Group task-specific circuit training for patients discharged home after stroke may be as effective as individualised physiotherapy in improving mobility

Synopsis


**Question:** Does task oriented circuit training improve mobility in patients with stroke compared with individualised physiotherapy? **Design:** Randomised, controlled trial with concealed allocation and blinded outcome assessment. **Setting:** Nine outpatient rehabilitation centres in the Netherlands. **Participants:** Patients with a stroke who had been discharged home and who could walk 10 m without assistance were included. **Interventions:** The primary outcome was the mobility domain of the stroke impact scale measured at 12 weeks and 24 weeks. The domain includes 9 questions about a patient’s perceived mobility competence and is scored from 0 to 100 with higher scores indicating better mobility. Secondary outcome measures included other domains of the stroke impact scale, the Nottingham extended ADL scale, the falls efficacy scale, the hospital anxiety and depression scale, comfortable walking speed, 6-minute walk distance, and a stairs test. **Results:** 242 participants completed the study. There were no differences in the mobility domain of the stroke impact scale between the groups at 12 weeks (mean difference (MD) –0.05 units, 95% CI –1.4 to 1.3 units) or 24 weeks (MD –0.6, 95% CI –1.8 to 0.5). Comfortable walking speed (MD 0.09 m/s, 95% CI 0.04 to 0.13), 6-minute walk distance (MD 20 m, 95% CI 35.3 to 34.7), and stairs test (MD –1.6 s, 95% CI –2.9 to –0.3) improved a little more in the circuit training group than the control group at 12 weeks. The memory and thinking domain of the stroke impact scale (MD –1.6 units, 95% CI –3.0 to –0.2), and the leisure domain of the Nottingham extended ADL scale (MD –0.74, 95% CI –1.47 to –0.01) improved a little more in the control group than the circuit training group at 12 weeks. The groups did not differ significantly on the remaining secondary outcomes at 12 weeks or 24 weeks. **Conclusion:** In patients with mild to moderate stroke who have been discharged home, task oriented circuit training completed in small groups was as effective as individual physiotherapy in improving mobility and may be a more efficient way of delivering therapy. [95% CIs calculated by the CAP Co-ordinator]

Commentary

Evidence that task-specific circuit training may improve walking after stroke has been growing since the first pilot study published in 2000 (Dean et al 2000). From research into motor learning and several meta-analyses of rehabilitation we know that increasing the amount of practice will improve outcome. However repeated behavioural observation studies have shown low levels of physical activity during rehabilitation after stroke. Circuit class training was proposed as a means of increasing the amount of activity undertaken by having a higher patient-to-staff ratio. This high quality, large multi-centre trial by Van de Port and colleagues (2012) is the latest contribution to the body of evidence. The study confirms that task-oriented circuit class training in small groups is as effective as individual intervention in improving mobility in people who require outpatient rehabilitation within the first six months after stroke. More important, the efficiency in terms of staff resources of small groups suggests that where possible circuit class intervention should be used. Specifically, for the same healthcare costs, classes could afford more therapy for the individual either through increases in amount delivered in one day or by increasing the time over which services can be delivered.

The differences between the groups in terms of walking speed and 6 minute walk distance were modest but in favour of the circuit class intervention. Without more detail of the interventions delivered to both groups it is hard to discuss the reasons for this result. For example there is evidence that treadmill training improves walking in both ambulatory (Ada et al, in press) and non-ambulatory (Dean et al 2010, Ada et al 2010) people after stroke. Similarly the use of biofeedback has been found to improve outcome (Stanton et al 2010). The trial also had a large number of secondary outcomes measures some of which were redundant. Omitting some redundant measures and including a measure of free-living physical activity would have been useful to see if benefits had carried over into everyday life. Alzahrani and colleagues (2009) have shown stair ability predicts free living physical activity after stroke. Inclusion of a free-living activity measure could have allowed subsequent analysis of this relationship in a Dutch sample.

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References

Neuromuscular electrical stimulation appears to be useful in people with severe chronic obstructive pulmonary disease

Synopsis


**Question:** In patients with chronic obstructive pulmonary disease (COPD), what effect does neuromuscular electrical stimulation (NMES) have on muscle function and walking endurance?  

