Archives of ISPRM 2026;1(2):171-179

Original Article

Brace-removal transition, gait changes, and early falls after arthroscopic rotator cuff repair

Aya Kamimura[1], Kazumasa Takayama[2]

[1]Department of Rehabilitation, Mabi Memorial Hospital, Kurashiki, Okayama, Japan
[2]Department of Orthopaedic Surgery, Kurashiki Central Hospital, Kurashiki, Okayama, Japan

Abstract

Objectives: This study examined whether gait and trunk acceleration changes around brace removal were associated with falls within 30 days after discharge after arthroscopic rotator cuff repair (ARCR).

Patients and methods: This single-center exploratory observational study included 49 patients who underwent ARCR with a 30-day follow-up between May 2025 and April 2026. Gait was assessed immediately before brace removal (T3) and immediately after brace removal on the day of discharge (T4) using a triaxial accelerometer at the third lumbar vertebra. Gait speed, step length, and trunk acceleration root-mean-square (RMS) were analyzed. Falls within 30 days after discharge were recorded during outpatient rehabilitation visits. Between-group comparisons used the Mann-Whitney U test, Fisher's exact test, and Cohen's d.

Results: Forty-nine participants were divided into two groups based on their fall status: non-fallers (21 males, 15 females; mean age: 70.7 ± 7.9 years; range, 48 to 84 years) and fallers (5 males, 8 females; mean age: 74.8 ± 6.0 years; range, 65 to 86 years; 13/49, 26.5%). Median time from the post-brace removal assessment to first fall was two days (interquartile range 1-6), and 11 of 13 fallers (84.6%) fell within seven days. Before brace removal, no group differences were observed. After brace removal, fallers showed lower gait speed, shorter step length, and higher RMS total. Changes across brace removal showed the largest between-group differences in all primary gait parameters (all $p \leq 0.010$; Cohen's d = 0.82-1.44).

Conclusion: Early falls after ARCR were associated with gait and trunk-control changes across brace removal rather than with pre-removal gait performance itself. Clinicians should consider reassessing gait and providing targeted fall-prevention education at the time of brace removal.

Keywords: Exploratory observational study, gait analysis, postoperative falls, rotator cuff repair, shoulder abduction brace, trunk acceleration, wearable accelerometer.

Arthroscopic rotator cuff repair (ARCR) is a common surgical treatment for symptomatic rotator cuff tears, particularly in older adults. After ARCR, the repaired tendon is typically protected for several weeks with a shoulder abduction brace as part of postoperative care.[1] Although the operated limb is the upper extremity, shoulder immobilization can restrict arm swing and trunk rotation during walking, both of which contribute to dynamic gait stability.[2] Older patients

Submitted: May 11, 2026
Accepted: June 14, 2026
Published: June 23, 2026

Correspondence: Aya Kamimura, OT. Department of Rehabilitation, Mabi Memorial Hospital, Kurashiki, Okayama 710-1313, Japan.

E-mail: ayakamimura0214@gmail.com

Doi: https://doi.org/10.5606/archisprm.2026.70

Citation:
Kamimura A, Takayama K. Brace-removal transition, gait changes, and early falls after arthroscopic rotator cuff repair. Arch ISPRM 2026;1(2):171-179. https://doi.org/10.5606/archisprm.2026.70.

undergoing ARCR may also share characteristics of fall-prone populations, including age-related decline in balance and comorbidities such as diabetes mellitus.[3,4]

Sonoda et al.[5] reported that patients using a shoulder abduction brace after ARCR demonstrated changes in gait performance and experienced postoperative falls more frequently than patients after total hip or knee arthroplasty during a comparable period. Their findings indicate that mobility safety should not be overlooked after upper-limb surgery. However, the specific period around brace removal has received little attention.

The day of brace removal represents a transition from a constrained to an unconstrained postural state. Patients are released from upper-limb immobilization, and the gait-related contributions of the upper limbs and trunk must be reintegrated. This transition often coincides with hospital discharge, when patients return to the home environment with new movement freedom but without continuous inpatient supervision.

