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ORIGINAL REPORT

ROLLATOR USE ADVERSELY IMPACTS ON ASSESSMENT OF GAIT AND MOBILITY DURING GERIATRIC REHABILITATION

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Objective: **To investigate the influence of the use of a rollator walking aid on assessment of gait and mobility.**
Design: **Prospective, longitudinal study.**
Subjects: **Geriatric patients during inpatient rehabilitation (n=109; mean age 83.1 years).**
Methods: **Assessment at the beginning and prior to discharge from rehabilitation using: gait-analysis (GAITRite®, speed, cadence, stride-time, stride-length, base-of-support, double-support), Performance-Oriented-Mobility-Assessment (POMA), and Timed-Up-and-Go (TUG). Differences between outcomes obtained without and with rollator use were calculated for baseline assessment and for changes over time for the total group and subgroups according to diagnosis (hip fracture vs. other). Responsiveness was calculated using standardized response means.**
Results: **Baseline performances were significantly ($p \leq 0.05$) higher when assessed with vs. without rollator in the total group and in hip fracture (except cadence) and other (except cadence, stride-time, TUG) patients. Changes over time were significantly greater when assessed without vs. with rollator in the total group and hip fracture (except cadence, POMA) and other patients (except base-of-support, double-support). Tests without rollator showed superior responsiveness (except TUG).**
Conclusion: **The use of rollator walking aids limits the detection of initial gait and mobility deficits, adversely affects the assessment of changes over time in gait and mobility performance, and reduces the responsiveness of tests. When full weight-bearing is permitted, assessment without a walking aid is recommended.**

Key words: assistive devices; rollator; walking aid; geriatric assessment; geriatric rehabilitation; gait; mobility; treatment outcome; responsiveness.

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INTRODUCTION

Assistive devices for mobility, such as rollator walking aids, are frequently used to support independent ambulation and social participation (1). These walking aids are prescribed routinely during geriatric rehabilitation to compensate for balance and mobility deficits (2), protect against falls (3), and increase activity and participation in patients with mobility limitations (4).

Assistive devices are also used during gait and mobility assessment (5–12). However, whether a walking aid is employed during the assessment is based predominately on therapeutic or security-related reasons with little or no regard to methodological considerations. Manuals of established gait and mobility tests (6–8) are lacking with respect to the standardization of walking aid use (5). This lack of standardization during assessment negatively impacts on the reproducibility and comparability of test outcomes (5, 9–11). Cross-sectional studies have demonstrated that use of assistive devices during assessment substantially influences test results (5, 9–15). For example, patients after hip prosthesis implantation and capable of full weight-bearing demonstrate a substantially improved gait pattern due to walking aids (13, 14), and wheeled walkers can lead to faster walking speeds (5, 15) and increased step length (15) in frail elderly patients. The influence of walking aids depends on the type of aid (9–11), the type of mobility or gait tests (5), the patient experience with a device (5), and the functional level of subjects with motor limitations, such as hemiplegia (12).

During geriatric rehabilitation, the use of walking aids may substantially hinder the detection of initial gait and mobility deficits and impair the assessment of rehabilitation-related changes over time, thus substantially restricting the responsiveness (16) of tests. The lack of standardization with regard to assistive devices during assessment has been discussed as a potential confounder when assessing changes in gait and mobility performance over time (9, 10). However, existing longitudinal studies investigating mobility in geriatric patients, e.g. by Timed-Up-and-Go (TUG) performances, do not specify particular walking aids used during testing (11), thereby disallowing a calculation of the effects of walking aids on test results.

To our knowledge, no study has thus far systematically investigated the effect of walking aids on gait and mobility assessment in a prospective longitudinal design. The aim of the present study was to measure the effect of walking aids on gait and mobility assessment during geriatric rehabilitation. It was hypothesized that the use of a rollator walking aid during testing hampers the diagnosis of initial gait and mobility deficits and adversely effects the assessment of changes in gait and mobility performance over time.

