Wearing pedometers in conjunction with daily step goals and incentives can increase physical activity among children

Synopsis


Question: Does an incentive-based physical activity intervention increase physical activity and fitness in children aged 6–12 years? Design: Cluster randomised, controlled trial with concealed allocation and blinded outcome assessment. Setting: Hospital and community settings in Singapore. Participants: Healthy children aged 6–12 years. With any severe chronic medical condition, such as Type 1 diabetes, were excluded. Randomisation of 212 families (285 participants) allocated 106 families (138 participants) to the incentive-based physical activity program group and 106 families (147 participants) to a control group. Interventions: Both groups received pamphlets presenting information on the benefits of physical activity. In addition, the intervention group participated in a 9-month incentive-based physical activity program. Participants in the intervention group received information on structured weekend outdoor activities including 2–3 hour hikes at nature reserves and parks, and families were encouraged to attend sessions at least twice a month. The children in this group also received a pedometer to track daily steps taken and were offered incentives to meet a goal of 8000 steps per day. Each child who logged 8000 steps per day for at least half of the days in a month received a voucher worth SGDS30. Prizes of SGDS120 were awarded via lotteries held monthly for children who met their monthly pedometer step goal and attended at least 2 outdoor sessions per month. The control group continued with their usual daily activities. Outcome measures: The primary outcome was the mean number of steps per day in the last week of the 9-month program. The pedometers worn by children in the intervention group were unsealed but children in the control group wore sealed pedometers. Secondary outcome measures were 6-minute walk test (6MWT) distance, Pediatric Quality of Life Inventory, and body mass index. Results: 251 children (mean age 8.2 years, SD 1.5) completed the study. At the end of the 9-month program, the mean number of steps per day was significantly more in the intervention group, by 893 steps (95% CI 759 to 1027), with 24% of the intervention group and 2% of the control group reaching the target of 8000 steps per day. The groups did not differ significantly on any of the secondary outcomes. Conclusion: Pedometers and incentives increased the mean daily number of steps performed by children but did not result in improved health outcomes at follow-up. These results are consistent with behavioural change theory that incentives motivate sustained behaviour change through feedback and tangible reinforcements.

[95% CIs calculated by the CAP Editor.]

Commentary

Due to concerns of decreasing levels of physical activity in children, there is a need for interventions aimed at increasing physical activity. Higher levels of physical activity in children may decrease risk factors for cardiovascular disease and cancer in adulthood and prevent overweight and obesity.

A strong aspect of the methods implemented by Finkelstein and colleagues was the use of pedometers. Pedometers capture the number of steps taken. Determining if an exercise intervention leads to physical activity behaviour change can be difficult. Between group differences can be due to the control group increasing their overall activity or the intervention group decreasing their background physical activity levels due to engaging in the prescribed exercise intervention (known as the ‘activitystat’ hypothesis) (Rowlands 1998). Measuring overall physical activity continuously throughout the duration of the study helps account for these unexpected changes.

No changes in secondary outcomes (BMI, 6MWT, and quality of life) were found. However the levels of BMI and quality of life appeared to be within normal ranges. It is possible that the relatively moderate target of 8000 steps may not have been sufficient to result in secondary changes such as BMI. Also, the 6MWT may not have been an accurate measure of fitness as the heart rates obtained at the end of the test would suggest a less than maximal effort (O’Donovan et al 2013).

Improvement in physical activity as measured by steps taken was evident in this study indicating it is possible to increase physical activity in young children. It adds to the growing evidence for including incentives as part of interventions to change physical activity behaviour. Pedometers are low cost and widely available. When faced with the challenge of increasing activity levels in children, therapists should consider using pedometers and other incentives to motivate behaviour change along with family involvement. Initial costs in terms of pedometers, vouchers, and prizes may seem high but are low in terms of preventing the considerable healthcare costs due to chronic disease in later life.

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References

Sun-style T’ai Chi improves walking endurance and health-related quality of life in people with COPD

Synopsis


Question: Does short-form Sun-style T’ai Chi (SSTC) change exercise capacity, balance, physical performance, quadriceps strength, health-related quality of life (HRQoL) or mood in patients with chronic obstructive pulmonary disease (COPD)?

Design: Randomised controlled trial with concealed allocation and blinding of outcome assessors.

Setting: The out-patient department of a hospital in Sydney, Australia.

Participants: Adults with stable COPD were included if they had not participated in exercise training in the previous 12 months, had no significant co-morbidities that precluded participation in SSTC and did not require supplemental oxygen during exercise. Randomisation allocated 22 to the intervention group and 20 to the control group.

Interventions: Participants in the intervention group attended two supervised 1-hour sessions of SSTC training each week, for 12 weeks. Training intensity was titrated to achieve a moderate dyspnoea by encouraging participants to imagine pushing against a resistance, perform deeper squats or with the use of wrist weights. Participants were also encouraged to complete 30 minutes of SSTC each day that they did not attend a supervised session and were provided with a training booklet and DVD to facilitate home training. Those in the control group continued with usual medical care.

