87) years old. The intervention and control group consisted of respectively nine and six female participants and one and three male participants. The age between both groups did not differed significantly (p =.33) and there was a trend to a significant difference in MMSE-score were the control group had a lower score (p=.06). The reason for this was that in the control group a participant had a total score of the MMSE of 3/20. An overview of baseline characteristics can be found in table 1. After signing the informed consent and at the start of the first session of exercises, one female participant did not want to participate in the study anymore. After one week, the other female participant in the intervention group deceased. In the control group, none of the participants dropped out, resulting in nine participants in the control group and eight in the intervention group. These drop-outs were not taken into account for the analysis and had respectively the following characteristics: 91 years old with an MMSE of 23 and 96 years old with an MMSE of eight. The post tests after six weeks were measured of eight participants in the intervention group and nine participants in the control group.

The other baseline characteristics of the participants are shown in table 1.

Primary outcome measures

Balance

The 4-Stage Balance Test did not significantly differ between groups at the beginning of the study. After six weeks, there was still no significant difference between both groups. Balance did not significantly improve in CG and IG after six weeks. No significant interaction effect was found (p= .22).

The Functional Reach Test was not significantly different between the intervention and the control group at the beginning and at the end of the study. In the intervention group, a trend to significant improvement was found after the exercise program (p-value =.05). This was not the

case in the control group, who showed no significant effect after six weeks of usual care. A trend to a significant group x time effect was found (p-value = .08).

The test characteristics are shown in table 2 and Table 3.

Strength

At the start of the study no significant difference was found in strength of the M. Biceps Brachii between the intervention and the control group as well as no significant difference between both groups at the end of the study. The intervention group showed no significant improvement in strength of the M. Biceps Brachii after six weeks and so did the control group. No significant interaction effect was found (p =.66).

The strength of the M. Quadriceps showed no significant difference between the intervention and the control group at the start of the study. No significant difference between the groups was found at the end of the study. The intervention group showed a trend to a significant improvement in M. Quadriceps strength (p =.06) after the exercise program, while the control group showed no improvement in M. Quadriceps strength after the usual care. No group x time effect was found between the intervention and the control group (p =.70).

The test characteristics are shown in table 2 and table 3.

Gait

Gait was examined with the Tinetti (gait) test and did not show a significant difference between the intervention and the control group at the beginning and at the end of the study. There also was no significant effect found after six weeks in the intervention and control group. No group x time effect was found between the intervention and the control group (p =.33). The test characteristics are shown in table 2 and table 3.

Functionality

Functionality was measured with the five times sit-to-stand test and did not show a significant difference between the intervention and the control group at the beginning and at the end of the study. No significant effect was found after the study in the intervention group as well as in the control group. No group x time effect was found between both groups (p =.16). The test characteristics are shown in table 2 and table 3.

Secondary outcome measures

As previously mentioned, the IG ended the program with eight participants. The average compliance rate reached a score of 65.87%. Only one participant was able to achieve an adherence rate of 100%. Another participant took part in all sessions except for one in this experiment, which resulted in a percentage of 94.444%. One of the participants complained about her (severe) arthrosis, as such, her participation was limited through her pain and she only had a compliance rate of 50%. The reasons for two participants not to take part in a session were feeling too weak according to the difficulty of the video and feeling to old; and she said she had already worked enough in her early years and as such only needed rest. A special notion should be made in case of two participants: due to sickness they did not take part in five and six sessions. The compliance rate varied between 27.78% and 100%.

Table 4 shows all information about the compliance rate.