Wearable accelerometers have been used to characterize gait and fall risk in older adults, including trunk acceleration features related to gait stability.[6-8] However, few studies have focused on the brace-removal transition after upper-limb surgery or on the temporal relationship between gait changes and subsequent falls. We hypothesized that falls after ARCR would be associated less with pre-removal gait performance itself than with the magnitude of gait and trunk-control changes around brace removal. The aim of this exploratory observational study was to examine whether changes in gait and trunk acceleration parameters between immediately before brace removal (T3) and immediately after brace removal on the day of discharge (T4) were associated with falls within 30 days after discharge in patients who underwent ARCR.

PATIENTS AND METHODS

This was a single-center exploratory observational study conducted at Mabi Memorial Hospital, Department of Rehabilitation in Japan. Consecutive patients who underwent ARCR at the institution between May 2025 and March 2026 were screened for eligibility, and follow-up assessments were completed by April 2026. Written informed consent was obtained from all participants prior to participation. The study protocol was approved by the Mabi Memorial Hospital Ethics Committee (Date: 22.04.2025, Approval number: 2025-102). The study was conducted in accordance with the principles of the Declaration of Helsinki. Reporting follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.[9] Inclusion criteria were as follows: (1) age ≥ 20 years; (2) ARCR performed for a rotator cuff tear; (3) postoperative shoulder abduction brace use as standard care; and (4) ability to walk independently without a walking aid during the inpatient stay. Exclusion criteria were as follows: (1) revision shoulder surgery; (2) bilateral rotator cuff repair during the same admission; (3) neurological or musculoskeletal conditions that independently affect gait, such as stroke or recent lower-extremity surgery; (4) inability to complete gait measurement at either assessment time point; and (5) requirement for a walking aid during gait assessment.

Postoperative protocol and tear-size protocol

All patients followed the institutional postoperative rehabilitation protocol, including shoulder abduction brace immobilization for approximately four weeks. Postoperative rehabilitation was conducted according to the institutional medium-tear or large-tear protocol. Protocol selection was based on intraoperative findings and the operating surgeon’s judgment. In all participants included in the analysis, the day of brace removal coincided with the day of hospital discharge.

Gait measurements

Gait was evaluated at two study-specific time points around brace removal: immediately before brace removal (T3) and immediately after brace removal on the day of discharge (T4). These two time points were selected since they directly captured the clinical transition from brace immobilization to brace-free walking.

Gait was measured along an indoor straight walkway. A 10-m steady-state walking section was analyzed. Participants walked at their self-selected comfortable speed without walking aids. Three consecutive trials were recorded at both assessment time points, and the mean value was used for analysis.

Gait acceleration was recorded using a triaxial accelerometer module (AYUMI EYE Medical, Waseda Elderly Health Association Co., Ltd., Tokyo, Japan) attached at the level of the third lumbar vertebra (L3) using an elastic belt. The sampling frequency was 31.25 Hz. The dedicated AYUMI EYE software automatically processes triaxial acceleration signals, including internal gravity correction and filtering, and outputs device-derived parameters, including gait speed, step length, and trunk acceleration root-mean-square (RMS). We used the device-derived output values without modifying the proprietary signal-processing algorithm. Trunk acceleration RMS was calculated for the resultant signal (RMS total) and for each anatomical axis, including anteroposterior RMS. Directional accelerations were also derived as exploratory variables. Measurements were performed by trained rehabilitation staff using a standardized procedure.

