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Clinical References & Related Studies
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Gait Training Using Walking Poles To Facilitate Trunk Rotation and Reciprocal Arm Swing In a Patient With a Cerebellar Tumor Resection Secondary To Metastatic Breast Cancer

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Background & Purpose: The cerebellum monitors movement of a body segment, comparing the outcome to the original motor command and makes corrections as necessary. Ultimately, cerebellar insults have the potential to produce motor function deficits, balance impairments, and decreased muscle tone. These impairments may limit an individual’s ability to fully function within their environment. Physical therapy interventions often aim to augment these deficits through the use of mobility aids. Unlike walkers and canes, walking poles facilitate reciprocal arm swing and trunk rotation similar to that found in an individual with an unimpaired gait pattern.

The purpose of this case report is to describe the use of walking poles as part of an intervention program in a patient with balance deficits following a cerebellar tumor resection.

Case Description: The subject is a 51 year old female, who was referred for physical therapy 18 months following recovery from a cerebellar tumor resection. The subject presented with gait and balance impairments, as well as a high fear of falling and a low falls self efficacy. The intervention program consisted of eight treatment sessions over five weeks including evaluations at the initiation and conclusion of treatment. Sessions occurred twice per week for one hour each. Over these eight sessions, the interventions used included gait training with forearm crutches and walking poles, the Balance Master and functional balance activities, and a home exercise program (HEP) including ambulation with walking poles for 20 minutes a day three times a week. She was asked to keep an exercise log to assess adherence to the HEP. The investigators provided support during weekly phone calls with the patient. The subject was also re-evaluated 10 and 16 weeks following the cessation of twice weekly therapy sessions with the continuation of the home exercise program.

Outcomes: The subject demonstrated a significant improvement in her Berg Balance Scale score, ABC fear of falling scale score, and her comfortable gait speed with the walking poles. Though non-significant, this patient demonstrated an improvement of 38 feet on her 6MWT.

Discussion: The addition of walking poles may allow for further improvements in gait and balance deficits in patients following a cerebellar tumor resection. The support and confidence provided by gait and balance training with walking poles, along with reinforcement of normal gait mechanics, may allow patients to improve gait components such as arm swing and trunk rotation. This more normalized gait pattern allows for safe ambulation and facilitates improvements in static and dynamic balance.
Efficacy of Nordic Walking in Obesity Management.

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The effects of a Nordic walking (NW) program compared to those of a walking (W) program on physiological and perceptual variables in obese middle-aged women were investigated. Subjects (n=12 NW group, n=11 W group) trained over 12 weeks 3 times.week (-1). Body mass, body mass index (BMI), body fat, heart rate (HR), resting blood pressure, peak oxygen consumption (V’O (2peak)) were measured before and after the training period. Moreover, HR, rating of perceived exertion (RPE) and adherence were recorded during all training sessions. After the training period body mass, body fat and diastolic blood pressure decreased in both groups (P<0.05) whereas V’O (2peak) increased in the NW group (+3.7 ml.min (-1).kg (-1); P=0.005). During the training sessions, mean HR (P=0.021), HR at preferred walking speed (P=0.020) and % of time at high intensity (P=0.031) were higher in NW than in the W group. Finally, RPE was not influenced by the modality of exercise and NW group showed a higher rate of adherence (91±19% vs. 81±29%; P=0.011). To conclude, NW activity in obese women allows an increase in exercise intensity and adherence to a training program without increasing the perception of effort leading to enhanced aerobic capacity.
Nordic Pole Walking Injuries – Nordic Walking Thumb as Novel Injury Entity

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Background: Nordic pole Walking (NW) as trend sport is associated with beneficial effects on the cardiovascular system. Data regarding the injury and overload injury rates are pending.

Methods: 137 athletes (74 % females, 53 ± 12 years, weight 73 ± 13 kg, height 169 ± 11 cm) were prospectively asked using a two-sided questionnaire. Mean NW experience was 212.8 weeks with 2.9 ± 1.8 hours/week. The overall exposure was 29 160 h.

Results: NW injury rate was 0.926/1000 h. Falls were evident in 0.24/1000 h. The upper extremity was involved more frequently (0.549/1000 h) than the lower extremity (0.344/1000 h). The most severe injury was a concomitant shoulder dislocation and luxation of the proximal interphalangeal joint of the index finger after a fall. The most frequent injury in NW was a distortion of the ulnar collateral ligament of the thumb (0.206/1000 h) after fall. Shoulder injuries account for 0.171/1000h with 0.069/1000 h shoulder dislocations.
Nordic Walking is a safe sport. The most frequent injury in Nordic Walking is a distortion of the ulnar collateral ligament of the thumb after a fall during which the pole acts as hypomochlium. Modifying the construction of the Nordic Walking pole handle, avoiding holding onto the pole in the event of a fall, as well as education could be preventive measures.

Nordic Walker Characteristics: A total of 137 participants were included in this study. Eleven participants (8%) complained of a prior wrist distortion, 6 (4.4%) of a distal radius fracture, no one of an injury to the ulnar collateral ligament of the thumb. 14.7% (n = 20) reported pain in the thoracic and lumbar spine, and 4 participants had a total hip endoprosthesis (2.9%, 2 right, 2 left). None of the participants had a knee endoprosthesis. In the medical history, independent from Nordic Walking, muscle strains of the M. biceps femoris (11.7%, n = 16) were more frequent than of M. quadriceps (5.9%, n = 8). 15.4% (n = 21) had knee ligament injuries in their history with 8 frontal cruciate ligament injuries (6 right, 2 left). Independent of Nordic Walking, affections of the lower leg muscles, known as "shin splints", the second most common injury for long-distance runners after peripatellar frontal knee pain, were rare with 1.4% (2%). 23.5% (n = 32) indicated a history of an upper ankle distortion after supination trauma independent of Nordic Walking. No participant had suffered a stress fracture at any point independent of Nordic Walking.

Conclusions: Nordic Walking is a safe sport: The overall injury rate was 0.926/1,000 hours of exposure. Falls occur at a frequency of 0.24/1,000 hours. The most severe injuries observed were shoulder dislocations at a frequency of 0.069/1,000 hours.
With a frequency of 0.206/1,000 hours, the most common injury in Nordic Walking is the distortion of the ulnar collateral ligament of the thumb, the skier's thumb. This is equivalent to data on the injury frequency in alpine skiing, cross-country skiing and telemark skiing, despite the lower speed of movement in Nordic Walking.
Modifications to the design of a Nordic walking pole handle, as well as fall exercises including education and avoidance of holding onto the pole in the event of a fall could be preventive approaches, just like a proprioceptive training of the lower extremity to help reduce supination trauma during off-road Nordic Walking.
Nordic walking in fibromyalgia: a means of promoting fitness that is easy for busy clinicians to recommend.

