2013•2014
FACULTEIT GENEESKUNDE EN LEVENSWETENSCHAPPEN
master in de revalidatiewetenschappen en de kinesitherapie

Masterproef

Feasibility of- and motivation during technology supported rehabilitation in persons with shoulder pain: a clinical pilot study

Promotor :
Prof. dr. Annick TIMMERMANS

Copromotor :
dr. Sara VAN DEUN

Bente Caels , Ine Camps

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

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KNOWLEDGE IN ACTION

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Preface

We, Bente Caels and Ine Camps, carried out a clinical pilot study to investigate the feasibility and motivation during technology supported rehabilitation in persons with shoulder pain. This research was conducted under the guidance of our promoter Prof. Dr. Annick Timmermans (Hasselt University). She guided this master thesis since part 1 (literature search) and we want to thank her for her commitment and feedback.

We are also very grateful to the Department of Physical Medicine and Rehabilitation at Jessa Hospital in Hasselt. The head of the department Dr. Guido Claes and the head of paramedical service mr. E. Olivieri were completely open to the thesis topics of the students en were very interested in this research. We also want to thank the physiotherapists who, guided by E. Olivieri, gave tips and advice when necessary. Furthermore, they decided together with the students the selection of the home exercises for every individual patient. The team consists of the following physiotherapists: Joren Gordts, Bart Kreemers, Stefanie Vanbrabant and Caroline Quetin.

We also want to thank the patients who participated in our study wholeheartedly. They made sure that we were able to carry out this research. They all did a very good job and it was very pleasant to work with them.

We are both very happy with what we have achieved with our investigation. It took us a lot of time and effort, but thanks to our good cooperation and division of labor, we could bring this investigation to a successful end.

Overpelt & Wijchmaal, 14/8/2014 B.C & I.C.

Situating the research

Background

Shoulder problems are, as musculoskeletal complaints, most commonly seen in health care [1]. Impingement syndromes seem to have a high prevalence among the shoulder pathologies [2]. These complaints are related to a poorer health status and can be recurrent and do not always disappear over time [1]. Scapular dyskinesis and timing of the activation of the upper, middle and lower trapezius, and serratus anterior are major contributors to the impingement syndrome [3]. In line of impingement, physical therapy is the first treatment to handle the problem [4]. However, it appears that the compliance of these exercises at home is difficult.

To stimulate the performance of home exercises, video instructions can be useful for teaching the correct performance of prescribed exercise [5]. Video instructions can be replayed many times, so the patient can repeat the instructions as many times as she/he finds necessary.

Research context

The aim of this study is to investigate the feasibility of using video instructions for performing home exercises during rehabilitation in patients with musculoskeletal shoulder pain. We will look for possible effects in treatment progress, motivation and compliance. We also aim to evaluate the possible reduction of shoulder complaints when using the video instructions (pain reduction, performing activities). This clinical study is not an impact study. We aim to evaluate the magnitude of the effects in order to set up a randomized controlled trial with a larger sample size.

Research framework

Prior to this pilot study, a literature search was performed by Bente and Ine in 2012-2013 as a basis for their investigation in 2014. The aim of the literature search was to detect all types of evidence-based technology-based rehabilitation that was used for musculoskeletal problems of the upper extremity. The results from this literature study provided a background in knowledge to carry out our pilot study. Our master's thesis project started in 2012 as a new research. During these two years Bente Caels and Ine Camps were responsible for the patient recruitment, data gathering and data analysis of the included patients under supervision of Prof. Dr. Annick Timmermans. In preparation of the clinical study, Bente and Ine created, under supervision of Prof. A. Timmermans and Drs Liesbet de Baets, a novel video-based exercise program that the included patients had to carry out on daily basis. This way we could determine the exercises for each individual patient in consultation with the physiotherapists of the department. In the clinical study, feasibility and magnitude of effects for pain reduction and improvement in activities were investigated, but also satisfaction and compliance were evaluated. In order to ensure a proper follow up, we visited the patients weekly in the hospital. This new research is prepared and written by the two thesis students, together with the advice and help of our promoter Prof. Dr. Annick Timmermans.

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Feasibility of- and motivation during technology supported rehabilitation in persons with shoulder pain: a clinical pilot study

Prepared according to the guidelines of 'PlosOne'

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Abstract

Aim: The aim of our clinical pilot trial is to investigate the feasibility of video-assistance to support home exercises for people with shoulder pain and to investigate changes in pain, in functional abilities, in motivation and in therapy compliance.

Methods: Patients with shoulder pain were recruited from the Jessa Hospital (Hasselt, BE). During their rehabilitation program the regular paper instructions for home exercises were replaced by a self-prepared, video-based exercise program. Four measurement points (T0, T1, T2 and T3) were used to assess the shoulder pain disability index (SPADI), scapula positioning (The Clinical protocol Scapula Positioning), quality of life (SF-36), patient specific functioning (PSFS), intrinsic motivation (IMI), self-efficacy (PSEQ), pain (Numeric Pain Rating Scale), and treatment credibility and expectancy (CEQ). Motivation, treatment compliance, satisfaction and user friendliness of the system were also evaluated.

Results: Five patients with shoulder pain have participated in this study (3 men and 2 women, mean age=49 years (SD: 7,68)). One patient dropped out at T3 measurement. A data-imputation technique was applied to estimate this one patient's T3 values. Overall improvement over time (Friedmann Test) was found for patient specific functioning (p=0.017) and general motivation for rehabilitation (p=0.034). Furthermore, patients improved on shoulder disability after rehabilitation (T0-T3, Wilcoxon Signed Ranks Test, p=0.043). Also on quality of life (subscale Physical health SF-36) an improvement was found between T1 and T3 (Wilcoxon Signed Ranks Test, p=0.043). A statistically significant improvement could not be found over time on pain (subscale Pain SPADI (p=0.251), NPRS (p=0.173)), quality of life (subscale Mental Health SF-36 (p = 0.724)), scapula positioning, self-efficacy (p=0.589), credibility and expectancy (p=0.498; p=0.686) and patient satisfaction (p=0.157). All patients show a forward shoulder posture through time and a limited upward rotation. The pectoralis minor length makes a positive progression over time (<7,65 at T3) as well as the medial rotation test and scapular distance. Patients scored above average on every subscale of the IMI (>3,5 out of 7). For usability and challenge of the system, an average score of 9,25 out of a possible 10 has been found. The NPRS did make a positive improvement of more than 2 points for three patients from T0-T3. Also credibility and expectancy positively scored more than 13 points at T3. Three patients exercised daily for about thirty minutes.

Conclusions: The use of video instructions for home exercises in patients with shoulder pain is feasible. Patients were very motivated to pursue a video-based rehabilitation program at home. Most patients exercised on a daily basis with an equal duration. Patients improved on specific functioning, on shoulder disability and on quality of life. Pain, self-efficacy, credibility and expectancy, scapular position and satisfaction do not demonstrate an improvement, although a positive progression can be found for pain, credibility and expectancy, pectoralis minor length, scapular motor control and scapular distance.

Keywords: Rehabilitation, shoulder pain, technology, video-assistance

Introduction

Shoulder problems are, as musculoskeletal complaints, most commonly seen in health care [1]. According to Lentz et al. [2] the prevalence of shoulder pain is estimated between 6,9% and 26%. Approximately one percent of patients with shoulder complaints seek for treatment in primary care [1]. Between 22-68% of these persons with shoulder pain continue to have symptoms even one year after the onset of their shoulder pain. Impingement syndromes seem to have a high prevalence among the shoulder pathologies. According to Van der Windt et al. [3] and Vecchio et al. [4] 44-60% of all consultations are for pain at the level of the shoulder due to impingement, of which the most prevalent is the subacromial impingement. These complaints are related to a poorer health status, can be recurrent and do not always disappear over time [1].