METHODS

Study population and design

Patients were recruited consecutively from two rehabilitation wards of a geriatric hospital between April 2007 and November 2008. Recruitment was first restricted to hip fracture patients (April 2007 to May 2008). To enlarge the sample, stroke patients (January 2008 to May 2008) and other patient groups (May 2008 to November 2008) were also recruited. Inclusion criteria were: (*i*) no severe cognitive impairment (Mini-Mental State Examination (17) (MMSE) score ≥17); (*ii*) allowed full weight-bearing post-operatively; (*iii*) ability to walk at least 4 m without a walking aid; (*iv*) use of a rollator at the beginning of rehabilitation; (*e*) no uncontrolled neurological, cardiovascular, or metabolic disorders; (*f*) no severe visual defects; and (*g*) written informed consent. A rollator walking aid was defined as any walking aid with 4 wheels. The study was designed as a prospective, longitudinal study with assessment at the beginning and prior to discharge of a 3-week rehabilitation period and was approved by the ethics committee of the medical department at the University of Heidelberg.

Gait and mobility assessment

Standardized gait and mobility assessment was conducted by a trained therapist. Patients performed all tests without and with a rollator walking aid. Testing was conducted in a randomized order. Due to the patients' low initial functional level only one trial of each test was performed. No physical assistance was allowed. Observers were blinded to baseline data at re-test.

Computerized gait analysis. Gait performance was measured during walking at maximum speed by using a GAITRite®-System (CIR Systems Inc., Havertown, PA, USA). The GAITRite® is an electronic gait analysis system (4.9 m long) based on embedded pressure sensors, which shows high concurrent validity relative to a three-dimensional motion analysis system (18). Quantification of spatio-temporal gait parameters (speed, cadence, stride-time, stride-length, base of support, and double-support as percentage of stride-time) was used for documentation of gait deficits and identification of changes over time in gait performance (7).

Performance-Oriented-Mobility-Assessment (POMA). The POMA (8) is a reliable and valid clinical test to assess gait and mobility deficits in specified motor tasks, related to risk of falling (i.e. rising from a chair, standing balance, turning, initiating gait, sitting down) in elderly people and patient populations (19). The total range is 0–28 scores, with higher values indicating better performance. An experienced therapist instructed the patients how to perform the manoeuvres, supervised the patients, and scored each patient's performance.

TUG. The TUG was used to test patients' basic functional mobility. The TUG is a reliable and valid clinical test (6, 20) to quantify mobility performance by timing patients with a stopwatch while rising from an armchair, walking 3 m, turning, walking back, and sitting down again (as fast as possible).

Clinical characteristics

Descriptive data, including age, gender, cognitive status (Mini-Mental State Examination (MMSE)), medication (*n*), comorbidity (Cumulative Illness Rating Scale (CIRS)) (21), screening for depression (15 point Geriatric Depression Scale (GDS) (22), 5–9 points indicate mild-moderate depressive symptoms, ≥10 indicate severe depressive symptoms), fear of falling (single-item question) (23), functional status (activities of daily living (ADL)) (24), and pain (visual analogue scale (VAS)) (25) were documented by standardized interview.

Data analysis

Statistical procedures were performed on SPSS 17.0 for Windows. Analysis was performed for the total group (TG) and for subgroups according to diagnosis of hip fracture (HF) and other diagnoses (OD). Exploratory data analysis determined the variability and distribution of outcome variables. For continuous variables, comparisons between subgroups were performed using the *t*-test when normally distributed, or the Mann-Whitney *U* test when not. The χ^2 test was used for dichotomous variables. For evaluating the influence of rollator use during baseline assessment, differences between results obtained with and without a rollator were calculated by the paired *t*-test when normally distributed or the Wilcoxon test when not. To analyse the influence of rollator use on the assessment of changes over time, pre-to post- changes in results obtained with and without rollator were compared using paired *t*-tests.

In addition, the responsiveness of the gait and mobility tests for detecting changes over time with and without a rollator was evaluated using the standardized response mean (SRM) (26). This effect size is calculated by dividing the mean of measurement differences by the standard deviation (SD) of those differences to obtain a standardized estimate to compare the different tests. To interpret the effect size we used Cohen's criteria: ≥0.2, small; ≥0.5, moderate; ≥0.8, large effect (27). Data are presented as means (SD). The level of significance was set at $p \leq 0.05$.