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Abstract

ABSTRACT: A total of 67 women with fibromyalgia were recruited to an exercise study and were randomized to moderate-to-high-intensity Nordic walking (age 48 ± 7.8 years) or to a control group engaging in supervised low-intensity walking (age 50 ± 7.6 years). A total of 58 patients completed. Significantly greater improvement in the 6-minute walk test was found in the Nordic walking group (P = 0.009), compared with the low-intensity walking group. A significantly larger decrease in exercise heart rate (P = 0.020) and significantly improved scores on the Fibromyalgia Impact Questionnaire Physical function (P = 0.027) were found in the Nordic walking group as compared with the low-intensity walking group. No between-group difference was found for the Fibromyalgia Impact Questionnaire total or pain scores. The authors conclude that moderate-to-high intensity aerobic exercise by means of Nordic walking twice a week for 15 weeks was found to be a feasible mode of exercise, resulting in improved functional capacity and a decreased level of activity limitations.
Canadian Physiotherapy Association, May 2010.

**Nordic walking for geriatric rehabilitation: A randomized pilot trial**

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**Purpose/Objectives and Rationale:** There is a need to identify effective interventions to promote walking capacity in seniors. This study will be the first to directly compare, using a randomized trial, Nordic Walking, a new technique, with traditional walking. The objective was to estimate the relative efficacy in improving walking capacity of Nordic walking and Overground walking for the elderly.

**Relevance to the Physiotherapy Profession:** Rehabilitation professionals are charged to use evidence-based practices, and because walking independence is of key importance, strategies to promote walking capacity would be of great benefit to elders and the health care system.

**Materials and Methods:** Participants randomized to Nordic Walking group (n = 14) were instructed on the use of the poles and used them with a therapist for 20 minutes, twice a week for six weeks; participants in the control group (n = 16) walked with the therapist without poles for the same amount of time. Outcomes were 6-minute walk test, gait speed, balance, pain, and leg function.

**Analysis:** Baseline and follow-up values on gait speed and distance walked were compared between the two groups using effect size; relative efficacy was calculated as the ratio from it was obtained.

**Results:** Nordic and Overground Walking participants improved 41 meters on the 6MWT and increased their gait speed by 0.21 m/s and 0.08 m/s, respectively. Only improvement in gait speed in the Nordic Walking group reached statistical significance, with a large effect size of 0.9.

**Conclusions:** Nordic Walking is 125% more effective in improving gait speed among a rehabilitation population than Overground Walking.

**Trekking Poles Reduce Exercise-Induced Muscle Injury during Mountain Walking.**


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**Abstract**

Temporary muscle damage precipitated by downhill walking affects muscle function and potentially exposes muscle to further musculoskeletal injury.

**PURPOSE:** We hypothesised that the use of trekking poles would help maintain muscle function and reduce indices of muscle damage following a day's mountain trekking.

**METHODS:** Thirty-seven physically active males (n = 26) and females (n = 11) volunteered to participate and were divided into either a trekking pole (TP) or no pole (NP) group. Participants carried a day sack (5.6 +/- 1.5 kg) and made the ascent and descent of the highest peak in England and Wales (Mt Snowdon). Heart rate (HR) and ratings of perceived exertion (RPE) were recorded during the ascent and descent. Indices of muscle damage; maximal voluntary isometric force (MVC), muscle soreness (DOMS) creatine kinase (CK), and vertical jump (VJ) performance were measured before, immediately after (except CK), 24 h, 48 h and 72 h post trek.

**RESULTS:** HR was not different between groups, although RPE was significantly lower in TP during the ascent. The TP group showed attenuation of reductions in MVC immediately after, 24 h and 48 h post trek; DOMS was significantly lower at 24 h and 48 h post trek and CK was also lower at 24 h post trek in the TP group. No differences in VJ were found.

**CONCLUSION:** Trekking poles reduce RPE on mountain ascents and reduce indices of muscle damage and assist in maintaining muscle function in the days following a mountain trek and reduce the potential for subsequent injury.
Nordic Walking improves daily physical activities in COPD: a randomised controlled trial.

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Abstract

BACKGROUND: In patients with COPD progressive dyspnoea leads to a sedentary lifestyle. To date, no studies exist investigating the effects of Nordic Walking in patients with COPD. Therefore, the aim was to determine the feasibility of Nordic Walking in COPD patients at different disease stages. Furthermore we aimed to determine the short- and long-term effects of Nordic Walking on COPD patients' daily physical activity pattern as well as on patients exercise capacity.

METHODS: Sixty COPD patients were randomised to either Nordic Walking or to a control group. Patients of the Nordic Walking group (n = 30; age: 62 +/- 9 years; FEV1: 48 +/- 19% predicted) underwent a three-month outdoor Nordic Walking exercise program consisting of one hour walking at 75% of their initial maximum heart rate three times per week, whereas controls had no exercise intervention. Primary endpoint: daily physical activities (measured by a validated tri-axial accelerometer); secondary endpoint: functional exercise capacity (measured by the six-minute walking distance; 6MWD). Assessment time points in both groups: baseline, after three, six and nine months.

RESULTS: After three month training period, in the Nordic Walking group time spent walking and standing as well as intensity of walking increased (Delta walking time: +14.9 +/- 1.9 min/day; Delta standing time: +129 +/- 26 min/day; Delta movement intensity: +0.40 +/- 0.14 m/s2) while time spent sitting decreased (Delta sitting time: -128 +/- 15 min/day) compared to baseline (all: p < 0.01) as well as compared to controls (all: p < 0.01). Furthermore, 6MWD significantly increased compared to baseline (Delta 6MWD: +79 +/- 28 meters) as well as compared to controls (both: p < 0.01). These significant improvements were sustained six and nine months after baseline. In contrast, controls showed unchanged daily physical activities and 6MWD compared to baseline for all time points.

CONCLUSIONS: Nordic Walking is a feasible, simple and effective physical training modality in COPD. In addition, Nordic Walking has proven to positively impact the daily physical activity pattern of COPD patients under short- and long-term observation.
Effects of Nordic Walking training on exercise capacity and fitness in men participating in early, short-term inpatient cardiac rehabilitation after an acute coronary syndrome -- a controlled trial.

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Abstract

OBJECTIVE: To investigate the effects of Nordic Walking training supplemental to a standard, early rehabilitation programme on exercise capacity and physical fitness in men after an acute coronary syndrome.

SUBJECTS: Eighty men 2-3 weeks after an acute coronary syndrome, with good exercise tolerance.

INTERVENTIONS: Three-week, inpatient cardiac rehabilitation programme (control group) supplemented with Nordic Walking (Nordic Walking group), or with traditional walking training (walking training group).

MAIN MEASURES: Exercise capacity was assessed as peak energy cost (in metabolic equivalents) in symptom-limited treadmill exercise test, and physical fitness with the Fullerton Functional Fitness Test.

RESULTS: Exercise capacity after the rehabilitation programme was higher in the Nordic Walking group than in the control group (10.8 +/- 1.8 versus 9.2 +/- 2.2 metabolic equivalents, P =0.025). The improvement in exercise capacity in the Nordic Walking group was higher than in the control group (1.8 +/- 1.5 versus 0.7 +/- 1.4 metabolic equivalents, P =0.002). In contrast to the control group, the results of all components of the Fullerton test improved in the Nordic Walking and walking training groups. After the programme, lower body endurance, and dynamic balance were significantly better in the Nordic Walking group in comparison with the walking training and control groups, and upper body endurance was significantly better in the Nordic Walking and walking training groups than in the control group.