Scapular dyskinesis and timing of the activation of the upper, middle and lower trapezius and serratus anterior are major contributors to the impingement syndrome [5]. The standard treatment is based on scapula setting and is applied in a situation where dysfunction is present, associated with abnormal scapular positioning and dynamic control [6].

To pursue a good treatment of muscle imbalances of the scapula, Cools et al. [7] investigated the activation of the m. trapezius and m. serratus anterius using rehabilitation exercises. According to these results, side-lying exorotation exercises, side-lying forward flexion exercises, horizontal abduction exercises with exorotation in prone position and extension exercises in prone position provide an added value in the treatment of scapular muscle imbalances.

Physical therapy is the first treatment to handle the impingement problem [8]. This is confirmed by Struyf et al. [9] who describes that exercise therapy and manual therapy, among Dutch physiotherapists, are the most widely used treatments in impingement syndrome.

Worsley et al. [8] describe a study in which electromyography (EMG) and 3-dimensional movement analysis are used to register muscle activation and kinematics during an elevation of the arm towards 90° in three fases. These patients underwent an intervention of ten weeks (2 minutes, 10-15 times, twice a day) based on motor learning principles where training of the scapular orientation is to be seen as most important. The participants with shoulder impingement had significant pain reduction and improved function post-intervention compared to before the intervention started.

Instructional technology has grown by an increase in the use of videotapes [10]. Today, it can be found in virtually all areas and stages of medical intervention, such as brain injury management, arthritis lifestyle intervention, presurgical anxiety reduction and cardiovascular risk reduction [11-14]. According to researchers in patient health education, new technology is considered more pleasant than traditional clinical teaching methods [11,15]. Patients raise their expectations and this will translate into better comprehension, better knowledge retention and eventually positive behavioral change [10].

Jay et al. [16] investigated video instructional material in an exercise-at-work setting with laboratory technicians and office workers suffering from neck/shoulder pain. They compared this video instructed regime with personalized exercise instruction. Errors in exercise execution, training frequency, use of material, personalized training adherence and self-perceived pain of the neck, shoulder, arm and wrist were reported. Their hypothesis of a higher error score in the video-based instruction group was not verified. This study suggests that using visual feedback can be equally effective as having an instructor present. The authors conclude that the use of video material is a robust solution that can be easily implemented in corporations with challenging work schedules. It is a cost-effective way to integrate exercise at work.

Lysack et al. [10] investigated the potential of an exercise videotape system to use in the home setting and the effects on the satisfaction and compliance of the patients. They carried out a randomized controlled trial to compare two alternative methods of exercise instruction in orthopedic rehabilitation patients. The control group received routine inpatient rehabilitation exercise education and the intervention group received routine care plus one additional therapeutic session to download a videotape for continued use at home. As result, they found no differences at follow-up in exercise compliance or patient satisfaction between the videotaped approach and the inpatient rehabilitation exercises given by physical therapists. Miller et al. also compared the effectiveness of videotape with face-to-face instruction for shoulder pain. In terms of clinical progress, they concluded that instruction by videotape was no more effective than face-to-face, but it was more popular and motivates the patients to continue self-treatment [17].

Kingston et al. [18] reviewed published research in order to evaluate the evidence surrounding video or DVD technology to promote compliance with home exercise. The authors concluded that the findings are generally inconclusive in determining whether the use of video can improve compliance and that accurately measuring and influencing compliance is very complex and difficult. Because of the heterogeneity across the tools used to determine compliance, the study results could not be compared. The method of measuring compliance in the majority of the studies was through patient report, such as logbooks and patient self report. The reviewed studies also indicate the need for more studies into the clinical use of technology to enhance compliance with home exercises and the need for well-designed randomised controlled trials with adequate sizes and reliable outcome measures.

Current models of video-assistance to support home exercises could not conclude that this technology-supported system has preference over the classic, face-to-face, inpatient rehabilitation. It is established that video-assistance may have a positive effect on motivation and compliance to perform home exercises [10,17,18].

This clinical pilot trial assesses the feasibility of using video instructions to support home exercises in patients with shoulder pain. The exercises support specific patient goals that make the home exercise program individualized and patient centered. Previous studies on performing home exercises did not apply an individualized regime, but rather a standardized exercise protocol [10,17,18,19]. Jay et al.

[16] compared video plus personal instruction with video-based instruction and found no difference in effectiveness.

The aim of our study is to: 1) investigate the feasibility of video-assistance to support home exercises for people with shoulder pain and 2) investigate any changes in pain, functional abilities, motivation, and compliance.

Materials and methods

Aim of the study

The aim of our study is to: 1) investigate the feasibility of video-assistance to support home exercises for people with shoulder pain and 2) investigate any changes in pain, functional abilities and motivation and compliance.

Research questions

At the start of this study we formed three questions:

1. Is a video instructed client centered home training feasible for persons with shoulder pain?
2. Do individualized home exercises, supported by video instructions improve pain and functional abilities during the rehabilitation process of patients with shoulder pain?
3. Are patients with shoulder pain motivated to perform home exercises through video-instructions and what is the compliance?

Hypotheses

At the start of this study we formed three hypotheses:

1. A video instructed client centered home training is feasible for persons with shoulder pain.
2. Patients with shoulder pain demonstrate an improvement in pain and functional abilities.
3. Patients with shoulder pain are motivated to perform home exercises through video-instructions and show compliance to the rehabilitation.

Study design

The current study is a clinical pilot trial.

Subjects

Recruitment

The purpose for this study was to include five patients from the Department of Physical Medicine and Rehabilitation at Jessa Hospital in Hasselt, together with the head of the department Dr. Guido Claes and the head of paramedical service mr. E. Olivieri. Only patients who meet the inclusion and exclusion criteria mentioned below are eligible for the study. Patients who meet the criteria, will be informed by the physiotherapist. The information booklet and consent form will be explained. If interested, one receives the consent form. Patients receiving the consent form signed within a week from returning to the medical secretary of the Department of Physical Medicine and Rehabilitation will be included in the study, after which the questionnaires are delivered and the measurements are done. The current study was approved by the medical ethics committee of UHasselt and Jessa Hospital.

In- and exclusion criteria

The following inclusion criteria were used to select the participants to the study: a) patients with main complaints at the shoulder complex or proximal arm, b) patients older than 18 years, c) patients who understand spoken and written Dutch. The exclusion criteria were: a) previous surgical intervention at the level of the shoulder complex and/or cervical vertebral column in the last 6 weeks, b) comorbidity: paresis and sensory problems of neurological origin / diabetes mellitus / rheumatoid arthritis, pain > 8/10 for the last 48h, symptom reproduction with cervical movements and c) current compensation claims.

Tabel 1: Overview of in-and exclusion criteria

Inclusion	Exclusion
- Main complaints shoulder complex or proximal arm	- Previous surgical intervention at the level of the shoulder complex and/or cervical vertebral column in the last 6 weeks
- > 18 years	- Comorbidity: paresis and sensory problems of neurological origin / diabetes mellitus / rheumatoid arthritis, pain > 8/10 for the last 48h, symptom reproduction with cervical movements
- Understand spoken and written Dutch	- Current compensation claims

Procedure

Patients follow the regular treatment program in the Jessa Hospital. This program lasts 12-16 weeks and is prepared by the therapists of the Jessa Hospital. However, in this study the paper instructions concerning the home exercises are replaced for eight weeks by video instructions of the exercises. The researchers, together with the therapists, select exercises that apply to the patient. These exercises are selected from a training bundle which consists of 35 different exercises. Patients take the exercises that are selected for them to practice on, home on a memory stick. The home program always consists of exercises that work on control of the scapula in shoulder movements and everyday tasks, as well as stretching exercises.