RESULTS

Patient characteristics

Of 364 patients screened for eligibility 255 met the exclusion criteria and 109 were enrolled (Fig. 1). Admission diagnoses were HF (48%), followed by respiratory and cardiac disease (17%), and stroke (12%). Twenty-three percent of the patients had a miscellaneous diagnosis, such as surgery after cancer, syncope, or arthrosis/arthritis. No major health problem occurred during testing and no patients were excluded from assessment. Drop outs were related to death (*n*=1), serious medical events during rehabilitation, which excluded further assessment (*n*=4), or lost for follow-up due to premature discharge (*n*=3).

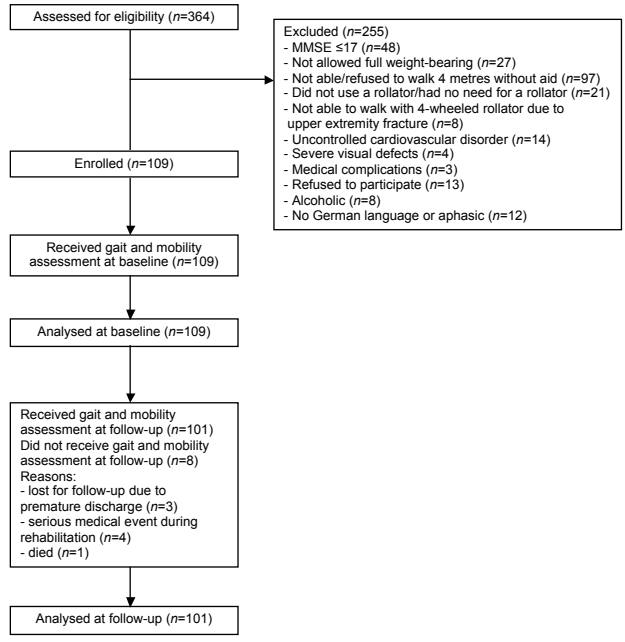

Fig. 1. Progress through the phases of screening, enrolment, baseline assessment, follow-up assessment and data analysis. MMSE: Mini-Mental State Examination.

Table I. *Patient characteristics for the total group and subgroups*

Variable	Total group ($n=109$)	Hip fracture ($n=52$)	Other diagnosis ($n=57$)	p-value[a]
Age, years, mean (SD)	83.1 (5.5)	82.7 (5.5)	83.3 (5.6)	0.527
Gender, *n* (%)				0.049
Male	16 (14.7)	4 (7.7)	12 (21.1)	
Female	93 (85.3)	48 (92.3)	45 (78.9)	
MMSE, score, mean (SD)	24.4 (3.6)	25.3 (2.9)	23.6 (3.9)	0.009
CIRS, score, mean (SD)	22.7 (2.6)	22.6 (2.4)	22.9 (2.7)	0.489
Medications, *n*, mean (SD)	8.6 (3.2)	8.9 (3.1)	8.3 (3.2)	0.313
ADL, score, median (range)	70.0 (25–90)	67.5 (25–80)	70.0 (25–90)	0.767
GDS, score, mean (SD)	4.5 (3.2)	4.5 (3.4)	4.6 (3.1)	0.829
VAS Pain score, mean (SD)	3.3 (2.5)	4.1 (2.0)	2.5 (2.6)	0.001
Fear of falling, number of patients (%)	78 (72.9)	44 (86.3)	34 (60.7)	0.003
Days of rehabilitation, mean (SD)	14.6 (3.4)	14.1 (3.8)	15.0 (3.0)	0.260
Walking aid prior to rehabilitation, *n* (%)	70 (64.2)	33 (63.5)	37 (64.9)	0.875

[a]*p*-values for *t*-tests (age, MMSE, CIRS, medications, GDS, VAS, days of rehabilitation), χ^2 (gender, fear of falling, walking aid prior to rehabilitation) and Mann-Whitney *U* test (ADL) applied to test for differences between the hip fracture and other diagnosis subgroup.
SD: standard deviation; MMSE: Mini-Mental State Examination; CIRS: Comorbidity Illness Rating Scale; ADL: activities of daily living (Barthel Index, range 0–100); GDS: Geriatric Depression Scale (range 0–15), VAS: visual analogue scale for pain (range 0–10, higher scores indicate more pain).