CONCLUSIONS: Nordic Walking may improve exercise capacity, lower body endurance and coordination of movements in patients with good exercise tolerance participating in early, short-term rehabilitation after an acute coronary syndrome.
Energy expenditure and comfort during Nordic walking with different pole lengths.

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Abstract

Energy expenditure and comfort for Nordic walking with self-selected and 7.5-cm shorter poles and ordinary walking were measured during uphill (12 degrees), downhill (12 degrees), and horizontally. Twelve (11 women and 1 man) Nordic walking practitioners participated (mean +/- SEM: 171.5 +/- 1.5 cm, 67.0 +/- 2.7 kg, 50.6 +/- 2.4 years, and maximal oxygen uptake of 43.4 +/- 2.8 mL x kg(-1) x min(-1)). Energy expenditure was calculated from oxygen uptake and comfort was self-rated. Differences in physiological responses between the 3 locomotion types at each slope were first analyzed by a 1-way analysis of variance. In case of significance, Student's paired samples 2-tailed t-test was applied twice to test for differences between the 2 pole lengths and between Nordic walking (with self-selected pole length) and ordinary walking. The corresponding differences in comfort were evaluated by a Wilcoxon matched pairs test. The relative exercise intensity during Nordic walking with self-selected pole length ranged between approximately 44 and 87% of the maximal oxygen uptake across the different slopes. For comparison, it ranged between approximately 29 and 80% during ordinary walking. Uphill Nordic walking with short poles compared with poles of self-selected length caused 3% greater energy expenditure. Notwithstanding, comfort was similar. Horizontally and downhill energy expenditure and comfort were similar between pole lengths. Compared with ordinary walking, Nordic walking required as much as 67% greater energy expenditure. Comfort was similar for ordinary and Nordic walking for each slope. In conclusion, shorter poles caused greater energy expenditure during uphill Nordic walking, whereas comfort was similar to poles of self-selected length. The substantially enhanced energy expenditure of Nordic walking compared with previous studies reflects the vigorous technique used here.
Pole walking for patients with breast cancer-related arm lymphedema.

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Abstract

Arm lymphedema is a well-known side effect of breast cancer treatment. Studies of the effect of physical exercise on arm lymphedema are very rare. The purpose of this study was to investigate the influence of pole walking on breast cancer-related arm lymphedema when using a compression sleeve. Twenty-six women with unilateral arm lymphedema took part in a clinical study of pole walking on one occasion, 4 kilometers for 1 hour. Measurements were made before, immediately after, and 24 hours later. Results revealed no changes in total arm volume of the swollen arm, measured with water displacement method, or in subjective assessments of heaviness and tightness in the affected arm using visual analogue scale. Immediately after pole walking, a temporary increase in total arm volume of the healthy arm (P=0.037) was found. Twenty-four hours later, no differences were found compared to the measurements before walking. The median for perceived exertion immediately after pole walking, measured with Borg scale, was 11 (“fairly light”). The results suggest that a controlled, short-duration pole-walking program can be performed by patients with arm lymphedema, using a compression sleeve, without deterioration of the arm lymphedema.
**Energy cost and pole forces during Nordic walking under different surface conditions.**

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**Abstract**

**INTRODUCTION:** The purpose of the study was to identify the effect of three different surfaces on energy consumption and the forces acting on the walking poles during ground contact in Nordic walking (NW).

**METHODS:** Thirteen female NW instructors (age = 26 +/- 4 yr, weight = 58.5 +/- 4.2 kg, height = 168.1 +/- 4.6 cm) volunteered in the study. The subjects walked a distance of 1200 m at a controlled, constant speed of 2.2 m x s(-1) on each of a concrete surface (C), an artificial athletics track (A), and a naturally grown soccer lawn (G). They used NW poles with inbuilt strain gauge force transducers to measure ground reaction forces acting along the long axes of the poles. Oxygen uptake, capillary blood lactate (La), HR, and RPE were measured before and after the tests.

**RESULTS:** Impact forces, maximum forces, force rates during ground contact identified from the registered force time histories, displayed significant differences related to the surface conditions. However, force time integrals did not show surface-related differences. Relative oxygen consumption showed significant differences between NW on C and on G whereas no surface-related differences could be identified between the surface conditions for the parameters La, HR, and RPE.

**CONCLUSION:** Our data indicate that the impulse that is generated by the poles on the subjects is identical between the varying surfaces. Because there are differences for the oxygen uptake between C and G, the main regulator for the propulsion must be the musculature of the lower extremities. The work of the upper extremities seems to be a luxury effort for Nordic walkers with a proper technique.
Nordic poles immediately improve walking distance in patients with intermittent claudication.

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Abstract

OBJECTIVES: To investigate the immediate effects of Nordic pole walking (NPW) on walking distance and cardiopulmonary workload in patients with intermittent claudication.

METHODS: Using a standardised treadmill test (3.2 km h\(^{-1}\) at 4\% gradient), walking distance, cardiopulmonary responses, leg pain and perceived exertion during NPW were compared to responses evoked by normal walking in 20 patients with intermittent claudication. The distance to onset of claudication pain (claudication distance: CD) and to maximum walking distance (MWD), heart rate (HR), expired gas parameters, leg pain (Borg's CR-10 Scale) and perceived exertion (Borg's Rating of Perceived Exertion: RPE Scale) were compared.

RESULTS: CD increased significantly from a median (range) distance of 77 m (28-503) to 130 m (41-1080) and MWD increased significantly from 206 m (81-1078) to 285 m (107-1080) when patients used the Nordic poles (P=0.000). The level of leg pain at MWD was also significantly reduced during NPW (P=0.000). Perceived exertion at MWD did not increase despite an increase in cardiopulmonary work, as indicated by an increase in oxygen consumption (16.5\%; P=0.000).

CONCLUSION: These results show that NPW immediately enables patients with intermittent claudication to walk further with less pain, despite a higher workload. NPW might also be a useful exercise strategy for improving the cardiovascular fitness of patients with intermittent claudication.
Physical activity of depressed patients and their motivation to exercise: Nordic Walking in family practice.

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Abstract

The objectives of this study were to find out how motivated depressed patients are to exercise regularly, to measure the physical activity of depressed patients and to find out how regular Nordic Walking affects the mood and physical fitness of depressed patients. A cross-sectional study was carried out. Three years after the Prediction of Primary Episodes of Depression in Primary Medical Care study, telephone calls were made to 178 patients who had had depression during that study. We enquired whether and why they would be interested in starting regular Nordic Walking three times a week, at least 30 min at a time, for 24 weeks. Furthermore, there were questions about the patients' earlier physical activity. The Composite International Diagnostic Interview was used to assess depression. To measure physical fitness, we used an outdoor 2 km walking test. Altogether, 106 patients were interviewed, 48 (45%) of them were depressed and 58 (55%) were nondepressed. Of the depressed patients, 16, and of the nondepressed patients, five, started the training programme. During the past 2 years, 12 of the patients had not had any regular physical activity. One-fourth of the depressed patients completed the study. Mean fitness index was 21.99+/-20.38 at week 0 and 38.72+/-26.12 at week 24. The feedback of the patients and their families to the programme was positive. Depressed patients in family practice were physically inactive. About one-third of the depressed patients were motivated to start regular physical activity. Nordic Walking increased the patients' physical activity and improved their mood.
Trekking poles increase physiological responses to hiking without increased perceived exertion.