In the total bundle, there are 30 exercises that work on control of the scapula during shoulder movements, six exercises that work on control of the scapula in everyday tasks and 10 stretching exercises. These exercises focus on posture, muscle strengthening, endurance, functional activities and stretching. Every exercise from the video has a number that corresponds to the number of the paper instructions. Patients are asked, before starting the exercises, to watch the videos at least five times and to think along with the movement while observing the execution as if it were their own arm

that moves (motor imagery). The exercise program provides exercises similar to the exercises that are given (on the paper version) to the patients. Much attention is paid to the use of stabilization exercises for the shoulder. These exercises are combined with a number of analytical movements (flexion / abduction / external rotation / internal rotation shoulder) and functional activities of increasing difficulty. Patients are encouraged to perform daily home exercises that get progressively more difficult for 20 to 30 minutes.

The patients can only take the video instructions at home after 2 weeks of regular rehabilitation. This allows them to get used to the new time schedule. Patients will also attend regular therapy two weeks after the completion of the technology-based training.

Measurements

Sociodemographic information

- Gender
- Age
- Social and employment situation
- Time since the onset of shoulder pain
- Rehabilitation history (general and with regard to shoulder pain)
- Medication use in function of shoulder pain (yes / no)
- Work accident, juridical procedure related to shoulder pain
- Duration of work with arm / hand elevation (overhead work)

Primary outcome measures

- **Shoulder Pain Disability Index (SPADI)** [20,21]: SPADI is a short questionnaire (5-7 minutes), specific for the shoulder, which is based on self-reporting by the patient. The questionnaire is valid and responsive for questioning / evaluating the pain (5 items) and functional limitations (8 items) in patients with shoulder pain of musculoskeletal origin. Each item is scored on a VAS scale (100 mm. Right: worst pain / so difficult that help is needed, Left: no pain or functional problems).
- **Pain self-efficacy questionnaire** [22]: This scale consists of 10 items that are scored on a 7-part numeric scale, and examines how confident patients have that one, despite the pain, is able to perform certain actions.
- **Patient specific functioning scale (PSFS)** [23]: The patient is asked to nominate up to five activities which he / she considers important and that are difficult or impossible to perform at the time of its purchase. The difficulty will be scored on an 11-part numerical scale (0 = not able to perform the activity; 10 = activity may be performed as before the symptoms). There is a good validity and reliability (activities and participation level).

- **Clinical protocol Scapula Positioning** [24]: This protocol consists of:

  (a) Observation and measurement of the scapular position: observation of the position of the scapula (static and dynamic), the AT-distance (the distance from angulus acromialis to the table by a person in a supine position), the measurement of resting length M. Pectoralis Minor (the distance from coracoid process to the lower edge of rib 4), the scapular distance measurement (the distance between angulus acromialis and T3), and the measurement of the scapular upward rotation by inclinometry.

  (b) measurement of the dynamic control of the scapula: the medial rotation test

  (c) scapular positioning and the relationship with the symptoms: scapular repositioning test, scapular assistance test.

  To perform every measurement of the Clinical protocol Scapula Positioning, we used a goniometer and a measuring tape. In order to keep the intra-individual differences low and to standardize these measurement, we used the same materials at every measurement point. One of us always carried out the measurement, while the other took the notes. In that way, we could avoid inter-individual differences.
- **Numeric pain rating scale** [25,26]: This is a measurement where the patient indicates the degree of pain he / she is experiencing. This is an 11-part scale (0-10), which at the left end represents "no pain" and the right end "the worst pain imaginable." An improvement in a pain level of 2 points or more is considered a clinically significant and meaningful difference.
- **Short Form (SF-36)** (RAND36) [27]: The SF-36 is a questionnaire that the quality of life and general healthcare evaluates. The test has a good test-retest reliability. There must be a difference of 5 points over time, to speak of a clinically relevant difference.
- **Compliance**: Study participants keep a journal in which they write when they exercise (date, time) and for how long. Patients also write down the exercises they have done (note the code of practice).
- **Motivation**: It asks the patient to answer the following questions:

  1) How motivated were you to practice this week? The patient's response to his / her opinion on an 11-part scale (not challenging, very challenging 0-10):

  2) Are there factors that have influenced your motivation for home exercises? (positive and/or negative)

Secondary outcomes

- **Credibility and Expectancy Questionnaire (CEQ)** [28,29]: The CEQ evaluates the credibility of the evaluated treatment for the patient, as well as the treatment effect that he / she expects from the treatment. The questionnaire has been validated for pain problems of musculoskeletal origin (low back pain).
- **Intrinsic Motivation Inventory (IMI)** [30]: IMI is a questionnaire for measuring intrinsic motivation of individuals to perform certain specific motion tasks / activities in this study, "the physical therapy exercises at home."
- **Patient satisfaction:** The patient is asked to respond to the following question by indicating his / her opinion on an 11-part scale (not at all satisfied, very satisfied 0-10):
  1) How satisfied were you with this form of technology-assisted rehabilitation?
- **User Friendliness System**: It asks the patient to respond to the following questions by indicating his / her opinion on an 11-part scale (not challenging, very challenging 0-10) :
  1) How easy did you find it to use the system?
  2) Was the system challenging enough?
  It also asks the patient to mention potentially negative factors related to usability.

Data analysis

Data were analyzed using SPSS 16.0. (SPSS Inc., Chicago, IL). For primary outcome measurement data, a Friedman two-way analysis of variance by ranks was performed. Alpha was set at 0.05. For multiple comparisons between results measured at T0, T1, T2, and T3, a Wilcoxon signed ranks test was done. In case of missing data from individual participants, an imputation technique was used to estimate a subject's performance based on mean intra- individual progress between measurement points in time of all other participants [31].

Error analysis

All measurement data were collected according to the predefined protocol. The values of one patient at measurement point T3 (after 10 weeks rehabilitation) could not be recorded as the patient dropped out for reasons that are not related to this study (traffic accident). A data-imputation technique was applied to estimate this one patient's T3 values [31].

Time planning

This clinical pilot trial was planned in the academic year of 2013-2014. The preparation work ran from September 2013 to March 2014. The recruitment of the patients started in May 2014 and lasted until August 2014. Throughout the study, there were several measurement points (see table 2) at which we saw the patients. At the end of the treatment program, we carried out the statistical analysis and data extraction which ran until the beginning of August 2014.

Table 2: Measurement points

Primary measures	T0	T1	T2	T3	T4
Shoulder Pain Disability Index	X	x	X	x	x
Pain self-efficacy questionnaire	X	x	X	x	x
Patient specific functioning scale	X	x	X	x	x
Evaluation Scapula Positioning	X	x	X	x	x
Numeric Pain Rating scale	X	x	X	x	x
SF-36	X	x	X	x	x
Compliance *	X	x	X	x	x
Motivation **			X	x	x
Secondary Measures	**T0**	**T1**	**T2**	**T3**	**T4**
Credibility and Expectancy Questionnaire		X	X		
Intrinsic Motivation Inventory				x	
Patient satisfaction			X	x	x
User friendliness system				x	

Abbreviations: T0: baseline at inclusion, T1: after 2 weeks rehabilitation (without technology), T2: after 6 weeks rehabilitation (including 4 weeks with technology), T3: after 10 weeks rehabilitation (including 8 weeks with technology), T4: 6 months after the end of the rehabilitation. * daily registration in diary, ** weekly registration

Results

Sociodemographic information

At the baseline measurement of our clinical study (T0) we gathered some overall information of the patients. This allowed us to determine the characteristics of our 5 patients (3 men and 2 women, with a mean age of 49 years (SD: 7,68)). These characteristics are shown in Table 3.

