

Interactive distance technology enabling home-based motor training for stroke patients

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Parts involved in the project

Danderydsgeriatriken/SLSO

Danderyds sjukhus AB

Landstinget Västmanland

Strokeförbundet

World Stroke Organization

Västerås Stad

Örebro kommun

Örebro läns landsting

Alkit Communications AB

JP Relations AB

Karolinska Institutet

Microsoft AB

Mälardalens Högskola

Robotdalen

SICS Swedish ICT

SLL Innovation

Aim, goal and methodology of the work

Aim

To develop a technical tool, based on interactive communication technology, supporting home-based motor training of stroke patients

Goal

That the developed concept has the potential to become a future product used in stroke rehabilitation

Methodology

Needs-driven and in close co-operation with end-users

Developing and testing the technology

(1) Collection of needs and requirements from end-users

Workshops

- (a) patients with stroke
- (b) persons close to patients
- (c) occupational- and physiotherapists

(2) Iterative development-testing of technology

Prototype development (in collaboration with physiotherapists)



Workshops (testing)

- (a) Patients + therapists
- (b) Stroke org + health care professionals

(3) Pilot study

More information on (1) and (2) found in

1. Sjölander et al, Human-Computer Interactions, CHII 2014, 351-362
2. Ehn et al, Proceedings pHealth2015 (2015), *in press*

Overall aim for the technical support

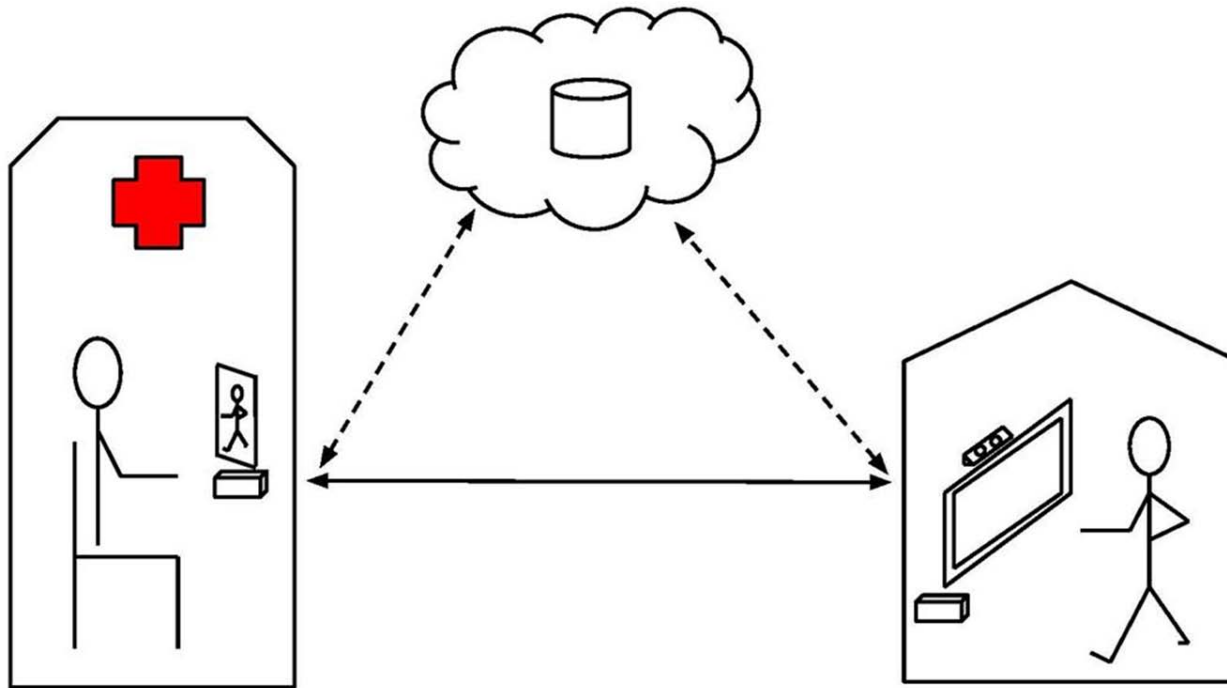
- To support motor function and independence after stroke by enabling
 - Enhanced access for the patient to efficient, continuous training
 - Support for additional training to prevent dips in training activity during the rehabilitation process
 - Enhanced possibilities for follow-up on training results