Outcome measures: The primary outcome measure was time walked during the endurance shuttle walk test (ESWT) at 12 weeks.

Results: A total of 38 participants completed the study. On completion of the training period, greater gains were seen in the intervention group compared with the control group in time walked during the ESWT (348 sec; 95% confidence interval [CI], 186 to 510 sec). Significant between group differences, in favour of the intervention group, were also seen in measures of balance, physical performance, quadriceps force, HRQoL and anxiety.

Conclusion: The use of SSTC is an effective intervention to improve several outcomes in people with COPD, including walking endurance, HRQoL and quadriceps force.

Commentary

Chronic obstructive pulmonary disease (COPD) is a condition characterised by impaired pulmonary function and reduced exercise capacity and health-related quality of life (HRQoL). There is compelling evidence that pulmonary rehabilitation is effective at improving exercise capacity, physical function and HRQoL in people with stable COPD (Lacasse et al 2006) and following exacerbations (Puhan et al 2011). Appropriate exercise reconditioning is essential for successful pulmonary rehabilitation but exercise outcomes vary depending on the mechanism of exercise limitation (Plankeel et al 2005). The mode of exercise training should be versatile and tailored to an individual’s needs. The study by Leung et al (2013) describes a Sun-Style T’ai Chi (SSTC) exercise program which resulted in a clinically important increase in endurance, balance and HRQoL scores. The Incremental Shuttle Walk Test (ISWT) was used to establish SSTC exercise intensity, which was assessed as moderate. The commendable aspect of the study was adding resistance loading to the wrists during T’ai Chi practice to ensure standardisation of exercise intensity. Most T’ai Chi studies allow their subjects to practice traditional, relaxed, smooth and rhythmical movements. The SSTC combined a ‘hard and soft’ form of Chinese martial arts, which ensured a training intensity high enough to yield physiological training benefit, which satisfies the essential principle of western exercise training. The focus on rhythmic breathing during SSTC may have expedited better diaphragmatic control during exercise in people with COPD.

A key goal of pulmonary rehabilitation is to encourage the patient to maintain an active lifestyle. If the practice of T’ai Chi arouses sufficient interest in people with COPD for them to adopt this as a daily exercise of moderate intensity, future work should focus on how SSTC could be incorporated in pulmonary rehabilitation.

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References

Body-weight supported treadmill training improves cardiovascular fitness and walking endurance early after stroke

Synopsis

Question: Does body-weight supported treadmill training improve cardiovascular fitness and walking function in people with subacute stroke compared with overground gait training? Design: Randomised, controlled trial with concealed allocation and blinded outcome assessment. Setting: Stroke rehabilitation unit in Canada. Participants: Adults within 1 month of a first ischaemic stroke, and ability to walk 5 m with or without walking aids or standby assistance were key inclusion criteria. A key exclusion criterion was contraindication to maximal exercise stress testing. Randomisation of 50 participants allocated 24 to the experimental group and 26 to the control group. Interventions: Both groups were trained 5 days per week for 6 weeks and then 3 days per week for a further 6 weeks. The experimental group underwent body-weight supported treadmill training. The target exercise intensity and duration was set at 60–75% of the peak oxygen consumption rate (peak VO₂) for a minimum of 20 minutes. The control group was instructed to walk overground at comfortable, self-selected speeds for the same duration. The two groups were given home programs (3 days per week) after the 12-week supervised training. Outcome measures: The primary outcomes were peak VO₂, 6MWT, and overground walking speed. The secondary outcomes were Berg Balance Scale, and Chedoke-McMaster Stages of Recovery (CMSR) score. Outcomes were measured at baseline, post-training, and at 6- and 12-month follow-up. Results: 37 participants completed the study. The experimental group improved more than the control group for measures of peak VO₂, 6MWT, and CMSR foot score. At the end of the 12-week intervention period, the experimental group had significant improvement in peak VO₂ (by 4.2 ml/kg/min, 95% CI 2.5 to 5.9) and CMSR foot score (by 1.0 point, 95% CI 0.3 to 1.7) whereas the control group had no significant improvement in these variables. The experimental group also had significantly more improvement in the 6MWT (by 89.7 m, 95% CI 54.4 to 125.0) than the control group (by 36.8 m, 95% CI 4.2 to 69.4). These effects were largely preserved at 12-month follow-up. There were no between-group differences for other outcomes. Conclusion: A body-weight supported treadmill training program is effective in improving cardiovascular fitness and walking endurance in people after stroke.

Commentary
Regaining the ability to walk is a common goal priority after stroke such that gait-related activities receive the most attention during stroke rehabilitation (Latham et al 2005). Body-weight supported treadmill training (BWSTT) has received much attention as a modality to improve walking outcomes, but its superiority over other means of gait training has not been consistently demonstrated (Duncan et al 2011, Moseley et al 2005).