Discussion

This clinical trial was set up to examine whether a six-week video-based exercise program in addition to the usual care would lead to improvements in strength, gait, balance and functionality, compared to the usual care alone in older people suffering from dementia and living in nursing homes. The video-based exercise program showed a trend to a significant improvement of M. Quadriceps strength and balance, measured with the functional reach test, within the intervention group. In Potter et al., a systematic review, two articles showed a significant improvement of balance using the berg balance scale after a physical training intervention of 40 weeks and six months (Potter, Ellard, Rees, & Thorogood, 2011). Toots et al. found after a four month lasting high-intensity functional exercise program a significant between-group improvement of balance (Toots et al., 2016). Telenius et al. showed that after a 12 week high intensity functional exercise program and a six month follow up, the intervention group showed an improvement of balance while the control group showed a decrease of balance (Telenius, Engedal, & Bergland, 2015). These outcomes were comparable with this study, as this study showed a trend to significance with balance measured with functional reach as outcome. No significant improvements were found in M. Biceps Brachii strength, balance measured with the 4-stage balance test, gait and functionality within the intervention group and the control group, as well as no significant differences were found between both groups. The findings of this study suggest that a video-based exercise program compared to the usual care in nursing homes could have a beneficial effect to improve M. Quadriceps strength and balance, measured with the functional reach test. In the study of Cadore et al., an eight weeks lasting multicomponent exercise existing of four weeks walking, cognitive and balance exercises and afterwards four weeks resistance exercises, they found several improvements. After four weeks an improvement of balance was found and after eight weeks participants needed less time completing the timed-up-and-go test as well as, hip flexion and knee extension strength, and the leg press 1RM increased (Cadore et al., 2014). According to this data, the findings in this study were comparable, as a trend to significance was found in M. Quadriceps strength. Hauer et al. found similar results according to increased maximal strength (Hauer et al., 2012). Multiple articles found improvements of gait. Exercise training showed a significant improvement in walking speed,

cadence, stride length, stride time, double support and distance walked (Kemoun et al., 2010; Potter et al., 2011; Rolland et al., 2007; Schwenk et al., 2014).

Burton et al. carried out a systematic review of the effectiveness of exercise programs for reducing falls in elderly, combining 4 articles. This systematic review suggested that exercise programs have the ability to reduce the risk of falling in elderly with dementia. As falls often are related with balance, the study of Burton et al. should have been able to find positive results on balance outcome as well (Burton et al., 2015).

The previous study on this topic was the feasibility study of Ite Speetjens. The study examined if a video-based exercise program for three weeks was feasible in older people suffering from dementia living in nursing homes (Speetjens, 2015). Because the study obtained positive results, we examined in this study the effect of it after six weeks. According to the study of Hageman et al., a six-week resistance training program was not of sufficient duration for a significant change in gait outcome measures, so a three weeks exercise program was definitely too short to investigate an effect (Hageman & Thomas, 2002). To receive a higher power, we tried to recruit more participants than in the feasibility study and this also could be the reason why there was a low compliance rate compared with the compliance rate in the feasibility study. It could be that in the feasibility study, only the most motivated persons wanted to participate and were included as compared with our study, where more persons, sometimes less motivated, were included. Receiving a higher power was not easy, as not many participants suffering from dementia in the nursing home met the selection criteria. Because in the study of Ite Speetjens the participants stopped doing the exercises when the music stopped, in this study the music continued to play through the entire 30 minutes.

After six weeks, we do not yet see a significant deterioration of the outcomes, but this could be the case if the duration of the study lasted longer. The study of Rolland et al. did not show an immediate improvement, but they showed a significantly slowing effect of the progressive deterioration due to dementia after 12 months. (Rolland et al., 2007). Holthoff et al. showed comparable results as well (Holthoff et al., 2015). While the control group experienced a decrease, Schwenk et al. showed improvements in spatio-temporal gait parameters as a result of

a three months lasting supervised, progressive resistance and functional group training (Schwenk et al., 2014).

In this study 80% of all participants were female. However, according to similar interventional studies, the gender ratio achieved a value between 73.3% and 75.8% for a female to male ratio (Hauer et al., 2012; Rolland et al., 2007; Telenius et al., 2015; Toots et al., 2016). Schnelle et al. even presented a percentage of 80% female participants in the intervention group, and 90% female participants in the control group (Schnelle et al., 2003).

Strengths

During the study no participants dropped out as a result of the given intervention. The only drop-outs were at the beginning of the study, before the first exercise session was given and due to decease in the intervention group. In the control group, no drop-outs were noticed. The drop-out rate was 20%, this could be considered as a high drop-out rate if a large amount of participants were recruited. With only ten participants in the intervention group, a drop-out rate of two participants results instantly in a high drop-out rate. If 2 participants dropped out in a larger study, this percentage would be significantly lower. Toots et al. showed an attrition rate of 8% at four months and 16% after seven months for a total number of 186 participants (Toots et al., 2016). However, Schnelle et al. showed an attrition rate of 10% due to illness and 10% due to mortality in the intervention group and an attrition rate of 10% due to mortality and 2% due to illness. This percentage was taken from a total of 190 participants in their study. This results in a loss of data of 18 participants in the intervention group and 12 participants in the control group (Schnelle et al., 2003). Roach et al. showed a drop-out rate of 23 out of 105 participants, this resulted in 21.90% (Roach, Tappen, Kirk-Sanchez, Williams, & Loewenstein, 2011). As such, we could conclude that the drop-out rate of 20% was acceptable for this type of study.