Baseline characteristics are summarized in Table I. Thirty-seven percent had cognitive impairment (MMSE ≤24) and 48.6% had a possible depressive disorder based on the results of the screening tool (GDS) (41.1% GDS 5–9, 7.5% GDS ≥10 points). Seventy-seven percent of patients had a moderate to severe functional impairment (Barthel Index < 75). The HF group had marginally more females ($p=0.049$) and HF patients reported more pain ($p=0.001$) and a stronger fear of falling ($p=0.003$).

Baseline results of gait and mobility tests are summarized in Table II. Physical performance at baseline was low: maximum gait speed (as assessed without walking aid) averaged 63 cm/s, POMA averaged 12.3 points and the median TUG was 21.4 seconds. Seventeen patients were unable to perform the initial TUG test because of inability and/or fear of falling in turning around without assistance or inability to get out of a chair without assistance. Performances were lower in HF patients for GAITRite® (speed: $p=0.012$, stride-length: $p=0.003$, double-support: $p=0.002$) POMA ($p<0.001$) and TUG ($p=0.011$) compared with patients with OD when assessed without a rollator. Performances assessed with a rollator only differed between subgroups for the POMA ($p<0.001$) but not for GAITRite® ($p=0.155$–0.679) and TUG ($p=0.124$).

Influence of rollator use on baseline gait and mobility assessment

Differences between test results obtained without and with a rollator at baseline are summarized in Table III. Use of the rollator during baseline assessment led to significantly improved performances in all tests applied in the TG and in subgroups of HF (except cadence: $p=0.090$) and OD (except cadence: $p=0.080$, stride-time: $p=0.112$, TUG $p=0.162$)

Table II. *Baseline results in gait and mobility tests assessed with and without rollator walking aid*

Variable	Total group ($n=109$)	Hip fracture ($n=52$)	Other diagnosis ($n=57$)	p-value[a]
GAITRite, mean (SD)				
With rollator				
Speed, cm/s	82.61 (30.46)	78.26 (28.38)	86.58 (31.96)	0.155
Cadence, steps/min	106.86 (24.16)	104.23 (23.99)	109.24 (24.28)	0.282
Stride-time, s	1.20 (0.37)	1.23 (0.43)	1.16 (0.30)	0.304
Stride-length, cm	91.40 (22.91)	88.63 (21.47)	93.92 (24.06)	0.231
Base-of-support, cm	9.62 (3.18)	9.49 (2.83)	9.74 (3.49)	0.679
Double-support, % of GC	31.18 (8.65)	32.25 (8.39)	30.19 (8.84)	0.216
Without rollator				
Speed, cm/s	62.92 (36.04)	53.87 (33.54)	71.18 (36.52)	0.012
Cadence, steps/min	103.06 (28.85)	100.09 (31.56)	105.76 (26.12)	0.307
Stride-time, s	1.37 (0.89)	1.46 (1.02)	1.29 (0.74)	0.298
Stride-length, cm	69.39 (30.90)	60.23 (27.84)	77.75 (31.40)	0.003
Base-of-support, cm	13.42 (4.12)	13.24 (3.83)	13.59 (4.40)	0.657
Double-support, % of GC	42.03 (19.40)	48.13 (21.98)	36.48 (14.81)	0.002
POMA, score, mean (SD)				
With rollator	19.30 (5.33)	17.20 (5.79)	21.21 (4.07)	<0.001
Without rollator	12.26 (5.33)	10.33 (4.71)	14.02 (4.06)	<0.001
TUG[b], s, median (range)				
With rollator	18.8 (10.8–48.5)	20.2 (11.9–48.5)	18.4 (10.8–45.9)	0.124
Without rollator	21.4 (8.6–92.6)	24.3 (12.0–90.1)	17.1 (8.6–92.6)	0.011

[a]*p*-values for *t*-tests (GAITRite, POMA) and Mann-Whitney *U* Test (TUG) applied to test for differences between the hip fracture and other diagnosis subgroup. [b]Due to mobility deficits and/or fear of falling (floor effects) the TUG could only be performed in $n=92$ (total group), $n=40$ (hip fracture), $n=52$ (other diagnosis) SD: standard deviation; POMA: Performance-Oriented-Mobility-Assessment (range 0–28); TUG: Timed-Up-and-Go; GC: gait cycle.

patients. Walking aid-related within-patient differences were more pronounced in HF compared with OD patients for gait speed ($p = 0.008$), stride-length ($p < 0.001$) and double-support ($p = 0.001$), but not for other gait parameters ($p = 0.394$–0.871), POMA ($p = 0.645$) and TUG (0.092).