Table 3: Patient characteristics

Patient characteristics		Total (n=5)
Gender	Male	3
	Female	2
Age	18-20y	/
	20-30y	/
	30-40y	1
	40-50y	1
	50-60y	3
	Mean (SD)	49y (7.68)
Social situation	Married	4
	Single	/
Employment situation	Retired	1
	Invalidity	2
	Sick leave	1
	Worker	1
Onset shoulder pain	>12m	1
	>6m	2
	>3m	2
Medication	Yes	1
	No	4
Work accident /Juridical procedure	Yes	/
	No	5
Duration of work with arm / hand elevation (overhead work)	<1h	4
	>1h	1
Previous rehabilitation	Yes	4
	No	1

Primary outcomes

Shoulder Pain and Disability Index, Pain Self-Efficacy Questionnaire, SF-36, Numeric Pain Rating Scale and Patient Specific Functioning Scale

The SPADI questionnaire shows a significant improvement at T0-T3 ($p<0.05$) on subscale Disability. Patients score their disability lower at T3 compared with T0. Looking at the mean scores of subscale Pain, presented at table 4, we can see a halving of the scores at T3 compared with T0. However, this difference is not significant.

The Pain Self-Efficacy Questionnaire showed no significant difference at the end of the study. Looking at the mean scores, presented in table 4, we can see an increase of 4 points at T0-T2. At T3, this increase drops 11 points. This could mean that at the end of our study, on average, the patients have less confidence to properly carry out activities.

For the SF-36, we look at the total scores on Mental Health and Physical Health. Looking at the mean scores, presented at table 4, we can see that Mental Health has an overall higher score. Physical Health shows a significant difference at T1-T3 ($p<0.05$). We could not find a significant difference at any measurement point for Mental Health. Although, a clinically relevant difference (a difference of 5 points or more over time) is found at T0-T1 (5,1) and T1-T2 (7,7).

Based on the Numeric Pain Rating Scale, there could not be found a significant difference in pain over time. Although, based on the scoring of this questionnaire, an improvement of 2 points or more is considered a clinically significant and meaningful difference. This means that patient 1, 2 and 4 show improvement in their pain level at T0-T3. The mean scores at each measurement point are presented in table 4.

The scoring of the PSFS questionnaire are presented in table 4. If we look from T0 to T3 measuring moment, an increase in the overall mean score can be found ($p<0,05$). These scores are based on activities the patient has difficulties with, due to their shoulder problem. Detailed activities and scoring are shown in table 5.

Table 4: Overview of the SPADI, Pain Self-Efficacy Questionnaire, Numeric Pain Rating Scale and SF-36 at T0, T1, T2 and T3

	T0 Mean (SD)	T1 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)	Significance level
SPADI					
Pain	59,6 (24,4)	52,4 (22,0)	25,8 (12,6)	33,2 (27,8)	
Disability	62,1 (26,8)	52,5 (29,5)	46 (21,8)	34,5 (29,4)	*
PSEQ	41,2 (15,4)	44 (16,2)	45,2 (14,5)	34,2 (16,8)	
SF-36					
Physical health	42,7 (24,2)	42,0 (16,1)	41,3 (11,1)	47,6 (17,1)	**
Mental health	69,8 (31,7)	64,7 (31,2)	72,4 (32,6)	69,6 (27,5)	
NPRS	5,4 (2,4)	4 (2,8)	4,2 (1,9)	3,2 (2,8)	
PSFS	4,3 (1,8)	4,1 (5,1)	3,9 (1,6)	5,2 (1,1)	†

Abbreviations: T0: Baseline Measurement; T1: Measurement after 2 weeks rehabilitation (without technology); T2: Measurement after 6 weeks rehabilitation (including 4 weeks with technology); T3: Measurement after 10 weeks rehabilitation (including 8 weeks with technology); SPADI: Shoulder pain and disability index; PSEQ: Paint self-efficacy questionnaire; SF-36: Short-form 36; NPRS: Numeric pain rating scale; PSFS: Patient specific functioning scale; Friedmann Test significant: † = p=0.017; Wilcoxon Signed Ranks Test: * = p=0.043 for T0-T3, ** = p=0.043 for T1-T3.

Table 5: Scoring of the PSFS

		T0	T1	T2	T3
Patient 1	Mowing grass	4	4	4	x
	Shaving the hedge	2	1	1	x
	Do the dishes	4	4	4	x
	Wipe dust	4	4	4	x
	Average	3,5	3,3	3,3	4,3
Patient 2	Reach high	7	6	4	6
	Working in the garden	6	6	6	6
	Reach backwards with the arm	3	3	3	6
	Lifting	7	5	2	6
	Average	5,8	5	3,8	6
Patient 3	Reach backwards with the arm	4	4	4	4
	Average	4	4	4	4
Patient 4	Window cleaning	5	5	7	7
	Ironing	7	7	6	7
	Put on cloths (pants)	7	7	7	7
	Perform work (kids)	6	5	5	5
	Average	6,3	6	6,3	6,5
Patient 5	Window cleaning	2	2	2	4
	Hang the laundry	2	2	2	5
	Wash your hair	2	2	2	5
	Playing with the kids	2	2	2	5
	Average	2	2	2	4,8

Clinical Protocol Scapula Positioning

In table 6, an overview of the mean scores of the distance between the angulus acromialis and the table (AT-distance), the M. Pectoralis minor length, the distance between the angulus acromialis and T3 (scapular distance), upward rotation of the scapula and the medial rotation test are presented. Patient three dropped out at T3, so these results are not presented. There could not be found a statistically significant improvement in any of the measurements. The mean scores of the AT-distance are high (>72 mm). This means that in all patients, a forward shoulder posture is seen. The mean results of the Pectoralis Minor Index (resting muscle length divided by subject height and multiplied by 100) show that at T0, a shortened M. Pectoralis Minor is present (<7,65). This score progresses positively through time (>7,65 at T3). All patients show an overall low score compared to a standard upward rotation of 60°. These scores do not make a clear progress through time. The medial rotation test shows a positive improvement from T0 (30°) to T3 (53,8°). The scapular distance is normalized by dividing it by the scapular length. An increase from T0 to T3 is found.

Appendix 1 shows an overview of the descriptive results of the Clinical protocol Scapula Positioning. As described above, every patients shows a forward shoulder posture during static observation at every measurement point. For patient five, four and three, there also is an elevated scapula present at approximately each measurement point. During dynamic observation, patient one and five show particularly a limited upward rotation. Patient two, three and four show especially a shrugging movement during this observation. The degree of symptom change (SRT and SAT) differs at each measurement point.

Table 6: Overview of the mean scores of the AT-distance, M. Pectoralis minor length, scapular distance, upward rotation of the scapula and the medial rotation test

	T0 Mean (SD)	T1 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)
AT-distance (cm)	9,3 (2,25)	9,3 (1,93)	9,0 (1,22)	8,5 (2,49)
PMI	7,4 (0,53)	7,9 (1,38)	8,6 (1,12)	9,6 (0,35)
Normalized scapular abuction	1,4 (0,18)	1,65 (0,17)	1,65 (0,13)	1,73 (0,15)
Upward rotation scapula (°)	25 (12,25)	30,5 (11,15)	29,5 (9,54)	33,8 (14,36)
Medial rotation test (°)	30 (16;33)	37,5 (17,08)	42,5 (17,08)	53,8 (7,5)

Abbreviations: AT-distance: distance between the angulus acromialis and the table; PMI: Pectoralis Minor Index; Normalized scapular abduction: distance between the angulus acromialis and processus spinosus of T3 divided by scapular length.

Compliance

Three patients were very consistent and exercised every day around 30 minutes (two patients for about 20-30 minutes and one patient for about 30-60 minutes). One patient did not practice every day. This patient went on a holiday twice. For unknown reasons, one patient did not complete the diary daily. All five patients started with ‘exercise 1: scapula movements’ and ‘exercise 2: neutral position’ that work on control of the scapula in neutral position. To progress, exercise 2 was combined with a number of analytical movements (flexion / abduction / external rotation / internal rotation shoulder), depending on the individual limits. When they could perform these exercises without difficulty, new exercises were presented. Every patient got at least one stretching exercise during the total study period. Not every patient received a functional activity exercise.

