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Feasibility of arm cycling in cognitively impaired patients

Arm cycling is both an exercise and a diagnostic procedure. It is often applied to patients with cardiovascular and motor problems.

There is a growing body of evidence, that motor training can improve age-associated neuromuscular deficits and thus restore functional disabilities and prolong the independent life expectancy.

Physical activity is an important approach to improve mobility and postpone the onset of disability. This aim is also important in the care for cognitively impaired patients. Because their motor learning is limited, special approaches are needed. Caring for them is especially demanding, because their compliance is reduced.

To apply exercise to patients with dementia, more man-power is needed compared to exercises with non-demented patients. Cognitively impaired patients need more time for instructions and more encouragement to continue exercise sessions, this is common clinical experience.

But it has to be underlined that also cognitively impaired patients are able to improve cardiovascular, metabolic and motor deficits by exercise.
Exercise devices can support motor learning of patients with dementia. They can reduce the time, which is necessary for instructions, can enhance the safety of exercise, the dosage and evaluation.

Usage of adequate exercise devices leads to some advantages compared to “free” training:
- instruction is easier,
- performing the exercises can more precisely be controlled, so
- exercises are safer,
- dosage and documentation of exercise is more precise and easier to be applied.

Thus human resources can be saved respectively more effectively be used.

Study protocol

Elderly patients of a Geriatric Center participated in an exercise study. Each subject had to perform three sessions of arm cycling (10 minutes each session) on three different days.

Objectives: to investigate,
- whether patients with dementia are able to perform the arm cycling exercises correctly
- which kind of and how often verbal encouragement is necessary
- which differences can be found between participants with and without dementia?

Participants
15 men and 9 women, age 60 years of age, mean age 79.7, SD 8.4, range 60-90ys.
No one of the participants had exercised with this or a similar device before.

Inclusion criteria
- age 60 years and older
- residents of a skilled nursing facility or patients of a geriatric clinic
- with and without dementia respectively cognitive impairment
- able to follow therapeutical commands
- ambulatory with and without personal help, or able, to be transported and positioned safely in the arm ergometer.

Exclusion criteria

- not being able or not willing to participate in arm cycling,
- not being able to be brought to and positioned in the training device,
- any kind of reluctance or resistance against invitation to participate,
- acute diseases, that interfere with exercise
- any condition, which increases the every-day risk

Setting

Geriatric Center in south-west of Germany, consisting of a Geriatric Clinic and a Skilled Nursing Facility.
The Aerpah Clinic comprises an Acute Geriatric department and a Geriatric Rehabilitation Unit.

Intervention

Arm cycling with the ergometer device “Thera-Vital” (medica, Hochdorf, Germany, www.theratrainer.de)

Each participant attended three classes of arm cycling (10 minutes, self selected power), under the guidance of a specially trained therapist, on three different days in one week.
During the exercising the therapist stood next to the participant, explained the technique, and gave verbal encouraging, if one interrupted the active performance.

The mode of encouraging was standardized, verbal expression friendly, but without pressing or strong emotions.
(“Bitte machen Sie weiter! Die zehn Minuten sind noch nicht rum! = Please go on, the 10 minutes are not yet over.”) If the participant did not start again, this encouragement was once repeated. If two interventions had been in vain, the lesson was finished.
During the consent interview the participants had been explicitly informed, that they are allowed to stop the training at any time without being forced to give a reason.

**Outcome parameters**
- number of adverse events
- attendance, measured by time of performance
- ability to complete the exercise, measured by the number of necessary verbal encouraging
- spontaneous signs of reluctance and resistance

The time of participation was measured by the report system of the device and additionally manually by a stop watch.

The data of the lessons were transmitted to an external printer.

**Safety measures**
The study had been conducted in the outpatient department of the Aerpah Clinic. In cases of emergency a rescue team of the clinic would have been available.

The study protocol had been approved by the institutional review board, all participants respectively – in case of dementia - their legal guardians had given a written informed consent.

**Results**

70 of 72 preplanned sessions (3 times 24) had been administered.
We have used three different devices (Thera-Vital).

Two (female) participants (one with, another without dementia) had cancelled their third session.
No serious adverse events had happened.

All sessions have been performed without any technical problem. The devices have worked without any trouble.

One subject (female, with dementia) complained of unspecific pain in one hand (recovering spontaneously) after each session without medical intervention.

All subjects without dementia completed the full time of 10 minutes of each session.

All subjects with dementia agreed to be brought to the training and started the training.

Four of the 14 subjects with dementia did not finish all the 10 minutes (all female):
one subject quitted each of her three sessions (after 4:00, 1:30 and 1.00 minutes).
One quitted two sessions (each after 4:30 minutes).
Two subjects quitted one session (first session, after 6:30 resp. third session after 1:30 min).

All other 10 subjects with dementia completed the full 10 min Time of each session.

Apparent differences between subjects with and without dementia have been proven regarding the number of necessary verbal interventions for encouraging.

The mean number of verbal intervention for encouraging to continue the exercise was about three times per session, range once to five times.

Discussion

Arm cycling is a broadly used mode both of exercise and cardiovascular testing.

An impressive body of evidence reports a lot of clinically relevant insights and positive results (references appendix 1).
Arm cycling is administered in a sitting position, thus also patients, who cannot stand or walk independently, can perform the exercise.

Bicycling with arms and legs complies particular requirements of motor learning:
- practicing the regularity and smoothness of movement
- providing higher number of repetitions
- representing an easy-to-learn movement
- providing a save movement with a low risk of injury
- providing a precisely adaptable and reproducible exercise
- submitting a easy evaluation

As the evidence in literature reports, the effects of arm cycling are transferred to the whole body, to the arms, to the muscles of the trunk, by neural processing also to the lower body, and to the whole cardiovascular and pulmonary system (references appendix 1).

Leg bicycling is a proved therapy for post stroke impairments (appendix 1), so we can conclude, that post stroke movement disorders can also be improved by arm cycling.

This feasibility study confirms the clinical experience that cycling devices are adequate means for motor and cardiovascular training even with patients with dementia.

The study results quantify the common sense knowledge, that dementia patients need more human resources than patients without cognitive impairment.

The tested device (Thera-Vital, medica, Hochdorf) has been proven as a well and easy applicable, technically reliable, safe method of arm cycling.

Arm cycling with the tested device has been accepted by most patients with dementia.

This mode of therapy has been proven as a feasible training approach. It has been accepted with sufficient adherence also by most dementia patients.
Most of them have been attended an adequate number of sessions and amount of training time.

The common sense knowledge could be confirmed in a standardized and quantified manner, that patients with dementia need considerable more therapists' interventions and resources compared with cognitively competent subjects.

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