Influence of rollator use on the assessment of changes over time in gait and mobility performance

Pre- to post-changes in gait and mobility performance assessed without and with a rollator are summarized in Table IV. In the TG changes over time were greater for all tests when assessment was performed without a walking aid compared with assessment with a rollator ($p \leq 0.001$–0.006). Greater changes without a walking aid were also found in the subgroups (HF: $p \leq 0.001$–0.021; OD: $p \leq 0.001$–0.050), except for the POMA ($p = 0.326$) and cadence ($p = 0.067$) in HF patients, and base-of-support ($p = 0.151$) and double-support ($p = 0.057$) in OD patients.

Larger SRMs were evident for GAITRite® parameters and POMA without vs. with a rollator, indicating higher responsiveness of tests when assessed without a walking aid. Peak responsiveness was obtained in HF patients for gait speed (SRM 1.13) and for the POMA (SRM 1.28), both when assessed without a walking aid. Whereas for the TUG, responsiveness was not superior without a walking aid compared with using a rollator (Table IV).

DISCUSSION

This longitudinal study investigated the influence of walking aids on the assessment of functional outcomes in geriatric rehabilitation. The results highlight that the use of rollator walking aids during testing limits both the detection of initial gait and mobility deficits and the assessment of changes over time in gait and mobility performance in geriatric patients.

Influence of rollator use on baseline gait and mobility assessment

The use of a rollator during testing enabled patients to compensate for impairments in gait and mobility, as indicated by significantly higher performances in all tests in the TG when assessed with a rollator compared with without a walking aid. Stabilizing adaptations during walking, such as increasing double-support phase and base of support, related to limitations in dynamic balance control (28), were significantly reduced by use of the rollator. Similar beneficial effects of rollators on gait performance in frail elderly subjects have been reported in earlier studies (5, 15) and relate to reduced weight-bearing on the lower extremities (29) and increased base of support, allowing a greater range of centre of mass motion to be tolerated without loss of stability (2).

In the present study in particular, the patients in the HF subgroup who exhibited significantly inferior gait and mobility performance, more fear of falling, and more pain compared with OD patients, could substantially improve gait performance by the use of a rollator. Consistent with the findings of earlier studies (12), our results demonstrate that more severely disabled patients profit most when using a walking aid.

Although rollators are important for increasing the safety and security of geriatric patients (2, 3), the results of this study demonstrate that they confound initial gait and mobility assessments. The benefits of assistive devices, such as enhancing gait stability, conflict with the detection of functional limitations. A major goal of geriatric assessment is the sound diagnosis of gait and mobility deficits (30). Thus, testing without a walking aid is advisable if the ability to walk without an aid is feasible and the bearing of full body-weight is not restricted.

Influence of rollator use on the assessment of changes over time in gait and mobility performance

The most important finding of this study was that the use of rollators during pre- and post-testing led to a substantial un-

Table III. *Differences between test results obtained with and without rollator walking aid at baseline*

	Total group ($n = 109$)		Hip fracture ($n = 52$)		Other diagnosis ($n = 57$)		Difference between subgroups
Variable	Difference without-with rollator	p-value[a]	Difference without-with rollator	p-value[a]	Difference without-with rollator	p-value[a]	p-value[b]
GAITRite, mean (SD)							
Speed, cm/s	+19.69 (17.87)	<0.001	+24.40 (18.97)	<0.001	+15.40 (15.78)	<0.001	0.008
Cadence, steps/min	+3.79 (15.94)	0.014	+4.15 (17.29)	0.090	+3.48 (14.75)	0.080	0.828
Stride-time, s	–0.18 (0.63)	0.004	–0.23 (0.67)	0.017	–0.13 (0.59)	0.112	0.394
Stride-length, cm	+22.00 (17.85)	<0.001	+28.40 (17.80)	<0.001	+16.17 (15.91)	<0.001	<0.001
Base-of-support, cm	–3.80 (3.15)	<0.001	–3.75 (3.52)	<0.001	–3.85 (2.80)	<0.001	0.871
Double-support, % GC	–10.86 (15.11)	<0.001	–15.88 (16.97)	<0.001	–6.28 (11.56)	<0.001	0.001
POMA, score, mean (SD)	+7.04 (3.57)	<0.001	+6.87 (3.24)	<0.001	+7.19 (3.87)	<0.001	0.645
TUG[c], s, mean (SD)	–4.78 (11.16)	<0.001	–7.15 (13.03)	0.002	–3.02 (9.28)	0.162	0.092