Motivation

In terms of motivation, patients never scored lower than half of the maximum score. Two patients scored the maximum at T3. There is a mean progression of 1,8 out of 10. This progression is statistically significant ($p<0.05$). The mean scores and significance level are shown in table 7.

Table 7: Overview of the results of Motivation

	T2	T3
N	5	5
Minimum	5,00	7,00
Maximum	8,00	10,00
Mean	6,4000	8,2000
Std. Deviation	1,51658	1,64317
Asymp. Sig.	p=0,034 (Wilcoxon Signed Ranks Test)	

Secondary outcome measures

Credibility and Expectancy Questionnaire (CEQ)

In table 8, the results of the Credibility and Expectancy Questionnaire are presented. The credibility subscale at T1 shows a mean score of 19 out of a possible 27 and at T2 a mean score of 21. A mean progression of 2 points can be found. This progression is not statistically significant (p>0,05). The expectancy subscale shows a small mean progression of 1,04 points. This progression is not statistically significant (p>0,05). The credibility subscale scores a minimum of 19 at T2. This is a positive score (>13 on 27). The expectancy subscale scores a minimum of 16 at T2. This is also a positive score. Statistical progression could not be found, but overall positive results (>13 on 27) at T2 can be found.

Table 8: Overview of the results of the CEQ questionnaire

Credibility	T1	T2
N	5	5
Minimum	13,00	19,00
Maximum	27,00	25,00
Mean	19,00	21,00
Std. Deviation	5,70	2,55
Asymp. Sig.	p=0,498 (Wilcoxon Signed Ranks Test)	

Expectancy	T1	T2
N	5	5
Minimum	13,40	16,00
Maximum	23,40	19,40
Mean	16,52	17,60
Std. Deviation	4,38	1,54
Asymp. Sig.	p=0,686 (Wilcoxon Signed Ranks Test)	

Intrinsic Motivation Inventory (IMI)

In table 9 the individual means of four patients are displayed. Due to the drop-out of patient one at T3, these results could not be recorded. Each patient scores above the average. In table 10 the average per subscale is shown. Looking at the interest/enjoyment scale, there is a mean score of 5,0 out of a possible 7,0. This may indicate that the patients thought that this training intervention was interesting. For the subscale value/usefulness, pressure/stress and solidarity, there is a mean score of 5,6 out of 7,0. This may indicate that the patients thought that this training intervention was useful, pleasant and that they experienced little stress. The subscales perceived competence and effort/importance score the lowest, but they stay above the mean (3,5/7). This may indicate that patients thought that this training intervention is less important, and that they feel less competent.

Table 9: Overview of the results of the IMI questionnaire (total mean per patient)

	Patient 2	Patient 3	Patient 4	Patient 5
N	6	6	6	6
Minimum	5,4	4,0	4,3	4,0
Maximum	6,0	7,0	5,7	5,0
Mean	5,7	5,7	5,1	4,2
Std. Deviation	0,3	1,4	0,5	0,4

Table 10: Overview of the results of the IMI questionnaire (mean per subscale)

Subscales	Minimum	Maximum	Mean	Std. Deviation
Interest/enjoyment	2,0	7,0	5,0	1,4
Perceived competence	3,0	6,0	4,5	0,8
Effort/importance	2,0	6,0	4,7	1,1
Pressure/stress	3,0	7,0	5,6	1,4
Value/usefulness	4,0	7,0	5,6	1,1
Solidarity	3,0	7,0	5,6	1,1

Patient Satisfaction

The scoring of satisfaction at T2 and T3 is very high on average. Three out of five patients scored the maximum at T3. Based on the mean score, there is an increase of 0,8 out of 10. This increase is not statistically significant ($p > 0.05$). An overview of the results is shown in table 11.

Table 11: Overview of the results of Patient Satisfaction

	T2	T3
N	5	5
Minimum	8,00	8,00
Maximum	10,00	10,00
Mean	8,8000	9,6000
Std. Deviation	1,09545	,89443
Asymp. Sig.	p=0,157 (Wilcoxon Signed Ranks Test)	

User Friendliness System

Patients scored friendliness based on two categories: the usability of the system and how challenging it was for them. This questionnaire was taken at one measurement point, namely T3. The mean scores are presented in table 12. For both Usability and Challenge, there is an average score of 9,25 out of a possible 10.

Table 12: Overview of the results of User Friendliness System

	N	Minimum	Maximum	Mean	Std. Deviation
Usability	4	7,00	10,00	9,2500	1,50000
Challenge	4	7,00	10,00	9,2500	1,50000

Discussion

The aim of this study was to: 1) investigate the feasibility of video-assistance to support home exercises for people with shoulder pain and 2) investigate any changes in pain, functional abilities, motivation and compliance.

Despite the fact that only a very small number of participants were included (n=5), significant improvements after rehabilitation were found for the Disability subscale of the SPADI, for the Physical Health subscale of the SF-36, for patient specific functioning (PSFS) and for patient motivation. With regard to the PSFS, patient three could only enumerate one activity (instead of five) per measurement point which he considered important and that was difficult or impossible to perform. This patient considered himself well able to carry out various activities and found it difficult to sum up five activities that were impossible or difficult to perform. With regard to the subscale Pain of the SPADI, a halving of the scores at T3 compared with T0 is found. However, this difference is not significant, probably due to the large standard deviation of a small sample size. Roy et al. [32] evaluated the effect of an intervention including shoulder control and strengthening exercises on function in persons with shoulder impingement and performed repeated measures of shoulder pain and function through the SPADI. Similar results were found with the present study. The participants were of the same age (mean = 46 years) as the present study (mean = 49 years) and also found significant changes during intervention. The difference between Roy et al. and the present study is that Roy et al. does not differentiate between the subscale Pain and Disability at which the present study could find a clear difference. We could not find a significant difference at any measurement point for the Mental Health subscale of the SF-36. The SF-36 is a valid and sensitive questionnaire for large groups. Since our study included only five participants, these results have to be considered with caution. Miller et al. [17] randomly assigned patients with shoulder pain to one of three regimes of instruction: (a) therapist video group, (b) anonymous video group and (c) control group. There were no significant differences in SF-36 scores when outcomes of the three groups were compared. Furthermore, no significant differences in the change of SF-36 scores were found when the overall video group (a+b) were compared to the control group (c). As in the SPADI, Miller et al. does not differentiate between subscale Physical health and Mental health. With regard to the NPRS, there could not be found a significant difference in pain over time. Considering the fact that an improvement of 2 points or more is considered a clinically significant and meaningful difference, patients 1, 2 and 4 do show a positive improvement in their pain level at T0-T3. Based on the results of the credibility and expectancy, not significant progressions were present. Although, a score of 13 or more is considered positive. This applies for both the credibility and expectancy at T2. With regard to the Clinical protocol Scapula Positioning and Compliance, there could not be found a statistically significant improvement. Although, some positive progressions have been found. The mean scores of the AT-distance are high (>72 mm). This means that in all patients, a forward shoulder posture is seen. We used the Pectoralis Minor Index (PMI) for discussing the M. Pectoralis Minor length. Because of height and muscle length variability among subjects, this measurement is normalized by dividing the resting muscle length measurement by the subject height and multiplying by 100 [24]. This index progresses positively

through time (<7,65 at T3). The scapular distance is normalized by dividing it by the scapular length [24]. These numbers also progress positively through time (from T0 30° to T3 53,8°). Upward rotation is rather limited and does not make a clear progress over time. Struyf et al. [9] used a scapular-focused treatment including stretching and scapular motor control training to assess forward shoulder posture, M. Pectoralis Minor length and scapular upward rotation. They could not find a change in any of the scapular measurements in response to the treatment. Based on the results of the Motivation questionnaire ($p<0.05$) and the average score of the IMI (<3,5 out of 7), we can determine that patients are very motivated to pursue a video-based rehabilitation program at home. Four patients declared that they performed the exercises daily. One patient went on a holiday twice and could not complete the diary at this time. For unknown reasons, one patient did not complete the diary for every week. Also, one patient told us that she found it difficult to perform the exercises in the lying position, because she used the computer which is placed on the desktop. These results of Compliance tell us that the carrying out of the exercise program is experienced differently from patient to patient. Most patients found it very interesting and more pleasant than the standard paper version of the home exercises, so it was easy for them to stick to the program. Kingston et al. [18] confirms that accurately measuring and influencing compliance is very complex and difficult. One patient told us that when he could find an everyday routine to perform the exercises, it was easier for him to persevere. Current models of video-assistance to support home exercises established that video-assistance could have a positive effect on motivation and compliance to perform home exercises [10,17,18].