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Abstract

Trekking poles are used by hikers for improved stability and lowered leg fatigue due to increased upper body muscle involvement. However, the weight of the poles and exaggerated upper body movement when using poles may increase total energy expenditure at a given walking speed. Few studies have investigated the physiological responses of hiking with trekking poles outside the laboratory setting. The purposes of this study were to determine if trekking poles altered physiological responses to hiking on varied terrain, and whether responses between trials were dependent on the grade of the terrain. Fourteen recreational hikers completed four hiking trials over a course that included sustained sections of flat (0 +/- 1% grade), steep uphill (>10% grade), gradual uphill (5% grade), gradual downhill (-5% grade) and steep downhill (<-10% grade) terrain. Subjects walked at a self-selected speed that was matched across trials using time-splits and a metronome. Two trials were conducted with hiking poles and two without poles. [O2]O2 was significantly elevated (p <0.05) during the pole trials (1502.9 +/- 510.7 ml/min) compared to the no-pole trials (1362.4 +/- 473.2 ml/min). Similarly, ventilatory efficiency ([E]E) (43.1 +/- 9.6; 38.3 +/- 10.1 L/min) and heart rate (HR) (112.1 +/- 9.7; 105.7 +/- 10.4 bt/min) were significantly higher during the pole trials than the no-pole trials. However, ratings of perceived exertion (RPE) was not altered by pole condition (8.5 +/- 0.7; 8.4 +/- 0.8). Comparisons within each grade revealed significantly higher physiological responses for [O2], [E]E and HR in the pole-condition at all grades, with no significant variable*grade interactions. RPE measures were not significantly different between pole trials at any grade. These data suggest that trekking poles may be a beneficial tool for increasing caloric expenditure, as energy production increased during exercise without increased perceptions of effort.
Nordic walking: a new form of physical activity in the elderly.

[Article in Croatian]

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Abstract

Nordic walking is a form of kinesiologic activity recognized in the Scandinavian countries more than ten years ago. This physical activity activates muscles of the whole body. The use of special sticks for Nordic walking has a simultaneous impact on the strength of shoulder, arm and trunk muscles. Walking with sticks is suitable for all seasons, age groups and all levels of physical ability. The results of studies conducted in the Scandinavian countries confirm that Nordic walking is more effective than walking without sticks.
Nordic walking improves mobility in Parkinson's disease.

van Eijkeren FJ, Reijmers RS, Kleinveld MJ, Minten A, Bruggen JP, Bloem BR.

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Abstract

Nordic walking may improve mobility in Parkinson's disease (PD). Here, we examined whether the beneficial effects persist after the training period. We included 19 PD patients [14 men; mean age 67.0 years (range 58-76); Hoehn and Yahr stage range 1-3] who received a 6-week Nordic walking exercise program. Outcome was assessed prior to training (T1), immediately after the training period (T2) and in a subgroup of 9 patients--5 months after training (T3). At T2, we observed a significant improvement in timed 10-m walking, the timed get-up-and-go-test (TUG), the 6-min walking test and quality of life (PDQ-39). All treatment effects persisted at T3. Compliance was excellent, and there were no adverse effects. These preliminary findings suggest that Nordic walking could provide a safe, effective, and enjoyable way to reduce physical inactivity in PD and to improve the quality of life. A large randomized clinical trial now appears justified.
Nordic walking--is it suitable for patients with fractured vertebra?

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Abstract

This article brings the biomechanical analysis of sport--Nordic walking--for patients with osteoporotic fractured vertebrae and shows that it is suitable for them. Based on the biomechanical model of skeletal load we have developed a method of walking movement for patients, different from the method of walking movement for healthy people. And so came into being the "first sport" for patients with osteoporotic fractures. They can go for regular walks in easy terrains outdoors with friends and family, and so be liberated from social isolation. It requires only one-off financial costs of buying the poles and special footwear (Tab. 7, Fig. 3, Ref. 14). Full Text (Free, PDF) www.bmj.sk.

**Rapid rehabilitation programme following sacral stress fracture in a long-distance running female athlete.**

Knobloch K, Schreibmuller L, Jagodzinski M, Zeichen J, Krettek C.

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**Abstract**

Stress fractures occur in normal bone due to mechanical overload by cyclic stress increasing the osteoclastic activity, thus facilitating weakening leading to fracture of bones. Long-distance running may lead to stress fractures of the mid- and distal tibia and of the metatarsal bones. Stress fractures to the sacrum are rare. Certain factors for stress fractures in runners have been identified, such as leg-length inequality, a high longitudinal arch of the foot, forefoot varus, and menstrual irregularities in case of female athlete triad. We report on a 22-year-old female runner (usually training 140 km/week) suffering a sacral fatigue-type fracture. The female athlete triad with eating disorders, dysmenorrhea, and osteopenia was ruled out. Sexual hormone blood samples proofed normal values. The diagnosis was performed using magnetic resonance imaging 2 weeks after the onset of buttock pain. A conservative treatment regimen was initiated with strict physical rest for the first 2 weeks, and then gradual increase of physical activity with 60-90 min of daily cycling and moderate 2 x 60 min cross-training. After another 2 weeks time, daily 60-90 min of walking, Nordic pole walking, and moderate strength training two times a week was performed. At 7 weeks running was started, gradually increased to 90 km/week without any pain. A rapid rehabilitation programme after sacral stress fractures involving low impact physical activity, such as Walking and Nordic pole walking, is applicable to female athletes after ruling out the female athlete triad.
The effects of walking poles on shoulder function in breast cancer survivors.

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Abstract

Breast cancer treatment often results in impaired shoulder function, in particular, decrements in muscular endurance and range of motion, which may lead to decreased quality of life. The purpose of this investigation was to determine the effects of walking pole use on shoulder function in female breast cancer survivors. Participants had previously been treated with 1 or a combination of the following: mastectomy, breast conservation therapy, axillary lymph node dissection, chemotherapy, or radiation. Participants were randomly placed in experimental (n = 6) and control (n = 6) groups and met with a cancer exercise specialist 2 times each week for 8 weeks. The experimental group used walking poles during the 20-minute aerobic portion of their workout, whereas the control group did not use walking poles but performed 20 minutes of aerobic exercise per workout session. Both groups participated in similar resistance training programs. Testing was done pre- and postexercise intervention to determine upper body muscular endurance and active range of motion at the glenohumeral joint. Repeated-measures analysis of variance (ANOVA) revealed significant improvements in muscular endurance as measured by the bench press (P = .046) and lat pull down (P = .013) in the walking pole group. No within-group improvements were found in the group that did not use walking poles. The data suggest that using a walking pole exercise routine for 8 weeks significantly improved muscular endurance of the upper body, which would clearly be beneficial in helping breast cancer survivors perform activities of daily living and regain an independent lifestyle.
Field testing of physiological responses associated with Nordic walking.