Decreasing values in stride-time, base-of-support, double-support and TUG and increasing values in all other parameters indicate improvements. [a]p-values for paired t-tests (GAITRite, POMA) and Wilcoxon test (TUG) applied to test for within-group differences between test results obtained without and with rollator. [b]p-values for t-tests applied to test for differences between subgroups. [c]Due to mobility deficits and/or fear of falling (floor effects) TUG could only be performed in $n = 92$ (total group), $n = 40$ (hip fracture), $n = 52$ (other diagnosis).The differences (means) between test results obtained without and with rollator for the total group and subgroups are shown. SD: standard deviation; POMA: Performance-Oriented-Mobility-Assessment; TUG: Timed–Up-and-Go; GC: gait cycle.

derestimation of gains in gait and mobility performance. In the TG, changes over time were significantly more pronounced without a walking aid in all tests. Objective analysis of gait performance, as assessed by GAITRite®, displayed underlying mechanisms of walking aid-related differences. Unaided walking allowed a sound analysis of clinically relevant changes in gait pattern: substantially increased step-length, decreased double-support phase within the gait cycle, and reduced base-of-support indicated increased gait stability and revealed a considerable improvement in patients' gait performance. In contrast, only minor changes in gait parameters were found when testing was performed with a rollator. Similar results were found for TUG and POMA, except for HF patients, where rollator-related differences between POMA results were not significantly different. This suggests that visual observation of changes in mobility performance is not necessarily influenced by rollator use in specific subgroups. Obviously, the considerable changes in mobility performance of the HF patients was observable either with or without a rollator. However, objective GAITRite® testing and TUG results clearly demonstrate the influence of rollator use on test results also in HF patients.

Responsiveness of gait and mobility tests to detect clinically relevant changes over time was adversely affected by use of the rollator during testing. Both GAITRite® parameters and POMA scores were most responsive to changes in gait and mobility when assessed without a walking aid. For the TUG, although changes over time in performance had been significantly greater when assessed without a rollator, responsiveness did not increase due to a high variability of outcomes, as some patients performed the TUG to the limits of their physical ability.

All patients in our study were allowed to bear full weight, only 7% of consecutively recruited patients were excluded due to a limited capability of weight-bearing, which is comparable to the level in other studies (11). Yet this allowance of full weight-bearing does not mean that gait and mobility performance is consistently assessed without a walking aid, as there is a lack of consensus among clinicians with respect to the use of walking aids (10, 12). Whereas some advocate the least possible support by walking aids, others feel that walking aids can give patients the support and confidence to walk (12). The results of the present study demonstrate that the function of assistive devices to increase safety and support mobility during rehabilitation conflicts with the quest for standardized, unbiased measurements.

The study has some limitations. In agreement with earlier studies (10, 31, 32) we documented floor effects in established gait and mobility tests used in this study. Twenty-seven percent of patients initially assessed for eligibility were unable or refused to walk 4 m without a walking aid and thus were excluded. Sixteen percent of included patients were unable to perform the initial TUG without assistance due to motor inability and/or fear of falling in turning, as was also found in other studies (33). This might have biased the results and limits the comparison between TUG and the other gait and mobility tests used in this study. Our results are restricted with respect to the use of a rollator as the assistive device, the

Table IV. *Pre- to post changes in gait and mobility tests assessed with and without rollator walking aid*