In most nursing homes there is a shortage of staff and that was why the flat screen TV was another strength of this study. In most nursing homes this is always present and could be used instead of extra physiotherapists to give an exercise program.

Because the exercise program was given in groups of five participants, this could be motivating. The music that was played during the exercises could stimulate the participants so they were more motivated to execute the program.

Limitations

There were also a couple of limitations in this clinical trial.

This study had a low amount of participants in the intervention group and control group. This could be considered as a limitation. However, Potter et al. showed on the basis of a systematic review that a participant's ratio below 20 participants per intervention group was able to find positive results. In this systematic review, six articles presented an amount of less than 20 participants per intervention group (Potter et al., 2011). Cadore et al. showed similar results with a total of 18 participants. However, the low amount of participants in this study were not congruent with a large part of the international literature (Cadore et al., 2014). Most studies concluded a much larger amount of participants. These studies consisted of an amount of 105 participants or higher, with a maximum amount of 186 participants (Hauer et al., 2012; Roach et al., 2011; Rolland et al., 2007; Schnelle et al., 2003; Telenius et al., 2015; Toots et al., 2016).

Due to the limited amount of participants in this study and the low compliance rate, for each session only three or four participants, instead of the five that would be expected, were present. The compliance rate was rather low, with a percentage of 65.87. In Schwenk et al. the compliance rate achieves a higher score, i.e. a percentage in the intervention group of 91.9 and a percentage of 94.4 in the control group (Schwenk et al., 2014). In the study of Ite Speetjens, a much higher compliance rate was found (88.9%). This may have been because only five participants were included and they could have been more motivated to participate and hence agreed to participate in the study. Another reason for the high compliance rate in the study of Ite Speetjens and the low compliance rate of this study could be that in the feasibility study, there always was one attender who assisted the participants in comparison with two attenders in this study, so that the participants had to get comfortable with two strangers and not just one (Speetjens, 2015).

In following studies it is recommended to use more participants so that more residents would be able to participate in any session.

Another reason why few participants completed every session was the severity of the dementia. As persons with dementia could differ from enthusiasm and cheerfulness from day to day, it may have an effect on the quality of each training session. It could influence the pre- and post-testing as well as participants were examined when they had a day full of enthusiasm, good

understanding of the tasks, they could achieve higher scores compared with days without enthusiasm.

This study used a non-parametric design because there were not enough participants to use parametric tests. This was another limitation of the study.

During the exercises, we recorded the participants' executions on video so we could examine if the participants correctly executed the exercises. We saw that this was not always the case. This could be a reason why we did not found more improvements in the outcome measures. As such, it was implemented that an additional video-based exercise program does not have much of a beneficial effect in elderly with dementia. It may however be beneficial when the physical therapist, who was present during the exercise program, tries to correct the wrong exercises that the participants execute, while the others could still continue the exercise program.

The biggest difference of this study compared with the main results of international literature was the duration of the intervention. As most international scientific studies lasted a minimum of 12 weeks and some lasting up to one year, six weeks was just a short period of time. In following studies it is recommended that the program lasts longer than six weeks, because it might be possible that more improvement could be measured (Hauer et al., 2012; Holthoff et al., 2015; Kemoun et al., 2010; Rolland et al., 2007; Schnelle et al., 2003; Schwenk et al., 2014; Telenius et al., 2015; Toots et al., 2016).

Because two investigators were responsible for this study and we could not be present at all of the exercise sessions, we divided the training sessions so that one investigator was present at Monday and the other one was present at Wednesday and Friday. We also had to do the pre- and post-testing ourselves, in that case we were not blinded for the intervention and control group. For following studies it is recommended that the investigators are blinded so that they could not be influenced.

The last limitation of this study was that there was no randomization in the allocation of participants to the intervention or control group. The reason for this was that there were not enough residents with dementia who met the selection criteria in each nursing home. For following studies, randomization is recommended.