A point of improvement may be the duration of the study. Because of the large variety of exercises, it is possible to individualize the exercise program for each patient, but not all patients can equally improve. An exercise is passed over a longer period of time when the patient feels that he needs this time to precisely perform this exercise. After 10 weeks (2 weeks without technology and 8 weeks with technology) we could not progress the exercises to the functional activities for all of the patients. A longer follow-up evaluation could have provided more information on the long term outcomes and guided us on the need for some subjects to have a longer duration of intervention. Another consideration is the influence of a cortisone injection some patients received just before the measurement. This could influence the results of this measurement. Looking at the pain results, based on the Numeric Pain Rating Scale, we cannot see a statistic significant difference. Although three patients showed an improvement of two points or more. This is considered a clinically significant and meaningful difference (T0-T3). This could also be influenced by the cortisone injection just before the measurement. The patients also found it very difficult to give a mean score of their pain, because their pain level varies through the day.

Limitations of the study and future research

The sample within this research was fairly small. A lager sample size may result more differences over time. A limitation is the recruitment of participants at the hospital. There are few patients who have the same pathology or syndrome. For future research it would be useful to recruit participants from private practices to select a specific pathology group, e.g. subacromial impingement.

Another recommendation for future research is to use a control group. In that way, the presence of a control group could clarify the differences or progresses with or without a video-based exercise program.

Conclusion

The use of video instructions for home exercises in patients with shoulder pain is feasible. Patients were very motivated to pursue a video-based rehabilitation program at home. Most patients exercised on a daily basis with an equal duration. Patients improved on specific functioning, on shoulder disability and on quality of life. Pain, self-efficacy, credibility and expectancy, scapular position and satisfaction do not demonstrate an improvement, although a positive progression can be found for pain, credibility and expectancy, pectoralis minor length, scapular motor control and scapular distance.

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APPENDIX 1: Overview of the descriptive results of the Clinical protocol Scapula Positioning

	Patient 1				Patient 2				Patient 3				Patient 4				Patient 5			
	T0	**T1**	**T2**	**T3**	**T0**	**T1**	**T2**	**T3**	**T0**	**T1**	**T2**	**T3**	**T0**	**T1**	**T2**	**T3**	**T0**	**T1**	**T2**	**T3**
Observation																				
- Static*	3; 5	1;8	1; 8	x	3;6;8	1;6;8	2;7;8	8	1; 8	1;8	8	1; 8	1;5;8	1; 8	1; 8	1; 8	1;5;8	1;5;8	1;3;6;8	1;6;8
- Dynamic**	9	9	9	x	1; 10	1; 10	10	9; 10	1; 10	1	10	10	10	10	10	9; 10	9	9	9	9
SAT***	a	c	b	x	c	a	c	c	a	a	c	c	b	b	a	b	b	a	c	a
SRT***	a	a	c	x	a	c	c	c	c	a	c	c	b	a	c	a	b	c	c	c

*1 = elevated scapula; 2 = depressed scapula; 3 = upward rotation; 4 = downward rotation; 5 = winging; 6 = tipping; 7 = atrophy; 8 = protraction

**9 = limited upward rotation; 10 = shrugging;

***a = geen verschil; b = moeilijker; c = gemakkelijker

APPENDIX 2: Sociodemographic information (Dutch)

Geslacht:	
Leeftijd:	
Sociale en werksituatie:	
Tijd sinds het ontstaan van schouderpijn:	
Revalidatiegeschiedenis:	
Medicatie gebruik ifv schouderpijn:	
Werkongeval, juridische procedure i.v.m. schouderpijn:	
Gemiddeld aantal uren werk per week:	
Tijdsduur werk met arm/hand in elevatie (overhead work):	

APPENDIX 3: Shoulder Pain Disability Index (SPADI) (Dutch)

Wilt u a.u.b. de onderstaande vragenlijst invullen.
De vragen gaan over uw schouder en hebben betrekking op de afgelopen week.

PIJN SCHAAL

Hoe erg is uw pijn?

Omcirkel het getal dat het best uw pijn weergeeft.
0 = geen pijn en **10** = de ergst bedenkbare pijn

De pijn op zijn hevigst…….. …….	0 1 2 3 4 5 6 7 8 9 10
Wanneer u op de pijnlijke zijde ligt…. …….	0 1 2 3 4 5 6 7 8 9 10
Reikend naar iets op een hoge plank …….	0 1 2 3 4 5 6 7 8 9 10
Het aanraken van de achterkant van de nek……..	0 1 2 3 4 5 6 7 8 9 10
Duwen met de pijnlijke arm……	0 1 2 3 4 5 6 7 8 9 10

Totaal pijn score _____

BEPERKING SCHAAL

Hoeveel moeite heeft u om het volgende uit te voeren?

Omcirkel het getal dat het best uw ervaring weergeeft.
0 = geen enkele moeite en **10** = zo moeilijk dat hulp hiervoor nodig is

Uw haar wassen……	0 1 2 3 4 5 6 7 8 9 10
Uw rug wassen……..	0 1 2 3 4 5 6 7 8 9 10
Een hemd aantrekken…….	0 1 2 3 4 5 6 7 8 9 10
Een shirt met knopen aantrekken……..	0 1 2 3 4 5 6 7 8 9 10
Uw broek aantrekken……	0 1 2 3 4 5 6 7 8 9 10
Een object op een hoge plank plaatsen……	0 1 2 3 4 5 6 7 8 9 10
Een zwaar object dragen van 5 kg……	0 1 2 3 4 5 6 7 8 9 10
Iets pakken uit uw achterzak. ……	0 1 2 3 4 5 6 7 8 9 10

Totaal beperking score _____

Totaal SPADI score _____

APPENDIX 4: Pain Self-efficacy Questionnaire (Dutch)

Duid aan hoe zeker u van uzelf bent dat u op dit moment de onderstaande dingen kan doen, ondanks uw pijn. Omcirkel het cijfer dat uw antwoord het best weergeeft, waarbij 0 = helemaal niet zeker of helemaal geen vertrouwen, en 6 = volledig zeker of vol vertrouwen.

Let op, er wordt niet gevraagd of u deze dingen al dan niet doet, maar wel hoe zeker u van u zelf bent dat u deze dingen kan doen, ondanks uw pijn.