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Abstract

This study compared the physiological responses (oxygen consumption and energy expenditure) of Nordic Walking to regular walking under field-testing conditions. Eleven women (M age = 27.1 years, SD = 6.4) and 11 men (M age = 33.8 years, SD = 9.0) walked 1,600 m with and without walking poles on a level, 200-m track. For women, Nordic Walking resulted in increased oxygen consumption (M = 14.9 ml x kg(-1) x min(-1), SD = 3.2 vs. M = 17.9 ml x kg(-1) min(-1), SD = 3.5; p < .001), caloric expenditure (M = 4.6 kcal x min(-1), SD = 1.2 vs. M = 5.4 kcal x min(-1), SD = 1.2; p < .001), and heart rate (M = 113.7 bpm, SD = 12.0 vs. M = 118.7 bpm, SD = 14.8; p < .05) compared to regular walking. For men, Nordic Walking resulted in increased oxygen consumption (M = 12.8 ml x kg(-1) min(-1), SD = 1.8 vs. M = 15.5, SD =3.4 ml x kg(-1) min(-1); p < .01), caloric expenditure (M = 5.7 kcal x min(-1), SD = 1.3 vs. M = 6.9 kcal x min(-1), SD = 1.8; p < .001), and heart rate (M = 101.6 bpm, SD = 12.0 bpm vs. M = 109.8 bpm, SD = 14.7; p < .01) compared to regular walking. Nordic Walking, examined in the field, results in a significant increase in oxygen use and caloric expenditure compared to regular walking, without significantly increasing perceived exertion.
Increasing exercise tolerance of persons limited by claudication pain using polestriding.


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Abstract

OBJECTIVE: The efficacy of polestriding exercise (walking with modified ski poles with a movement pattern similar to cross-country skiing) to increase exercise tolerance of persons with intermittent claudication pain caused by peripheral arterial disease was tested in this 24-week prospective randomized clinical trial.

METHODS: The study was conducted in a Department of Veterans Affairs Hospital with 52 individuals who gave written informed consent and were randomized into either a polestriding exercise (n = 27; age, 65.5 +/- 7.0 years; ankle brachial index, 0.64 +/- 0.25) or nonexercise control (n = 25; age, 68.6 +/- 8.9 years; ankle brachial index, 0.69 +/- 0.14) group (P > .05 for all comparisons). The polestriding exercise program consisted of supervised training three times per week for 4 weeks, two times per week for 8 weeks, one time per week for 4 weeks, biweekly for 4 weeks and unsupervised training for 4 weeks. Starting in week 5, subjects took their poles home with instructions to repeat the most recent supervised training walk at an appropriate and convenient location near their residence. This was referred to as unsupervised but directed exercise. Subjects were provided with a personal log book for documenting unsupervised exercise sessions. With both supervised and unsupervised exercise, subjects were expected to complete a total of four 30-minute to 45-minute polestriding exercise sessions per week. The main outcome measures were exercise duration on symptom-limited incremental treadmill test, Walking Impairment Questionnaire, rating of perceived leg pain at baseline, 4, 8, 12, 16, and 24 weeks, and constant work-rate treadmill exercise tests at baseline and at 4, 12, and 24 weeks.

RESULTS: Polestriding significantly (P < .001) improved exercise tolerance on the constant work-rate and incremental treadmill tests. Ratings of perceived claudication pain were significantly less after the polestriding training program. Subject perceived distance and walking speed scores on the Walking Impairment Questionnaire improved in the polestriding trained group only (P < .001 and .022, respectively).

CONCLUSION: This randomized clinical trial provides empirical evidence that 24 weeks of polestriding training significantly improves quantitative and qualitative measures of the exercise tolerance of persons limited by intermittent claudication pain.
Effects of walking poles on lower extremity gait mechanics.

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Abstract

PURPOSE: The purpose of this study was to determine whether walking with poles reduces loading to the lower extremity during level over ground walking.

METHODS: Three-dimensional gait analysis was conducted on 13 healthy adults who completed 10 walking trials using three different poling conditions (selected poles, poles back, and poles front) and without the use of poles (no poles). The inverse dynamics approach was used to calculate kinetic data via anthropometric, kinematic, and kinetic data.

RESULTS: All walking with poles conditions increased walking speed (P = 0.0001-0.0004), stride length (P < 0.0001), and stance time (P < 0.0001) compared with the no poles condition. There also was a decrease in anterior-posterior GRF braking impulse (P = 0.0001), a decrease in average vertical GRF walking with poles (P < 0.0001-0.0023), and a decrease in vertical (compressive) knee joint reaction force (P < 0.0001-0.0041) compared with the no poles condition. At the knee, extensor impulse decreased a 7.3% between the no poles and selected poles conditions (P = 0.0083-0.0287) and 10.4% between the no poles and poles back conditions (P < 0.0001). The support moment was reduced between the no poles and poles back (P = 0.0197) and poles front (P = 0.0002) conditions. Ankle plantarflexor work (A2) was reduced in the poles-front condition (P = 0.0334), but no differences were detected in all other ankle, knee or hip power and work variables (P > 0.05).

CONCLUSION: There were differences in kinetic variables between walking with and without poles. The use of walking poles enabled subjects to walk at a faster speed with reduced vertical ground reaction forces, vertical knee joint reaction forces, and reduction in the knee extensor angular impulse and support moment, depending on the poling condition used.
The physiological responses to walking with and without Power Poles on treadmill exercise.

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Abstract

Power Poles are specially constructed, rubber-tipped ski poles designed for use during walking. Using Power Poles simulates the arm motion of cross-country skiing, thus increasing the muscle mass used during walking. This study investigated the potential increases in exercise intensity and energy cost associated with the use of walking poles. Thirty-two apparently healthy volunteers (16 men and 16 women) between the ages of 19 and 33 years participated. Each completed a treadmill maximal oxygen consumption (VO2max) test and two randomly assigned, submaximal walking trials (one with poles and one without poles) on separate days. Each walking trial was conducted on a level treadmill, for 20 minutes, at an identical self-selected pace. Expired gases, heart rate in beats per minute (bpm), and ratings of perceived exertion (RPE) were recorded each minute. Results between trials were compared using repeated measures analysis of variance and Tukey’s post hoc tests. It was found that walking with poles resulted in an average of 23% (4.4 ml.kg-1.min-1) higher VO2, 22% higher caloric expenditure (1.5 kcal.min-1), and 16% (18 bpm) higher heart rate responses compared to walking without poles on a treadmill. RPE values averaged 1.5 units higher with the use of the poles, and the pattern of responses between conditions was similar for men and women. It is concluded that the use of Power Poles can increase the intensity of walking at a given speed and, thus, may provide additional training benefits to walkers.
Acute responses to using walking poles in patients with coronary artery disease.

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Abstract

PURPOSE: This study was designed to assess the safety and effectiveness of walking when using 1-lb walking poles in Phase III/IV cardiac rehabilitation patients.

METHODS: Following instruction on the proper use of the poles and adequate time to practice, each subject completed two 8-minute walking trials on a level treadmill either with or without walking poles. Each trial was conducted at an identical speed for each subject in a randomized order. Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and ratings of perceived exertion (RPE) were recorded every 2 minutes during each trial, while ECG responses (ST segment changes and dysrhythmias) were monitored continuously.