Conclusion

A video-based exercise program of six weeks showed a trend to a significant improvement of M. Quadriceps strength and balance, measured with the functional reach test, in older people suffering from dementia living in a nursing home. No significant improvements were found in M. Biceps Brachii strength, balance, measured with the 4-stage balance test, gait and functionality. This was compared with the control group who underwent the usual care. They showed a trend to significant improvement in M. Quadriceps strength, but also a trend to significant decrease in functionality. No significant differences were found between both groups. We could conclude that a video-based exercise program of six weeks may be able to improve M. Quadriceps strength and balance, measured with the functional reach test, in older people suffering from dementia living in a nursing home. Further research is needed to confirm the findings.

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Appendix

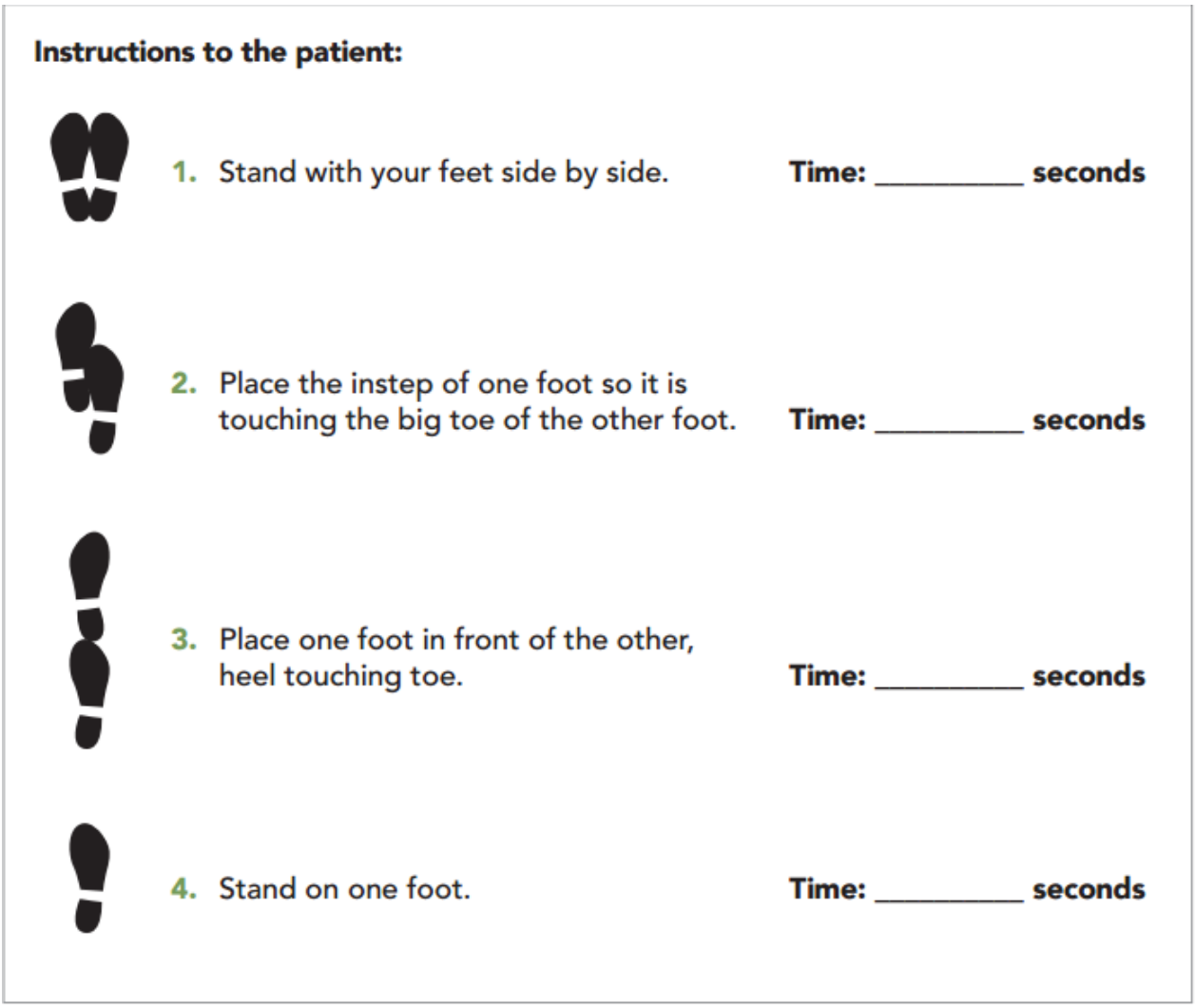

Figure 1. 4-Stage Balance Test

Table 1. Baseline characteristics of participants

Group	IG	CG	P-value
No of participants	8	9	
Age (median) (IQR)	85 (9)	84 (6.5)	0.36
Sex (female/male)	7/1	6/3	
MMSE (median) (IQR)	19 (14.5, 21.75)	13 (9, 17.5)	0.06°