**Design:** Randomised, controlled trial in which the patients and those who collected outcome measures were blinded to group allocation.  

**Setting:** Home-based intervention with outcomes collected at a hospital in Quebec City, Canada.  

**Participants:** Patients who were clinically stable, sedentary and able to travel to the hospital with: (a) a smoking history > 20 pack-years, (b) severe airflow obstruction, and (c) a 6-minute walk distance < 400 m. Exclusion criteria comprised any co-morbid condition associated with muscle wasting. Randomisation of 22 patients allocated 13 to the intervention group and 9 to the control group.  

**Interventions:** Both groups received electrical stimulation 5 times a week for 6 weeks. Each session comprised 35 min of bilateral stimulation for the quadriceps and 25 min of bilateral stimulation for the calf. Stimulation was applied with the patient in sitting. They were encouraged to increase the intensity to the maximum they could tolerate. Patients were visited weekly at home by a research nurse to monitor progress. Parameters used by the intervention group were 50 Hz frequency, 400 µs pulse duration, and 6 sec/16 sec duty cycle. Parameters used by the control/sham group were 5 Hz frequency, 100 µs pulse duration, applied continuously.  

**Outcome measures:** The primary outcome was quadriceps strength. The secondary outcomes included quadriceps endurance and performance during the endurance shuttle walk test.  

**Results:** Data were available on 12 and 8 patients in the intervention and control groups, respectively. Current intensity increased over the training period in the intervention group from 20 ± 4 mA to 31 ± 10 mA (p < 0.001). Compared with the control group, the intervention group conferred greater gains in quadriceps force (difference in mean percent change from baseline 14%, 95% CI 1% to 26%) and endurance (42%, 95% CI 4% to 80%), but not walking endurance.  

**Conclusion:** In patients with severe COPD, NMES delivered at home enhanced muscle function but not walking endurance.  

[95% CIs provided by primary author on request]

**Commentary**

Neuromuscular electrical stimulation (NMES) has increasingly been used in patients with chronic heart failure and chronic obstructive pulmonary disease with or without volitional exercise (Sillen et al 2009) and more recently in critically ill patients (Gerovasili et al 2009a). This well-designed, randomised study addressed some of the issues raised by the heterogeneity of NMES protocols and elucidated the mechanisms involved in the changes in muscle function. Despite the small sample size, this study carries some important clinical messages. First, the effectiveness was proportional to current intensity, which is clinically relevant when selecting patients for NMES. Namely, patients unable to tolerate progression of current intensity seem unlikely to benefit from NMES when prescribed as a home-based rehabilitation modality. Second, between-group differences in exercise capacity were not demonstrated. This may relate to a methodological issue; that is the authors opted for low exercise intensity by stimulating the thigh and calf muscles consecutively rather than simultaneously. The systemic effect of NMES, as previously shown (Gerovasili et al 2009b), is dependent on stimulating adequate muscle bulk, which the authors may have better achieved by simultaneously stimulating all muscle groups. Finally, the authors assessed the mechanisms involved in the improvement of muscle function, which was partially attributed to muscle hypertrophy and restoration of the anabolic/catabolic balance, although other mechanisms such as the role of microcirculation and neural adaptation are possible contributors.

NMES is an effective exercise modality for patients with severe COPD. Protocol and exercise intensity are relevant to induced changes in muscle function, which physiotherapists should take into account. Patients intolerant of progression of current intensity should be considered for supervised sessions.

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**References**

Aerobic treadmill training effectively enhances cardiovascular fitness and gait function for older persons with chronic stroke

Synopsis


**Question:** Does high-intensity aerobic treadmill exercise improve cardiovascular fitness and gait function in people with chronic stroke? **Design:** Randomised, controlled trial.