RESULTS: Walking with poles significantly (P < .05) increased the energy cost of walking by 21% (3.8 mL/kg/min) compared to walking without poles. There were also significant (P < .05) increases in HR (14 bpm), SBP (16 mm Hg), and DBP (4 mm Hg) when comparing conditions. Calculated oxygen pulse (mL O2.heart beat) values indicated that changes in HR were consistent with the increase in VO2 and were not related to a pressor response mechanism. The only dysrhythmias noted were isolated PVCs, with no differences in the frequency of occurrence between trials. There were no adverse ST segment changes with either trial.

CONCLUSIONS: These data demonstrate that at a given speed, the use of 1-lb walking poles can safely increase the intensity of walking exercise in Phase III/IV cardiac rehabilitation patients.
Effect of exercise on perceived quality of life of individuals with Parkinson's disease

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Abstract. The purpose of this study was to determine if individuals with Parkinson's disease (PD) who completed an 8-week, supervised PoleStriding exercise program would undergo significant improvements in cognitive skills, activities of daily living, motor function, and quality of life. The Unified Parkinson's Disease Rating Scale (UPDRS) and the Parkinson's Disease Questionnaire (PDQ-39) were used to measure functional independence. Six male volunteers (72.3±3.7 years of age) performed PoleStriding exercise three times per week for 37.3±3 minutes. Differences in the participants' pre- and post-training scores on the UPDRS and PDQ-39 were analyzed using the Wilcoxin Signed Ranks Test. A statistically significant improvement occurred in the UPDRS (P<0.026) and PDQ-39 (P<0.028) scores following the moderate-intensity exercise intervention. The results of this nonrandomized clinical trial indicate that an 8-week individualized PoleStriding exercise program increases perceived functional independence and quality of life in individuals with PD.

Key words: exercise tolerance, exercise training, Parkinson's disease, quality of life, rehabilitation.
Psychological profiles before and after 12 weeks of walking or Exerstrider training in adult women

A THESIS PRESENTED TO THE GRADUATE FACULTY
UNIVERSITY OF WISCONSIN – LA CROSSE

By: Laurie Jane Stoughton
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ABSTRACT

STOUGHTON, L.J. Psychological profiles before and after 12 weeks of walking or Exerstrider training in adult women. MS in Human Performance, 1992 83pp. (N.K. Butts)

87 sedentary women between 20 and 50 years of age (x = 37 yrs) volunteered to participate in a 12-week training program. They were randomly placed in a walking (W = 29), Exerstriding (E = 30), or control group (C = 28). The Profile of Mood States (POMS) questionnaire and the Body-Cathexis Scale were administered at the beginning and the end of the 12-week training period.

Both the W and E trained for 30-45 min per day, 4 days per week, at 70-85% of their maximal HR. The E walked 0.2 mph slower and 0.2 miles less than the W which were significantly (p <.05) different among the two groups. However, both groups’ durations, frequencies, and intensities were not significantly (p >.05) different from each other throughout the 12 weeks of training. In addition, the E used “walking poles” throughout all their training sessions. There were no significant (p > 0.5) changes in any of the variables measured for the control group. The E showed significant (p < 0.5) improvements in depression, anger, vigor, fatigue, total mood disturbances, and total body-cathexis scores. Only tension and confusion were not significantly (p > 0.5) altered in E. In contrast, W showed significant (p, 0.5) improvements only in vigor and on total body-cathexis.

It was speculated that the E may have felt more unique and special because of their opportunity to do a “new” and more enjoyable method of walking.

Also, during Exerstriding, the use of both arms and legs working in opposition to each other (cross-patterning) may have stimulated a greater number of nerves and muscles, creating a more rhythmic and tranquil exercise. Using Exerstrider poles as a supplement with walking may enhance self-acceptance and result in participants developing a more favorable attitudes toward exercise than walking alone.
The effect of hiking poles on oxygen uptake, perceived exertion and mood state during a one hour uphill walk

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ABSTRACT
Duncan MJ, Lyons M. The effect of hiking poles on oxygen uptake, perceived exertion and mood state during a one hour uphill walk.

JEPhysical 2008;11(3):20-25. This study assessed changes in oxygen uptake, perceived exertion and mood state during a one hour uphill walk with and without hiking poles. Six males and one female with hill walking experience (Mean age ± SD = 24.2 ± 4.7 years) completed two, one hour walking trials in a counterbalanced order (one with hiking poles, one without) and separated by 48-72 hours, on a treadmill inclined at 5%. Treadmill velocity was established a priori such that the subject’s heart rate was between 55-65% of their maximum, using the Karvonen formula.

Ratings of perceived exertion (RPE) were collected at 10-minute intervals. Oxygen uptake (ml·kg⁻¹·min⁻¹) was assessed continuously and averaged over 10-minute periods and mood state was assessed pre and post each condition.

Results indicated that oxygen uptake was significantly greater ($P = 0.001$) during the poles condition compared to the no poles condition. RPE was not significantly different across conditions ($P = 0.07$).

In addition, there was a significantly greater change in mood state (pre to post) in the no poles condition compared to the poles condition ($P = 0.03$).

These results indicate that the use of hiking poles may have a psychological benefit to hill walkers despite increased physiological load associated with their use.
ENERGY EXPENDITURE DURING SUBMAXIMAL WALKING WITH EXERSTRIDERS®
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ABSTRACT
This study was designed to determine whether Exerstriding, a modified form of walking using walking sticks (Exerstriders®), resulted in an augmented cardiorespiratory response and a greater energy expenditure than when walking without Exerstriders®.

Female subjects (23.6 + 4.0 yr; 58.5 + 5.5 kg) completed two randomly assigned trials of treadmill walking (6.7 km/h; 0% grade; 30 min.) with Exerstriders® (E) and without Exerstriders® (C Control).

Mean oxygen consumption (E = 20.5 + 1.2 ml/min/kg; C = 18.2 + 2.5 ml/min/kg), heart rate (E = 132.5 + 19.2 beats/min; C = 121.5 + 21.2 beats/min) and respiratory exchange ratio (E = .82 + .03; C = .78 + .04) were significantly greater (P< 0.05) while walking with Exerstriders®.

Total caloric expenditure was also significantly greater during the Exerstrider® condition (E = 173.7 + 20.9 kcal; C = 140.7 + 27.2 kcal).

In contrast, the rating of perceived exertion did not differ significantly between the two conditions.

These data suggest that Exerstriding provides a means to increase caloric expenditure during submaximal walking, a factor that may be of critical importance in enhancing health benefits – such as improved body composition and aerobic capacity – typically associated with walking programs.
Kinetic Analysis of Telescope-Style Walking Poles on Elderly Gait

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INTRODUCTION

Walking has often been considered as a good exercise for the elderly because the risk of injury is relatively low and the activity increases caloric expenditure. Although walking, compared to running or other type of exercises, is excellent activity with low impact and load on the lower extremities, it is still difficult for some elderly individuals who have problems in their lower extremities to walk without the aid of assistive device. Assistive walking devices (AWDs) such as crutches, canes, poles, and walkers have demonstrated to be beneficial (i.e., reduced lower extremity loading and improved gait/dynamics stability) as well as adverse effect (i.e., increased burden on the shoulder) for elderly gait. Recently, a newly-designed walking pole, termed telescope-style poles (T-poles) which has distinctive functional properties that can potentially change the mechanics of walking and reduce the burden on the shoulder compared with AWDs has been introduced [2, 3]. To date very few studies have investigated the effects of T-poles on elderly gait.