	Total group (n=101)			Hip fracture (n=48)			Other diagnosis (n=53)		
Variable	Change pre-post	SRM	p-value[a]	Change pre-post	SRM	p-value[a]	Change pre-post	SRM	p-value[a]
GAITRite, mean (SD)									
Without rollator									
Speed, cm/s	+21.97 (22.87)	+0.96	<0.001	+23.50 (20.88)	+1.13	<0.001	+20.59 (24.64)	+0.84	0.004
Cadence, steps/min	+13.10 (18.46)	+0.71	0.006	+13.59 (17.23)	+0.79	0.067	+12.66 (19.66)	+0.64	0.042
Stride-time, s	–0.23 (0.48)	–0.46	<0.001	–0.31 (0.65)	–0.48	0.005	–0.15 (0.24)	–0.63	0.026
Stride-length, cm	+14.61 (18.51)	+0.79	<0.001	+17.51 (19.07)	+0.92	<0.001	+11.98 (17.75)	+0.67	0.003
Base-of-support, cm	–1.14 (3.55)	–0.32	0.001	–1.97 (3.38)	–0.58	0.001	–0.38 (3.56)	–0.11	0.151
Double-support, % of GC	–8.01 (13.23)	–0.61	<0.001	–11.19 (16.94)	–0.66	<0.001	–5.13 (7.73)	–0.66	0.057
With rollator									
Speed, cm/s	+13.11 (21.10)	+0.62	–	+13.18 (19.21)	+0.69	–	+13.05 (22.87)	+0.57	–
Cadence, steps/min	+8.91 (15.88)	+0.56	–	+9.81 (15.34)	+0.64	–	+8.10 (16.47)	+0.49	–
Stride-time, s	–0.07 (0.26)	–0.27	–	–0.12 (0.33)	–0.36	–	–0.07 (0.17)	–0.41	–
Stride-length, cm	+6.87 (15.51)	+0.44	–	+6.96 (14.33)	+0.49	–	+6.79 (16.63)	+0.41	–
Base-of-support, cm	–0.08 (2.25)	–0.04	–	–0.43 (2.09)	–0.21	–	+0.23 (2.36)	+0.10	–
Double-support, % of GC	–2.68 (7.50)	–0.36	–	–2.54 (6.42)	–0.40	–	–2.80 (8.41)	–0.33	–
POMA, score, mean (SD)									
Without rollator	+5.29 (4.65)	+1.14	0.003	+6.18 (4.84)	+1.28	0.326	+4.49 (4.36)	+1.03	<0.001
With rollator	+3.61 (4.44)	+0.81	–	+5.50 (4.66)	+1.18	–	+1.91 (3.47)	+0.55	–
TUG[b], s, mean (SD)									
Without rollator	–7.78 (11.84)	–0.66	<0.001	–11.15 (14.51)	–0.77	0.021	–5.25 (8.70)	–0.60	0.050
With rollator	–4.34 (6.01)	–0.72	–	–5.78 (7.59)	–0.76	–	–3.20 (4.30)	–0.74	–

[a]p-values for paired t-tests applied to test for differences between pre-post changes obtained without rollator vs. with rollator. [b]Due to mobility deficits and/or fear of falling (floor effects) the TUG could only be performed in n=84 (total group), n=36 (hip fracture), n=48 (other diagnosis). Given are the pre- to post changes (means) in gait and mobility test performed without and with rollator. Decreasing values in stride-time, base-of-support, double-support and TUG and increasing values in all other parameters indicate improvements. SD: standard deviation; POMA: Performance-Oriented-Mobility-Assessment; TUG: Timed-Up-and-Go; GC: gait cycle; SRM: standardized response means as indicator for the responsiveness of parameters, Liang 1995 (26).

specific time period of geriatric rehabilitation as measured in this study, and the specific study sample of geriatric patients with limited initial gait and mobility performance.

In conclusion, the results of this study demonstrate that the use of rollator walking aids limits the detection of initial gait and mobility deficits, adversely affects the assessment of changes over time in gait and mobility performance, and reduces responsiveness of test. Clinicians and researchers should be aware of the impact of walking aids on common outcome measures when assessing and interpreting gait and mobility performance of frail older patients. Based on the premise that assessment methods with the highest probability of demonstrating significant change would be the most desirable (34), we suggest testing without a walking aid if full weight-bearing is permitted.

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