**Setting:** An outpatient rehabilitation centre in Germany.

**Participants:** Individuals with chronic stroke > 60 years of age with residual gait impairment, and ability to walk on the treadmill at ≥ 0.3 km/h for 3 minutes were eligible. Serious cardiovascular conditions (eg, angina pectoris, heart failure, valvular dysfunction, peripheral arterial occlusive disease), dementia, aphasia, and major depression were exclusion criteria. Randomisation of 38 participants allocated 20 to the intervention group and 18 to the usual care group.

**Interventions:** The intervention group underwent treadmill training (3 times/week) for 3 months. The program was intended to achieve 30–50 minutes of treadmill training at 60–80% of the maximum heart rate reserve as determined by a maximum effort exercise test. The training was supervised by a physician and/or physiotherapist. The usual care group received conventional care physiotherapy for 1 hour 1–3 times a week without any aerobic training.

**Outcome measures:** The primary outcomes were peak oxygen consumption rate and the 6-minute walk test. Secondary outcome measures were self-selected and maximum walking speeds as measured in the 10-m walk test, Berg balance score, 5-Chair-Rise test, Rivermead Mobility Index, and Medical Outcomes Study Short-Form 12 (SF-12). The outcomes were measured at baseline, immediately after completion of training, and at 12 months.

**Results:** 36 participants completed the study. After the 3-month training period, the change in peak oxygen consumption rate was significantly more in the treatment group, by 6.3 mL/kg/min (95% CI 5.7 to 6.9). The change in distance achieved in the 6-minute walk test was also significantly more in the treatment group by 53 metres (95% CI 32 to 75). Among the secondary outcomes, maximum walking speed (by 0.14 m/s, 95% CI 0.08 to 0.20), Berg balance score (by 2.6 points, 95% CI 0.5 to 4.7), and SF-12 Mental score (by 4.0 points, 95% CI 3.4 to 4.6) improved significantly more in the treadmill training group than the usual care group after the treatment period. The groups did not differ significantly on the remaining secondary outcomes. It was reported that compared to baseline peak oxygen consumption rate and 6-minute walk test distance were significantly improved at 12 months.

**Conclusion:** A high-intensity treadmill training program improves cardiovascular fitness and gait in older adults with chronic stroke.

[95% CIs calculated by the CAP Editor.]

Commentary

Evidence is accumulating of the profound benefits conferred by aerobic training on cardiovascular function, mobility, brain health, and overall quality of life after stroke. However, when subjected to the rigors of systematic review, available data have failed to demonstrate superiority of such training over traditional therapies in optimising recovery post-stroke (Moseley et al 2005). The trial by Globas and colleagues contributes in important ways to elucidating the role fitness training plays in improving cardiovascular function and mobility after stroke. Level 2 evidence (ie, randomised controlled trial with < 100 subjects) is provided regarding the safety and effectiveness of a moderately intense training protocol for older individuals in the chronic post-stroke period (subjects were 5–10 years older than those in most previous trials). Considering the average age of stroke rehabilitation participants is > 70 years, use of a representative cohort speaks to the relevance of the study. Mean gain in exercise capacity of the training group (5.5 mL/kg/min or 1.6 metabolic equivalents, METS) is clinically meaningful – 1 MET improvement is associated with significantly fewer adverse events in people with coronary artery disease (Hambrecht et al 2004) and 12% increase in survival of men with cardiac disease (Myers et al 2002). Clinically meaningful change was also achieved in the 6 minute walk (ie, 49 m) but not comfortable walking speed (0.14 m/s) (Perera et al 2006) and Berg Balance Scale (5.8 points) (Stevenson 2001). The significant training-induced improvement in the SF-12 mental subscore is of interest, particularly given the recent links drawn between brain health and cardiovascular conditioning after stroke (Quaney et al 2009). That benefits were largely sustained at 12-month follow-up is encouraging. Use of a crossover design helped deal with the lack of dose equivalency in the intervention protocols (39 versus ~24 sessions in training and usual care groups, respectively) but unequal exposure precludes drawing conclusions about the ‘relative’ effectiveness of treadmill training. The troubling statement ‘current conventional care for chronic stroke survivors in Germany does not lead to improvements over 3 months’ is counter to findings reported elsewhere (Duncan et al 2003) and warrants further attention. We are reaching the stage where large multi-centred trials of aerobic training after stroke are necessary to answer definitively the central question of what attributes define ‘responders’ to this intervention.