Moreover, none of the studies have focused on the effects of T-poles on lower and upper extremity joints. The purpose of this study was to comprehensively investigate and describe the kinetics of T-pole walking in the elderly. It was hypothesized that walking with T-poles would a) significantly decrease the loads on lower extremity joints, and b) result in only a minor increase in upper extremity joint loading.

METHODS

Subjects were medically screened and cleared by a doctor to participate in the study. Eleven volunteers, age 65 years and older (74.2 ± 5.5 yrs), who have sufficient walking experiences with T-poles were recruited for the study. Each participant was asked to walk across the laboratory under two different walking conditions: walking with T-poles (PW) and normal walking without the poles (NPW). Each condition was performed at participants’ preferred walking speed. Three successful trials were collected for each walking condition. The three trials were averaged prior to data analysis. All conditions were balanced and randomized in order. A three dimensional motion analysis were performed with eight 60-Hz video camcorders (Panasonic DVC-15), using Kwon3D XP (version 4.0) motion analysis Suite (Visol, Inc., Seoul, Korea). A fourteen-segment, rigid-link human body model was used in this study. A paired t-test was employed for this study to determine the significances between two movements (α <.05).

RESULTS AND DISCUSSION

PW showed significantly longer support time than NPW (0.65 ± 0.09s and 0.62 ± 0.08s, p <.05). All peak GRFs and average vertical GRFs decreased significantly in PW than NPW (3.7% to 10.4%, p <.05). The reduction in average vertical GRF were caused mainly by reduction in peak forces than the increase in support time since the most impulse measures also showed significant decrease (5.9% to 15.2%, p <.05) due to the use of T-poles. All lower body resultant joint torques showed significant decreases in PW than NPW (5.7% to 18%, Table 1) while all upper body ones showed inversely (Table 1). Hinrichs[1] reported that the magnitudes of the elbow and shoulder peak flexion torques ranged from 8 to 11 N·m and from 7 to 14 N·m, respectively during running with 4.5 m/s running speed. Our data were normalized by BW but their actual peak torque values were ranged between 4 and 11 N·m, and 12 and 17 N·m at elbow and shoulder joint, respectively. Running speed of 4.5 m/s is relatively slow speed. Upper extremities burden found from our study is comparable in magnitude to those reported by Hinrichs [1]. This finding indicates that T-poles users have as little as risks on upper extremities during walking with T-poles.

CONCLUSIONS

In conclusion, the findings of this study revealed: (a) the use of T-poles decrease the loads on lower extremities mainly by reducing the foot-ground interaction; (b) the degree of burden on upper extremities in pole-walking increased but it is as little as a normal activity such as a slow running.
Mechanics of Pole Running in Subjects with Chronic Knee Problems

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The purpose of this study was to examine the effects of the telescope-style running poles on the lower-extremity running mechanics of the subjects with chronic knee problems. Ten male recreational runners (age = 55.2 ± 9.0 yr) with chronic knee problems participated in this study. Each subject was individually fitted with a pair of specially-designed telescope-style running poles. The pole-running trials of the subjects were compared with their normal running trials after a 4-week familiarization period. The maximum knee flexion angle during the swing phase significantly decreased by 12.2° due to the use of the running poles. The ground reaction force data revealed a consistent trend of decrease with significant decreases in the peak vertical propulsive force (11.4%) and the vertical impulse (11.4%) due to the use of the poles. It was concluded that (a) the telescope-style running poles significantly altered the lower-extremity kinematics by decreasing the knee flexion during the swing phase, and (b) the running poles generally reduced the foot-ground interaction and provided a source of propulsion during the push-off phase of the running gait.

Discussion

The data from the present study demonstrated that the use of the telescope-style poles significantly reduced the knee flexion during the swing phase and significantly increased maximum hyperextension of the hip. The motion of the upper body in one unit in this process, including the stretched arm-pole complex, causes an increased moment of inertia of the upper body. It could be that in order to keep the balance, subjects needed to increase the moment of inertia of the lower limb by reducing the knee flexion. The counter-rotation of the pelvis against the upper trunk in this process could contribute to a more trailing position of the push-off leg, causing increased maximum hip hyperextension angle at toe off. The ground reaction force variables in fact showed a consistent trend of decrease due to the use of the poles with the changes in the peak vertical propulsive force and the vertical impulse being statistically significant since the running poles can directly contribute to the propulsive phase of the pole-running cycle. From the toe-off to pole-off the pole is pointing rearward and runners can generate a propulsive force by pushing off the ground using the pole through trunk rotation, elbow flexion, and forearm pronation. Although the peak impact force has been historically linked to injury (Cavanagh & LaFortune, 1980; Clarke et al., 1983; DeWit et al., 1995; Nigg, Cole & Bruggemann, 1995), reduction of the peak propulsive force is more important than the reduction of the peak impact force in subjects with problems that involve the patellofemoral joint and the patellar tendon. Scott and Winter (1990) estimated the patellar tendon force and the patellofemoral joint force in running by using a knee model and showed that the peak internal forces were closely related to the peak propulsive force. Reduction of the propulsive ground reaction force by using the telescope-style running poles is thus meaningful and the significant reduction in impulse indicates an overall decrease in the interaction between the leg and the ground. An average reduction of 11.4% in the propulsive peak and impulse alike could allow the patients with knee problems to continue running without pain. From the data analysis, it was concluded that (a) the telescope-style running poles altered the lower-extremity running kinematics by decreasing the knee flexion during the swing phase and increasing the maximum hip hyperextension, and (b) the running poles generally reduced the foot-ground interaction and provided a source of propulsion during the push-off phase of the running gait, decreasing the amount of force and impulse imposed upon the foot in subjects with chronic knee problems.
Effects Of 12 Weeks Of Walking Or Exerstriding On Upper Body Strength And Endurance


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The purpose of this study was to determine potential changes in the upper body strength and endurance as a result of walking with the use of specially designed walking poles (Exerstriders). Ninety-two inactive females, 20-59 yrs, volunteered to participate in the study. The subjects were randomly assigned to one of three groups: Exerstriders (E), who walked using the Exerstriders; Walkers (W), who participated in a conventional walking program; and Controls (C). E and W participated in the supervised 12-week walking program, exercising 4 days per week, for 30-45 min per session, at 70-85% of maximal HR.

The subjects were assessed for upper body strength assessed using 1 RM tests for triceps pushdowns and a modified (palms up) lat pulldown exercise. To assess endurance, the subjects performed a 1 minute bout of alternating arm pulls on a modified Isokinetic Swimbench apparatus. Total work output (kgm) was used as the criterion measure. Changes in strength and endurance were analyzed with repeated measures ANOVA and Tukey’s post-hoc tests.

E had a significant (p<.05) increase (38%) in endurance from pre to post testing, which was greater than the non significant (p>.05) increases shown by W (14%) and C (5%). There were not significant (p>.05) changes in the pushdown or pulldown strength in any group.