Use of the technology

- Patients can perform training at home in front of a screen supported by training programs
- Patients can either do the training on his/her own or during video-conference with the therapist
- Support for planning and follow-up of training



Set-up



Computer
Web-Camera
Head-set
Internet access

Big screen
Kinect sensor
Computer
Speakers and microphone
Internet access

Components

HARDWARE

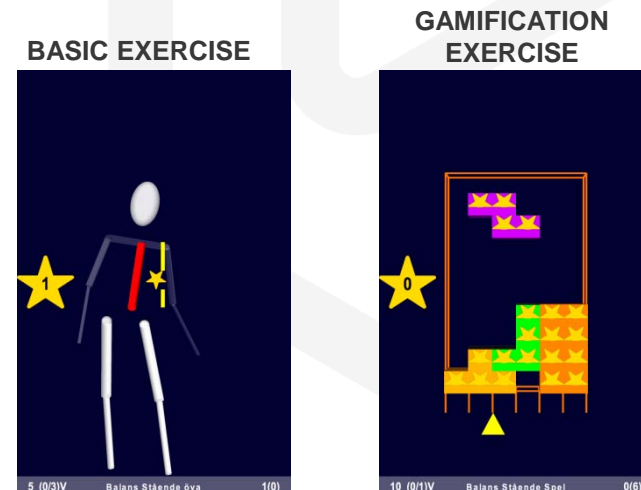
- Standard consumer products

DEVELOPED SOFTWARE

- Computer-based training programs
- Components for video-communication
- Tools for planning and follow-up of training

Computer-based training programs

- Contain selected exercises used by physiotherapists in motor training with stroke patients
- Exercises contain levels with different degree of difficulty
- First version of programs contain six exercises which comprise movements for training four specific motor functions (arm- and leg function and balance/posture)
- Feedback given includes
 - Audio feedback
 - Visual feedback



EXERCISES FOR STAND-UP BALANCE/POSTURE TRAINING

Interaction with the technology

- Exercises and level of difficulty are chosen in advance by therapist at a clinic
- During video-conference, therapist can add/retract exercises and adjust level of difficulty
- Starting up the computer (“power on”)
- Further interaction with the system via the Kinect sensor
 - Selecting an exercise (menu)
 - Using the programs
 - Ending session



Summary

- Technical support for home-based motor training of stroke patients developed in close co-operation with end-users
- Standard hardware products together with software including training programs, components for video-communication and tools for planning and follow-up
- With the support, patients can either do the training on his/her own or during video-conference with the therapist
- Early tests has been performed in workshops with end-users during the technical development
- Feasibility and safety when using the technology as support in stroke rehabilitation further explored in pilot study

DISKO – an interactive distance solution for stroke rehabilitation in the home setting based on modern information and communication technology - a pilot study

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In collaboration with: Maria Ehn, PhD, Robotdalen, Marie Sjölander, PhD and Pär Hansson, Swedish Research Institute for Computer Science , Jonas Jalminger, PhD, Alkit Communications AB.



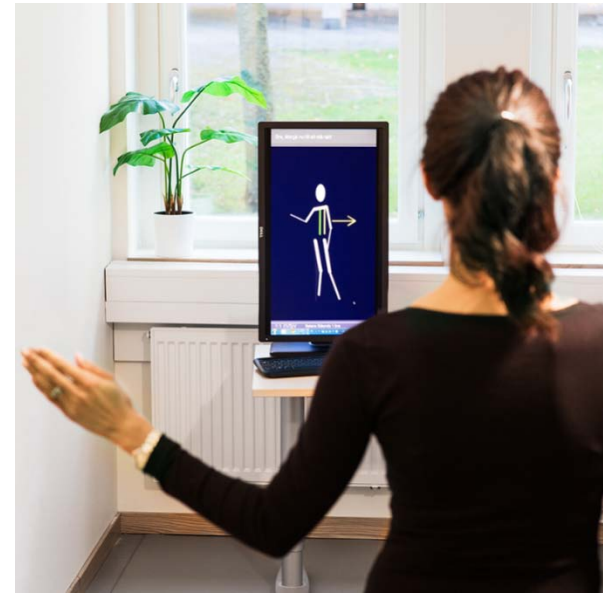
**Karolinska
Institutet**



DANDERYDS SJUKHUS

Aim

To explore the feasibility and safety of using DISKO in the home setting when used as a tool in different rehabilitation phases after stroke