1. Ik kan van dingen genieten, ondanks mijn pijn.

0	1	2	3	4	5	6
Helemaal niet zeker						Volledig zeker

2. Ik kan de meeste huishoudelijke taken (vb. opruimen, afwassen, enz.) doen, ondanks mijn pijn.

0	1	2	3	4	5	6
Helemaal niet zeker						Volledig zeker

3. In vergelijking met vroeger, kan ik even vaak met mijn vrienden en familie afspreken, ondanks mijn pijn.

0	1	2	3	4	5	6
Helemaal niet zeker						Volledig zeker

4. Ik kan met mijn pijn omgaan in de meeste situaties.

0	1	2	3	4	5	6
Helemaal niet zeker						Volledig zeker

5. Ik kan enige vorm van werk doen, ondanks mijn pijn (‘werk’ houdt zowel huishoudelijk werk, onbetaald als betaald werk in)

0 1 2 3 4 5 6
Helemaal niet zeker Volledig zeker

6. Ik kan nog altijd veel dingen doen waar ik van geniet, zoals hobby’s en vrije tijds-activiteiten, ondanks mijn pijn.

0 1 2 3 4 5 6
Helemaal niet zeker Volledig zeker

7. Ik kan met mijn pijn omgaan zonder medicatie.

0 1 2 3 4 5 6
Helemaal niet zeker Volledig zeker

8. Ik kan nog steeds de meeste van mijn doelen in mijn leven behalen, ondanks mijn pijn.

0 1 2 3 4 5 6
Helemaal niet zeker Volledig zeker

9. Ik kan een normale levensstijl behouden, ondanks mijn pijn.

0 1 2 3 4 5 6
Helemaal niet zeker Volledig zeker

10. Ik kan geleidelijk aan meer actief worden, ondanks mijn pijn.

0 1 2 3 4 5 6
Helemaal niet zeker Volledig zeker

APPENDIX 5: Patient Specific Functioning Scale (Dutch)

Eerste onderzoek (lees dit voor)
Ik ga u vragen 3 tot 5 belangrijke activiteiten te noemen die u niet of met moeite kunt uitvoeren als gevolg van uw _____ probleem. Zijn er vandaag activiteiten die u niet of met moeite kunt uitvoeren als gevolg van uw _____ probleem? (Leg de 0-10 schaal uit en vraag de patiënt elke activiteit een cijfer toe te kennen).

Aanvulling: Zijn er nog overige activiteiten die u een beetje moeite kosten om uit te voeren?
Bijvoorbeeld, activiteiten die u een score van 6 of meer zou toekennen.
Benoem niet meer dan twee activiteiten. (Schrijf deze op als Extra 1 en 2)

Vervolg onderzoek (lees dit voor)
Toen ik bij u de vragenlijst afnam op (noem datum eerste onderzoek), vertelde u mij dat u moeite had met (lees één voor één alle activiteiten van de lijst op).
In welke mate heeft u vandaag de dag nog steeds moeite met genoemde activiteiten? (laat de patiënt de activiteiten uit het eerste onderzoek nogmaals scoren).

Patiënt specifieke activiteiten schaal (wijs cijfer aan):

0 1 2 3 4 5 6 7 8 9 10

Kan activiteit niet uitvoeren

Kan activiteit zo goed uitvoeren als voor probleem

APPENDIX 6: Clinical Protocol Scapula Positioning (Dutch)

Observatie stand scapula (statisch & dynamisch):	
AT-afstand (afstand van angulus acromialis tot tafel):	
Meting rustlengte M. Pectoralis Minor:	
Meting scapulaire afstand (afstand van angulus acromialis tot T3):	
Meting scapulaire opwaartse rotatie:	
Medial rotation test:	
Scapular repositioning test:	
Scapular assistance test:	

APPENDIX 7: Numeric Pain Rating Scale (Dutch)

Er wordt aan de patiënt gevraagd om op een schaal van 0 tot 10 aan te duiden hoeveel pijn hij/zij ervaart.

0 1 2 3 4 5 6 7 8 9 10

Geen pijn **De ergst denkbare pijn**

APPENDIX 8: Short-Form 36 (Dutch)

Instructie: Deze vragenlijst gaat over uw standpunten t.a.v. uw gezondheid. Met behulp van deze gegevens kan worden bijgehouden hoe u zich voelt en hoe goed u in staat bent uw gebruikelijke bezigheden uit te voeren.

Beantwoord elke vraag door het antwoord op de aangegeven wijze te markeren. Als u niet zeker weet hoe u een vraag moet beantwoorden, geef dan het best mogelijke antwoord.

1. Hoe zou u over het algemeen uw gezondheid noemen?

(omcirkel één cijfer)

Uitstekend.....1

Zeer goed.....2

Goed.....3

Matig.....4

Slecht.....5

2. Hoe beoordeelt u nu uw gezondheid over het algemeen, vergeleken met een jaar geleden?

(omcirkel één cijfer)

Veel beter nu dan een jaar geleden.....1

Wat beter nu dan een jaar geleden.....2

Ongeveer hetzelfde nu als een jaar geleden.....3

Wat slechter nu dan een jaar geleden.....4

Veel slechter nu dan een jaar geleden.....5

3. De volgende vragen gaan over bezigheden die u misschien doet op een doorsnee dag. Wordt u door uw gezondheid op dit moment beperkt bij deze bezigheden? Zo ja, in welke mate?

(omcirkel één cijfer op elke regel)

BEZIGHEDEN	**Ja, ernstig beperkt**	**Ja, een beetje beperkt**	**Nee, helemaal niet beperkt**
a. Forse inspanning, zoals hardlopen, tillen van zware voorwerpen, een veeleisende sport beoefenen	1	2	3
b. Matige inspanning, zoals een tafel verplaatsen, stofzuigen, zwemmen of fietsen	1	2	3
c. Boodschappen tillen of dragen	1	2	3
d. Een paar trappen oplopen	1	2	3
e. Eén trap oplopen	1	2	3
f. Bukken, knielen of hurken	1	2	3
g. Meer dan een kilometer lopen	1	2	3
h. Een paar honderd meter lopen	1	2	3
i. Ongeveer honderd meter lopen	1	2	3
j. Uzelf wassen of aankleden	1	2	3

4. Heeft u in de afgelopen 4 weken, een van de volgende problemen bij uw werk of andere dagelijkse bezigheden gehad, ten gevolge van uw lichamelijke gezondheid?

(omcirkel één cijfer op elke regel)

	JA	**NEE**
a. U besteedde **minder tijd** aan werk of andere bezigheden	1	2
b. U heeft **minder bereikt** dan u zou willen	1	2
c. U was beperkt in het **soort** werk of andere bezigheden	1	2
d. U had **moeite** om uw werk of andere bezigheden uit te voeren (het kostte u bv. extra inspanning)	1	2

5. Heeft u in de afgelopen 4 weken, een van de volgende problemen ondervonden bij uw werk of andere dagelijkse bezigheden ten gevolge van emotionele problemen (zoals depressieve of angstige gevoelens)?

(omcirkel één cijfer op elke regel)

	JA	**NEE**
a. U besteedde **minder tijd** aan werk of andere bezigheden	1	2
b. U heeft **minder bereikt** dan u zou willen	1	2
c. U deed uw werk of andere bezigheden **niet zo zorgvuldig** als gewoonlijk	1	2

6. In hoeverre hebben uw lichamelijke gezondheid of emotionele problemen u gedurende de afgelopen 4 weken gehinderd in uw normale omgang met familie, vrienden of buren, of bij activiteiten in groepsverband?

(omcirkel één cijfer)

Helemaal niet.....1

Enigzins.....2

Nogal.....3

Veel.....4

Heel erg veel.....5

7. Hoeveel lichamelijke pijn heeft u de afgelopen 4 weken gehad?

(omcirkel één cijfer)

Geen.....1

Heel licht.....2

Licht.....3

Nogal.....4

Ernstig.....5

Heel ernstig.....6

8. In welke mate bent u de afgelopen 4 weken door pijn gehinderd in uw normale werk (zowel buitenshuis als huishoudelijk werk)?

(omcirkel één cijfer)

Helemaal niet.....1

Een klein beetje.....2

Nogal.....3

Veel.....4

Heel erg veel.....5

9. Mentale Gezondheid en Vitaliteit

Deze vragen gaan over hoe u zich voelt en hoe het met u ging in de afgelopen vier weken. Wilt u a.u.b. bij elke vraag het antwoord geven dat het best benadert hoe u zich voelde.