Low fitness levels may compound mobility limitations after stroke. There is an important interaction between neuromotor impairments and cardiovascular fitness as the capacity to meet the high metabolic demands of walking is reduced (Tang et al 2007). Historically, therapy during stroke rehabilitation provided minimal aerobic challenge (MacKay-Lyons et al 2002), but now it is known that early exercise interventions can improve fitness and walking ability (Stoller et al 2012).

The randomised trial conducted by MacKay-Lyons and colleagues contributes novel and important evidence in a number of ways. First, they demonstrated that BWSTT was effective in concurrently addressing cardiovascular fitness and walking ability in individuals with limited ambulatory capacity. It was also conducted within the first month post-stroke, capitalising on the window of opportunity for neurological recovery. Finally, it demonstrated that gains were retained long after completion of training.

Given the presence of post-stroke neuromotor impairment and cardiovascular deconditioning, and the interaction between these factors on functional mobility, it is important to develop interventions that effectively and concurrently address these issues and capitalise on the early time window of opportunity to maximise benefit. The results of this trial offer promising evidence supporting the use of individualised and progressive BWSTT among people in the early stages of stroke recovery.

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References
Positive expiratory pressure prevents more exacerbations than high frequency chest wall oscillation via a vest in people with cystic fibrosis

Synopsis


Question: What are the relative effects of high frequency chest wall oscillation (HFCWO) and positive expiratory pressure (PEP) therapy on pulmonary exacerbations, lung function, and quality of life in people with cystic fibrosis?

Design: Randomised trial with concealed allocation and blinded outcome assessment. Setting: Eight paediatric and four adult cystic fibrosis centres in Canada. Participants: People over 6 years old with clinically stable cystic fibrosis and forced expiratory volume in 1 sec (FEV1) over 45% of the predicted value. Uncommon respiratory organisms and recent changes in medications were exclusion criteria. Randomisation allocated 56 participants to HFCWO and 51 to PEP. Interventions: All participants used an airway clearance method other than HFCWO or PEP for 2 months prior to starting their intervention. The HFCWO group then used a pneumatic vest system to apply high frequency oscillations with a triangular wave form to the chest wall. A 30-min ramped protocol was used consisting of six 5-min cycles, with the participant performing 2–3 huffs between cycles. The PEP group breathed through a facemask with an expiratory resistor creating a back pressure of 10–20 cmH2O, for six cycles of 15 breaths, also separated by 2–3 huffs. The allocated airway clearance regimen was prescribed twice daily for one year.

Outcome measures: The primary outcome was the number of pulmonary exacerbations, defined as when prespecified symptoms lasted longer than 3 days and required antibiotics. Secondary outcomes included time to first pulmonary exacerbation and changes in lung function and quality of life.

Results: 88 participants completed the study. At one year, the median number of pulmonary exacerbations per participant was 2 (IQR 1 to 3) in the HFCWO, which was significantly higher than in the PEP group at 1 (IQR 0 to 2), p = 0.007. Median time to first exacerbation was 115 days in the HFCWO group, which was significantly sooner than in the PEP group at 220 days, p = 0.02. Changes in lung function and quality of life did not significantly differ between the groups. PEP was rated as significantly better than HFCWO with respect to flexibility in where it could be performed (p < 0.001) and the duration of each treatment, which differed by a median of 10 min (p < 0.001). Self-reported adherence was over 90% in both groups.

Conclusion: When prescribed as a long-term airway clearance therapy, PEP has significantly better outcomes than HFCWO in terms of exacerbations, flexibility, and treatment duration.

Commentary

This study is an excellent example of research designed to resolve a widespread clinical question. The marked difference in pulmonary exacerbations in this trial, alongside equivocal outcomes for lung function and quality of life, shows clearly the superiority of PEP over HFCWO as a regular airway clearance therapy for this population. PEP’s superiority is reinforced by the other characteristics on which it was rated as better than HFCWO by participants: treatment duration, and flexibility of treatment location.

The paper does not provide much detail about the standard care received by both groups, apart from baseline respiratory medication use. Given that ordering and overlapping nebulised and physical therapies in an airway clearance session can influence the overall session duration (Bishop et al 2011, Dentice et al 2012, Dentice et al 2013), more information about how nebulised therapies were incorporated into the overall airway clearance sessions could have been provided.

Another crucial consideration is cost, with a HFCWO system being about 100 fold more expensive than a PEP mask system. With better outcomes for far less expense, physiotherapists should strongly recommend PEP over HFCWO.

Adherence to the therapies was very high at 94%. Although self-reported adherence can easily be inflated, this is much higher than in other studies using self-report (Modi et al 2006, Myers & Horn 2006). This may be due to a selection effect of participation in an airway clearance study and the monthly telephone calls to encourage good adherence.

This study illustrates the importance of obtaining evidence about the effects of therapies that are prescribed for long-term use. Recent studies of new airway clearance and exercise interventions in CF continue to consider only single doses (Kuys et al 2011, Reix et al 2012), so clinicians should be wary of prescribing regular use of new interventions (especially expensive ones) before their long-term effects are known.

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References