° = trend to significant difference with the Wilcoxon/Kruskal-Wallis Exact Test or the Wilcoxon Signed Rank test. ($P \leq 0.05$)

Table 2: median (Q1, Q3) of the scores and statistical evaluation of Functional Reach, 4-Stage Balance Test, strength biceps, strength quadriceps, Tinetti test, 5 Times Sit-To-Stand test.

	Intervention group		**Pwithin**	**Control group**		**Pwithin**
	pre	post		pre	post	
Balance						
Functional Reach (FR)	12.5 (6.25, 25.75)	24.5 (20, 30.5)	0.05 °	16 (8, 25)	17 (11, 30)	0.28
4-stage balance test	2 (2, 2)	2 (2, 3.5)	0.38	2 (1, 3)	2 (1.5, 2.5)	1.00
Strength						
M. Biceps Brachii	83.5 (47.75, 103.75)	76 (47.75, 96.75)	0.45	76 (63.5, 100)	63 (53, 114)	0.89
M. Quadriceps	96 (57.25, 136.25)	115 (73.5, 143.5)	0.05 °	86 (62, 97)	96 (65, 115.5)	0.13
Gait						
Tinetti	7.5 (6.25, 11)	7.5 (6.25, 11.25)	1.00	8 (5.5, 11)	8 (6.5, 9)	0.75
Functionality						
5 times sit-to-stand test (FTSST)	17.5 (13.75, 37)	16.5 (13.75, 38.75)	0.94	24 (15, 26.5)	25 (16.75, 40)	0.10

° = trend to significant difference with the Wilcoxon Signed Rank test. ($P \leq 0.05$)

Table 3: median (Q1, Q3) of the scores and statistical evaluation of Functional Reach, 4-Stage Balance Test, strength M. Biceps Brachii, strength M. Quadriceps, Tinetti test, 5 Times Sit-To-Stand test.

	Intervention group		**Control group**		**P between - pre**	**P between - post**	**P interaction effect**
	pre	post	pre	post			
Balance							
Functional Reach (FR)	12.5 (6.25, 25.75)	24.5 (20, 30.5)	16 (8, 25)	17 (11, 30)	0.64	0.38	0.08 °
4-stage balance test	2 (2, 2)	2 (2, 3.5)	2 (1, 3)	2 (1.5, 2.5)	0.65	0.63	0.22
Strength							
M. Biceps Brachii	83.5 (47.75, 103.75)	76 (47.75, 96.75)	76 (63.5, 100)	63 (53, 114)	0.74	0.81	0.67
M. Quadriceps	96 (57.25, 136.25)	115 (73.5, 143.5)	86 (62, 97)	96 (65, 115.5)	0.31	0.23	0.70
Gait							
Tinetti	7.5 (6.25, 11)	7.5 (6.25, 11.25)	8 (5.5, 11)	8 (6.5, 9)	0.96	0.96	0.33
Functionality							
5 times sit-to-stand test (FTSST)	17.5 (13.75, 37)	16.5 (13.75, 38.75)	24 (15, 26.5)	25 (16.75, 40)	0.60	0.49	0.16

° = trend to significant difference with the Wilcoxon/Kruskal-Wallis Exact Test or the Wilcoxon Signed Rank test. ($P \leq 0.05$)

Table 4: compliance rate of the IG

Participants	Compliance rate (participated sessions/total number of sessions)	Percentage (%)
1	7/18	38.89
2	9/18	50.0
3	15/18	83.33
4	12/18	66.67
5	18/18	100
6	5/18	27.78
7	12/18	66.67
8	17/18	94.44

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Richting: **master in de revalidatiewetenschappen en de kinesitherapie-revalidatiewetenschappen en kinesitherapie bij musculoskeletale aandoeningen**
Jaar: **2016**

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