Scoremogelijkheden:

1	altijd
2	meestal
3	vaak
4	soms
5	zelden
6	nooit

Hoe vaak gedurende de afgelopen vier weken:

(omcirkel één cijfer op elke regel)

Voelde u zich levenslustig?	1	2	3	4	5	6
Was u erg zenuwachtig?	1	2	3	4	5	6
Zat u zo in de put dat niets u kon opvrolijken	1	2	3	4	5	6
Voelde u zich rustig en tevreden?	1	2	3	4	5	6
Had u veel energie?	1	2	3	4	5	6
Voelde u zich somber en neerslachtig?	1	2	3	4	5	6
Voelde u zich uitgeput?	1	2	3	4	5	6
Was u een gelukkig mens?	1	2	3	4	5	6
Voelde u zich moe?	1	2	3	4	5	6

10. Hoe vaak hebben uw lichamelijke gezondheid of emotionele problemen u gedurende de afgelopen 4 weken gehinderd bij uw sociale activiteiten (zoals vrienden of familie bezoeken, etc.)?

(omcirkel één cijfer op elke regel)

Altijd.....1

Meestal.....2

Soms.....3

Zelden.....4

Nooit.....5

11. Hoe JUIST of ONJUIST is elk van de volgende uitspraken voor u?

(omcirkel één cijfer op elke regel)

	Volkomen juist	Grotendeels juist	Weet ik niet	Grotendeels onjuist	Volkomen onjuist
a. Ik lijk wat gemakkelijker ziek te worden	1	2	3	4	5
b. Ik ben even gezond als andere mensen	1	2	3	4	5
c. Ik verwacht dat mijn gezondheid achteruit zal gaan	1	2	3	4	5
d. Mijn gezondheid is uitstekend	1	2	3	4	5

APPENDIX 9: Motivation (Dutch)

De volgende 2 vragen worden gesteld:

1) Hoe gemotiveerd was u om te oefenen deze week?

0 1 2 3 4 5 6 7 8 9 10

Helemaal niet uitdagend **Uitermate uitdagend**

2) Zijn er factoren die uw motivatie voor de thuisoefeningen beinvloed hebben?

Positief:

Negatief:

APPENDIX 10: Credibility and Expectancy Questionnaire (Dutch)

1e reeks vragen

1. Hoe logisch lijkt u de geboden therapie nu?

   1 2 3 4 5 6 7 8 9

   Helemaal niet logisch enigszins logisch zeer logisch

2. Hoe succesvol denkt u nu dat deze behandeling zal zijn voor de behandeling van uw schoudersymptomen?

   1 2 3 4 5 6 7 8 9

   Helemaal niet succesvol enigszins succesvol zeer succesvol

3. Zou u er vertrouwen in hebben deze behandeling aan een vriend aan te raden die dezelfde problemen heeft?

   1 2 3 4 5 6 7 8 9

   Geen vertrouwen enig vertrouwen vol vertrouwen

4. Hoeveel verbetering zal er volgens u aan het eind van de therapie in uw schoudersymptomen zijn opgetreden?

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2e reeks vragen

Sluit voor deze reeks een paar momenten uw ogen en probeer te achterhalen wat u werkelijk *voelt* ten aanzien van de therapie en het waarschijnlijke succes. Beantwoord dan de volgende vragen.

1. Hoeveel *voelt* u nu dat therapie u zal helpen uw schoudersymptomen te verminderen?

   1 2 3 4 5 6 7 8 9

   Niets Enigszins Zeer veel

2. Hoeveel verbetering *voelt* u dat er aan het eind van de therapie in uw schoudersymptomen zal zijn opgetreden?

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

APPENDIX 11: Intrinsic Motivation Inventory (Dutch)

Interesse/Genot

1. Ik heb erg genoten van deze arm-hand training

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

2. Deze arm-hand training was leuk

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

3. Ik vond deze arm-handtraining saai

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

4. Deze training kon mijn aandacht helemaal niet vasthouden

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

5. Ik vond deze arm-hand training interessant

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

6. Ik dacht dat deze arm-hand training vrij prettig was

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

7. Terwijl ik deze training deed, dacht ik na over hoe prettig ik het vond

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

Ervaren competentie

8. Ik denk dat ik vrij goed ben in deze training

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

9. Ik denk dat ik deze training vrij goed doe in vergelijking met andere deelnemers

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

10. Na een beetje ervaring met deze training, voelde ik me vrij competent

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

11. Ik ben tevreden met mijn prestatie op deze trainingsactiviteit

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

12. Ik was vrij vaardig in het uitvoeren van deze trainingsactiviteit

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

13. Dit was een trainingsactiviteit die ik niet goed kon uitvoeren

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

Inspanning/Belangrijkheid

14. Ik heb veel moeite gedaan voor deze arm-hand training

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

15. Ik heb niet echt geprobeerd om goed te presteren op deze trainingsactiviteit

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

16. Ik heb me veel moeite gedaan tijdens deze trainingsactiviteit

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

17. Het was belangrijk voor mij om deze training goed te doen

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

18. Ik heb niet veel energie gestoken in de trainingsactiviteit

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

Druk/Spanning

19. Ik heb me helemaal niet zenuwachtig gevoeld terwijl ik de oefende

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

20. Ik heb me erg gespannen gevoeld terwijl ik oefende

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

21. Ik was zeer ontspannen tijdens het doen van deze oefeningen

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

22. Ik voelde me angstig tijdens het oefenen

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

23. Ik voelde dat ik onder druk stond tijdens het trainen

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

Waarde/Nut

24. Ik geloof dat deze activiteit waarde voor mij kan hebben

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

25. Ik denk dat deze activiteit nuttig is voor het verbeteren van arm-handvaardigheid

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

26. Ik denk dat deze training belangrijk is omdat ik mijn arm-hand meer en beter kan gebruiken

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

27. Ik zou dit nog opnieuw willen doen omdat het enige waarde voor mij heeft

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

28. Ik denk dat het doen van deze activiteit mij zou kunnen helpen om mijn aangedane arm en hand meer te gebruiken in alledaagse activiteiten

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

29. Ik geloof dat het doen van deze training mij ten goede komt

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

30. Ik denk dat dit een belangrijke training is

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

Samenhorigheid

31. Ik voelde me echt afstandelijk tot deze training

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

32. Ik zou graag een kans krijgen om vaker met deze trainingsmethode/ dit trainingssysteem te oefenen

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

33. Ik zou echt verkiezen om niet meer met deze trainingsmethode/dit trainingssysteem te oefenen in de toekomst

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

34. Ik voel niet dat ik deze trainingmethode/-systeem echt kan vertrouwen

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

35. Ik voel me aangetrokken tot deze trainingsmethode/dit trainingssysteem

1	2	3	4	5	6	7
helemaal niet waar			enigszins waar			zeer waar

APPENDIX 12: Patient Satisfaction (Dutch)

De volgende vraag wordt gesteld:

Hoe tevreden was u over deze vorm van technologie-ondersteunde revalidatie?

0 1 2 3 4 5 6 7 8 9 10

Helemaal niet tevreden **Uitermate tevreden**

APPENDIX 13: User Friendliness System (Dutch)

De volgende 2 vragen worden gesteld:

1) Hoe gemakkelijk vond u het om dit systeem te gebruiken?

0 1 2 3 4 5 6 7 8 9 10

Zeer moeilijk **Zeer gemakkelijk**

2) Vond u het systeem uitdagend genoeg?

0 1 2 3 4 5 6 7 8 9 10

Helemaal niet uitdagend **Uitermate uitdagend**

Negatieve factoren:

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Jaar: **2014**

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