CHEST

Original Research

COPD

The Effects of a "New" Walking Aid on Exercise Performance in Patients With COPD

A Randomized Crossover Trial

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Background: **Generally, the use of a rollator improves mobility in patients with COPD. Nevertheless, not all patients benefit from its use, and many patients feel embarrassed about using it. Therefore, other walking aids are worthwhile to consider. We compared the direct effects of a "new" ambulation aid (a modern draisine) with the effects of a rollator on 6-min walk distance (6MWD) in patients with COPD.**

Methods: **Twenty-one patients with COPD performed two 6-min walk tests (6MWTs) during prerehabilitation assessment (best 6MWD: 369 ± 88 m). Additionally, two extra 6MWTs were performed on two consecutive days in random order: one time with a rollator and one time with a modern draisine. Walking pattern (n = 21) was determined using an accelerometer, and metabolic requirements (n = 10) were assessed using a mobile oxycon.**

Results: **Walking with the modern draisine resulted in a higher 6MWD compared with walking with the rollator (466 ± 189 m vs 383 ± 85 m). Moreover, patients had fewer strides (245 ± 61 vs 300 ± 49) and a greater stride length (1.89 ± 0.73 m vs 1.27 ± 0.14 m) using the modern draisine compared with the rollator (all $P \leq .001$). Oxygen uptake, ventilation, heart rate, oxygen saturation, and Borg symptom scores were comparable between both walking aids. Ten percent of the patients felt embarrassed using the modern draisine compared with 19% for the rollator, and a significantly smaller proportion of patients would use the modern draisine in daily life.**

Conclusions: **The mean difference in 6MWD between a modern draisine and a rollator seems clinically relevant, with the same metabolic requirements and symptom Borg scores. Therefore, this "new" ambulation aid could be a good alternative to the rollator to improve functional exercise performance in patients with COPD.**

Trial registry: **The Netherlands National Trial Registry; No.: NTR1542; URL: www.trialregister.nl**

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Abbreviations: 6MWD = 6-min walk distance; 6MWT = 6-min walk test

Patients with COPD regularly experience walking as a problematic activity in everyday life.[1] Indeed, patients walk less and at a lower intensity in daily life compared with their healthy peers.[2] Moreover, patients with COPD have a severely reduced functional exercise capacity as assessed by the 6-min walk test (6MWT),[3-5] which contributes to a higher exacerbation-related hospitalization risk, a reduced quality of life, and a worse prognosis.[6]

Ambulation aids (ie, rollators [Fig 1A]) can contribute to independent living and safe mobility, although strength and metabolic demands can be excessive.[7] The use of a rollator generally results in clinically relevant improvements in 6-min walk distance (6MWD) of 22 to 46 m compared with an unaided 6MWD, particularly in sedentary patients with COPD.[8-11] This is at least in part due to an increase in maximal voluntary ventilation of about 10% while using a rollator compared with not using an ambulation aid.[10] Indeed, by bracing their arms on the rollator, patients with COPD can adopt the "forward-lean" position, which may improve diaphragm function and, therefore,

increase ventilatory capacity.[12] This may also explain why rollator use is effective in relieving exercise-induced dyspnea in patients with COPD and advanced disease.[13,14]

On average, a rollator is beneficial for patients with COPD,[15] yet not all patients benefit from its use.[8,10,16] Moreover, 48% of the patients with COPD using a rollator feel embarrassed about its use in daily life.[17] Therefore, other ambulation aids may be worthwhile to consider in patients with COPD. Unfortunately, the effects of unwheeled Zimmer frames on 6MWD are insignificant in elderly patients with COPD.[16]

In 1817, Karl Drais invented the "Laufmaschine," the earliest form of a bicycle, but without pedals, later also called the velocipede or draisine.[18] The modern version of the draisine (Fig 1B) may also improve 6MWD in COPD. Indeed, by holding the handlebars it increases maximal voluntary ventilation and, in turn, 6MWD, similar to the results achieved with a rollator.[10] Moreover, by sitting on the seat of the modern draisine the load on the deconditioned muscles of ambulation is reduced.[19] In turn, this may result in a significantly lower cost of transport (eg, milliliters per minute of oxygen uptake per meter), allowing patients with COPD to achieve a higher 6MWD with similar effort.

To date, the direct effects of this "new" ambulation aid on 6MWD remain unknown in patients with COPD. Prospectively, we sought to determine whether the modern draisine had similar direct effects on 6MWD as those of a rollator in patients with COPD. Moreover, we aimed to assess walking pattern, exercise-induced symptoms, metabolic requirements using both ambulation aids, and patient satisfaction using both ambulation aids.

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Materials and Methods

Design

The study followed a prospective, randomized, crossover design. Patients were eligible to participate when they had been given a diagnosis of COPD, had a 6MWD ≤ 500 m (see the "Study Protocol" section for details), and had had no acute COPD exacerbation in the previous 4 weeks. Patients suffering from a musculoskeletal, cardiovascular, or neurologic disorder were excluded. All subjects gave written informed consent to participate in the study, which was approved by the medical ethical committee of the Maastricht University Medical Centre (MEC 08-3-069). The current project was registered on www.trialregister.nl (NTR1542) before enrollment of the first volunteering participant.

Study Protocol

Patients were recruited by A. W. V. and M. W. J. C. at CIRO+.[20] During routine prerehabilitation assessment, pulmonary function and body composition were determined as described earlier.[3] A symptom-limited cardiopulmonary exercise test on a cycle ergometer (Ergoline 200P; Ergoline GmbH) was used to determine peak aerobic capacity and was performed according to international guidelines.[21] In addition, functional exercise performance, including a practice walk. was determined using the 6MWT as described by the latest American Thoracic Society guidelines.[22,23] Only patients with a 6MWD ≤ 500 m were eligible to participate in the current study, because these patients are expected to benefit the most from the use of ambulation aids.[15]

Eligible patients were asked to perform two additional 6MWTs in a triangular walking course of 125 m on two consecutive weekdays. Patients were randomly assigned, using sealed envelopes (made by M. A. S.), to do a 6MWT with a rollator on day 1 (Fig 1A), followed by a 6MWT with the modern draisine on day 2 (Fig 1B), or vice versa. See e-Appendix 1 for specifications and settings for both ambulation aids.

All patients were familiarized with both ambulation aids through verbal instructions, in combination with a practice session of 10 min by M. W. J. C. The familiarization procedure was set up in close collaboration with an experienced occupational therapist (J. W.). M. W. J. C. supervised all additional aided 6MWTs, which were also performed in accordance with American Thoracic Society guidelines.[22] At the end of the 6MWTs, patients were asked to complete a questionnaire about their preference for and confidence in and the safety of the ambulation aid (e-Appendix 1).

Outcomes

Primary outcome was the difference in 6MWD (in meters) between the modern draisine and the rollator. In addition, several explanatory outcomes were assessed: the number of assessor-initiated stops (based on an exercise-induced oxygen saturation < 80%), transcutaneous oxygen saturation, heart rate, Borg symptom scores for dyspnea and fatigue[24] before and after each 6MWT and after 2 min of recovery, metabolic requirements during each 6MWT, number of strides, stride length, root mean square of the acceleration in mediolateral direction, walk ratio, and patient's preference for and confidence in the ambulation aid. See e-Appendix 1 for details.

Statistics

Data are presented as mean and SD, unless noted otherwise. The paired-samples *t* test was used to assess differences between the use of the rollator and the modern draisine. A priori, the level of significance was set at ≤ .05. No adjustment was made to the statistical significance level for multiple comparisons. All data were analyzed with SPSS, version 17.0 (SPSS Inc).