Methods



Participants

- 5 participants – discharged home and to neuroteam in primary health care
- 5 participants – living at home and phased out from neuroteams in primary health care
- 5 participants- living at home and with long-term motor impairments

Methods

Inclusion criteria

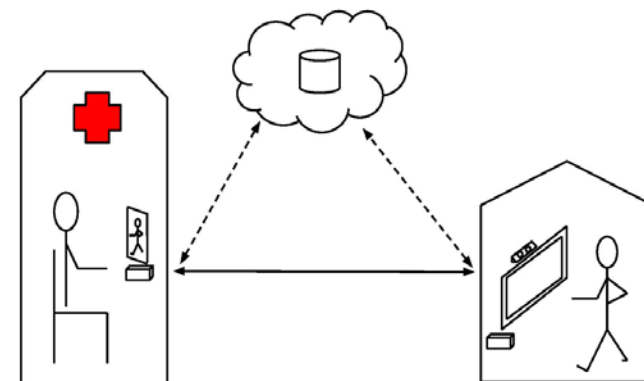
- Impaired motor function after stroke limiting activities of daily living
- Stand without support > 2 min
- Functional reach >12 cm

Exclusion criteria

- Limitations in following verbal and written training instruction or study information
- Impaired vision preventing orientation and reading instructions on a screen

Methods

- Assessment of functioning and disability
- DISKO installed in the home
- Information and instruction
- Individualised training program
- Training sessions 5 days/week
- Follow-ups by video communication 2/days week
- During 3 weeks



Data collection

| Participants | Data |
|--------------------------|---|
| Participants with stroke | <ul style="list-style-type: none">•Functioning and disability•Data from DISKO•Interview and questionnaire |
| Therapist | <ul style="list-style-type: none">•Logbook•Interview |
| Technician | <ul style="list-style-type: none">•Interview |

Preliminary results

Participants with stroke (n=14)

| | |
|---------------------------------------|-----------------------------|
| Age mean (range) | 68 (24-92) years |
| Women/Men | 7 / 7 |
| Time since stroke onset, mean (range) | 3 years (1 month - 9 years) |

Preliminary results

Participants with stroke (n=14)

| Assessment tool | Disability | n |
|------------------------------------|--|----|
| Birgitta Lindmark motor assessment | Impaired control of voluntary movement | 13 |
| | Impaired proprioceptive function | 8 |
| | Pain | 7 |
| Berg Balance Scale | Limited balance Mean 44 (SD 15) range 7-56 | 13 |
| NIHSS | Limited communication | 3 |
| Montreal Cognitive Assessment | Impaired mental function Mean 22 (SD 6) range 11-28 | 8 |

Preliminary results- Logbooks

- All managed the technology
- 3 with assistance
- 13 finalised the training period
- 12 of 15 training sessions were finalised



Preliminary results- Interviews

Participants with stroke (n=14)

- Feed back from therapist important
- Increasing the difficulty of the exercises –motivating
- Training at home-convenient
- Fun but too few exercises
- Placement of start button and design of the menue –difficult
- Perform exercises –easy to understand

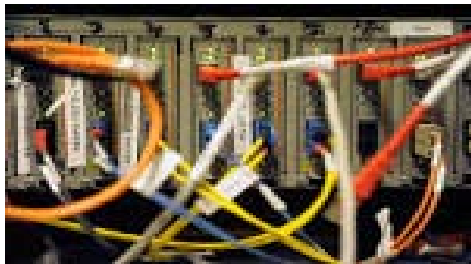
Preliminary results- Interviews Therapist and Technician

No negative side effects/risks identified

Low quality of internet access

Technical development areas related to design and functionality of the

- computer based training program
- component for video communication
- tool for planning and follow up of training



Conclusion

- DISKO is safe and feasible to be used as a tool for continuous, prolonged and/or recurrent training of motor function after stroke in the home setting.
- Further development of the technology and of evidence based training exercises are ongoing and thereafter a larger scale study will explore the effects of using DISKO for training in different phases after stroke.

Thank you for your attention