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References


Multi-modal realignment treatment decreases pain in people with medial tibiofemoral osteoarthritis

Synopsis


Question: Does a multi-modal realignment treatment relieve pain and improve function among persons with medial tibiofemoral osteoarthritis (OA)? Design: A double-blind (participant and assessor) 30 week randomised crossover trial. Setting: Participants were recruited from rheumatology and orthopaedic hospital departments and from persons already recruited for other clinical trials, using various forms of advertising in local public media in New England, USA. Participants: Ambulatory persons fulfilling American College of Rheumatology criteria for knee OA, with radiographically confirmed osteophytes and pain, aching or stiffness on most of the past 30 days, and radiographic evidence of disease in the medial tibiofemoral compartment were included. Key exclusion criteria included predominant lateral tibiofemoral or patellofemoral involvement, low WOMAC Pain scores (a minimal score of at least 2 out of 5 on at least 2 of the 5 questions was required for participation), use of ambulation aids and known causes of inflammatory arthritis. Interventions: Active treatment included a valgus knee brace and customised neutral foot orthoses and motion control shoes, while control treatment was a neutral knee brace that does not have any varus/valgus angulation and a flat unsupportive foot orthosis and shoes with a flexible mid-sole. A run-in design was used in order to maximise the likelihood of recruiting subjects who would remain in the trial. Participants were randomised to receive either active treatment or control treatment for 12 weeks. Following a 6-week washout period, the alternative treatment was assigned for the final 12 weeks. Outcome measures: Primary outcomes were the WOMAC Pain (0–20) and Function (0–68) subscales. Results: 80 participants were randomised and 56 completed the study. The active realignment intervention had effect on pain with a −1.82 unit decrease (95% CI −3.05 to −0.60), and a non-significant effect on function [2.90 unit decrease (95% CI −6.60 to 0.79)] compared with the control condition. Conclusion: Multi-modal realignment treatment can decrease pain in persons with medial tibiofemoral OA.

Commentary

Biomechanical factors such as alignment and changes in joint loading have shown to be significant for onset and structural changes of knee osteoarthritis. Treatment for knee osteoarthritis including medial wedge insoles for knee valgus and subtalar strapped lateral insoles for knee varus have been recommended in recently updated guidelines (Hochberg et al 2012). This study aimed to investigate the efficacy of multiple orthotic modalities, including valgus knee braces, customised neutral foot orthoses, and shoes designed for optimising motor control, in order to unload the overloaded and painful knee compartment. The intervention period included 12 weeks of treatment intervention, 6 weeks of wash-out, and 12 weeks of control intervention for two groups. As the study design employed a crossover design, both groups received both the treatment and control interventions. The control intervention included neutral knee braces, unsupportive foot orthoses, and shoes with a mid-sole. The results showed a statistically significant decrease in pain of 20% for the active treatment compared to the control intervention, suggesting a clinically important difference in knee pain.

This double-blinded randomised crossover trial was well conducted, even though the study did not involve a control group without any interventions making it hard to state the possible placebo effect. Furthermore, a high drop-out rate was reported (30%), but the study was adequately powered to detect a clinically relevant difference in knee pain. To be able to demonstrate the efficacy of multiple orthotic modalities, adherence to treatment is important. This study emphasised adherence to intervention by giving educational messages, assessed adherence by calling the patients every week, and asked the included patients to diary record their daily use of orthoses. The participants wore the orthoses on average more than 3 hours a day, however, the dose-response for orthoses was not appropriately documented. The study participants were predominantly those with medial knee osteoarthritis, without severe co-morbidities, and obese individuals with high average body mass index (> 32.8). Even though the present study showed a significant and clinical reduction in knee pain for obese individuals treated with multiple orthotic modalities, both weight loss and exercises should be the first choice treatment for these individuals. However, recommendations involving use of multiple orthotic modalities more than 3 hours a day seem to be an effective additional treatment option for obese patients aged over 60 years with medial compartment knee osteoarthritis.

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Reference