It would appear that although Exerstriding can result in substantial increases in muscular endurance, they may not provide sufficient stimulus to increase strength. A longer training period may be needed to alter this parameter.
Calorie Expenditure: Nordic walking compared to regular walking

T. Church, C. Earnest, G. Morss

The Cooper Institute, RQES, vol 73, No.3, pp. 296-300, September 2002

The Cooper Institute in Texas compared physiological responses of Nordic Walking to regular walking. The caloric expenditure and the oxygen consumption increased on an average of 20% and the heart rate increased with about 10 beats per minute when using the Exel Nordic Walker poles. The RPE (rated perceived exertion) was the same walking with or without poles.

Dr. Tim Church said, “Some individuals increased as much as 46% in oxygen consumption and just about the same in caloric expenditure.”

Quotes from the study:

- “Individuals who poled more intensely had higher oxygen consumption.”
- “There is potential for considerably more or less benefit depending on the selection of poling-off intensity. This may have particular significance for individuals who need to increase caloric expenditure but have walking speed limitations.”
- “Increased caloric expenditure with no corresponding increase in perceived exertion during Nordic Walking, may have important public health applications.”
- “The use of Nordic Walker poles is particularly promising, as the poles provide stability that may promote physical activity among older individuals and those with orthopedic and balance concerns.”

T. Church, C. Earnest, G. Morss at The Cooper Institute, RQES, vol 73, No.3, pp. 296-300, September 2002

**Utilizing exercise to affect the symptomology of fibromyalgia: a pilot study.**

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**Abstract**

Fibromyalgia (FM), a rheumatological disorder of unknown origin, is characterized by both physical and psychological symptoms. Although inconclusive results have been reported for most treatment modalities, exercise appears to have universal support for decreasing the myriad of symptoms associated with FM. Weaknesses in the literature, however, prevent conclusive statements regarding exercise prescription and concomitant impact on FM symptomology.

**PURPOSE:** The current pilot study attempted to examine the effect of a 24-wk walking program at predetermined intensities on FM.

**METHODS:** Initial design was a randomized control trial with high- and low-intensity exercise groups, and a control group. Subsequent nonrandomized control trials were based on actual exercise behavior.

**RESULTS:** No differences between initial groups were identified. By collapsing groups, heart rate (HR) decreased (P < 0.05) weeks 0-12. Functional impairments were reduced 54% weeks 0-24, with exercise having a large impact (omega2 = 0.30) on this decrease. By reassigning groups, impact of FM on current health status decreased in the low-intensity group (P < 0.05) and increased in the high-intensity group (P < 0.02) weeks 0-24. Omega squared indicated strong influence of exercise on pain (omega2 = 0.51), with greater pain in the high-intensity group.

**CONCLUSIONS:** A larger number of subjects and direct supervision of the training program to increase compliance is necessary to clarify the effects of a walking program on the manifestations of FM. Results indicate that intensity of the walking program is an important consideration. Individuals with FM can adhere to low-intensity walking programs two to three times per week, possibly reducing FM impact on daily activities.
Muscular and metabolic costs of uphill backpacking: are hiking poles beneficial?

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Abstract

PURPOSE: The purpose of the present study was to compare pole and no-pole conditions during uphill backpacking, which was simulated on an inclined treadmill with a moderately heavy (22.4 kg, 30% body mass) backpack.

METHODS: Physiological measurements of oxygen consumption, heart rate, and RPE were taken during 1 h of backpacking in each condition, along with joint kinematic and electromyographic comparisons from data collected during a third test session.

RESULTS: The results showed that although imposing no metabolic consequence, pole use elicited a longer stride length (1.27 vs 1.19 m), kinematics that were more similar to those of unloaded walking, and reduced activity in several lower extremity muscles. Although pole use evoked a greater heart rate (113.5 vs 107 bpm), subjects were backpacking more comfortably as indicated by their ratings of perceived exertion (10.8 vs 11.6). The increased cardiovascular demand was likely to support the greater muscular activity in the upper extremity, as was observed in triceps brachii.

CONCLUSION: By redistributing some of the backpack effort, pole use alleviated some stress from the lower extremities and allowed a partial reversal of typical load-bearing strategies.
PoleStriding exercise and vitamin E for management of peripheral vascular disease.


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Abstract

PURPOSE: The purpose of this investigation was to evaluate the efficacy of PoleStriding exercise (a form of walking that uses muscles of the upper and lower body in a continuous movement similar to cross-country skiing) and vitamin E (alpha-tocopherol) to improve walking ability and perceived quality of life (QOL) of patients with claudication pain secondary to peripheral arterial disease (PAD).

METHODS: Fifty-two subjects were randomized into four groups: PoleStriding with vitamin E (N = 13), PoleStriding with placebo (N= 14), vitamin E without exercise (N= 13), and placebo without exercise (N = 12). The dose of vitamin E was 400 IU daily. Only the PoleStriding with vitamin E and PoleStriding with placebo groups received PoleStriding instruction and training. Assignment to vitamin E or placebo was double blind. Subjects trained three times weekly for 30-45 min (rest time excluded). Individuals in vitamin E and placebo groups came to the laboratory biweekly for ankle blood-pressure measurements.

RESULTS: Results of this randomized clinical trial provide strong evidence that PoleStriding significantly (P< 0.001) improved exercise tolerance on the constant work-rate and incremental treadmill tests. Ratings of perceived claudication pain were significantly less after the PoleStriding training program (P= 0.02). In contrast, vitamin E did not have a statistically significant effect on the subjects' ratings of perceived leg pain (P= 0.35) or treadmill walking duration ( P= 0.36). Perceived distance and walking speed (Walking Impairment Questionnaire) and perceived physical function (Rand Short Form-36) improved in the PoleStriding trained group only (P< 0.001, 0.022 and 0.003, respectively).

CONCLUSION: PoleStriding effectively improved the exercise tolerance and perceived QOL of patients with PAD. Little additional benefit to exercise capacity was realized from vitamin E supplementation.
Nordic Walking – a new form of exercise in rehabilitation
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Abstract
Nordic Walking (NW) has become a popular form of physical activity. NW is a form of outdoor physical activity based on marching with use of poles adapted from cross–country skiing. The main goal of using the poles is to involve muscles, which are not used during normal walking. This enables performing high intensity exercises with a relatively low level of perceived exertion. The history, methodology and technique of Nordic Walking were presented in this paper. Moreover, possible role of Nordic Walking in physical rehabilitation, in particular in early cardiac rehabilitation, was discussed. This paper is based on the available data from the literature and on our own experience concerning the application of Nordic Walking in rehabilitation of patients early after a myocardial infarction. This study was performed in patients admitted to the Centre of Cardiac Rehabilitation in Kiekrz. NW is added as an additional training to standard rehabilitation program comprising ergometer endurance training and callisthenics. The literature review focused mainly on the usefulness of Nordic Walking in rehabilitation of various groups of patients, such as the elderly, patients with pain, and patients with neurological or cardiovascular disorders. The available evidence suggests that Nordic Walking is a natural and safe, yet intensive, form of physical activity that can be widely used in physical rehabilitation.