Outcome

The primary outcome was the occurrence of any fall within 30 days after discharge. A fall was defined according to the Prevention of Falls Network Europe (ProFaNE) consensus as an unexpected event in which the participant comes to rest on the ground, floor, or lower level.[10] Fall occurrence, fall count, and the date of the first fall were assessed during routine outpatient rehabilitation visits for at least one month after discharge. Patients attended outpatient rehabilitation approximately twice per week and continued rehabilitation for approximately six months. At each visit, patients were directly asked whether they had experienced a fall since the previous visit. Reported falls, including the number and date of falls, were documented in the medical record. Falls occurring on the day of brace removal and discharge were coded as day 0. The number of days from the post-brace removal assessment to the first fall was calculated. Fall-related injuries were not systematically recorded in this study.

Statistical analysis

No formal sample size calculation was performed; this was a consecutive-patient exploratory study in which all eligible patients were enrolled during the study period. For each

Table 1. Participant characteristics by group

	Non-fallers (n = 36)				Fallers (n = 13)						
Characteristic	n	%	Mean ± SD	Range	n	%	Mean ± SD	Range	r	ϕ	*p*
Age (year)			70.7 ± 7.9	48-84			74.8 ± 6.0	65-86	0.31		0.10
Sex										0.18	0.33
Male	21				5						
Female	15				8						
BMI (kg/m²)			23.4 ± 3.5				23.5 ± 3.3		0.05		0.78
Height (cm)			160.4 ± 9.5				155.7 ± 6.8		−0.34		0.07
Weight (kg)			60.7 ± 13.3				57.2 ± 9.5		−0.11		0.57
Affected side										0.03	1.00
Right	21				8						
Left	15				5						
Brace duration (weeks)			4.3 ± 0.7				4.6 ± 1.0		0.17		0.18
Diabetes mellitus	5	13.9			6	46.2				0.34	0.047
Pre-injury fall history	5	13.9			1	7.7				−0.08	1.00
Large-tear rehabilitation protocol	6	16.7			4	30.8				0.15	0.42

SD, standard deviation; BMI, body mass index; r, rank-biserial correlation (continuous variables); ϕ, phi coefficient (categorical variables). Continuous variables were compared using the Mann-Whitney U test; categorical variables using Fisher's exact test.

gait parameter, the change from the pre-brace removal to the post-brace removal assessment was calculated. For Table 1, effect sizes are reported as rank-biserial correlations (r) for continuous variables and phi coefficients (ϕ) for categorical variables. Patients were dichotomized into fallers (≥ 1 fall within 30 days after discharge) and non-fallers. Continuous variables were compared between groups using the Mann-Whitney U test and categorical variables using Fisher's exact test. Cohen's d was calculated as a standardized effect size for the primary variables of interest.[11] The primary variables of interest were the changes across brace removal in gait speed, step length, RMS total, and anteroposterior RMS. Given the exploratory nature of the study and the limited number of fallers (n = 13), no multivariable modeling was performed, no cut-off values were calculated, and no formal correction for multiple comparisons was applied. Effect sizes are reported alongside p-values to facilitate interpretation. All analyses were performed using EZR version 1.65 (Saitama Medical Center, Jichi Medical University, Saitama, Japan), a graphical user interface for R. Statistical significance was set at $p < 0.05$ (two-sided).

RESULTS

Fifty patients initially met the eligibility criteria and were enrolled. One participant was lost before completion of the 30-day follow-up assessment. Therefore, 49 participants completed the 30-day observation period and were included in the final analysis. The participants were divided into two groups based on their fall status: the non-faller group (21 males, 15 females; mean age: 70.7 ± 7.9 years; range, 48 to 84 years) and the faller group (5 males, 8 females; mean age: 74.8 ± 6.0 years; range, 65 to 86 years). Overall, 13 participants experienced at least one fall during the 30-day post-discharge follow-up period, resulting in a fall rate of 26.5%. Participant characteristics by group are shown in Table 1. Fallers tended to be older and shorter than non-fallers, although these differences did not reach statistical significance. Diabetes mellitus was significantly more common in fallers (6 of 13, 46.2%) than in non-fallers (5 of 36, 13.9%; $p = 0.047$). Pre-injury fall history did not differ between groups, with 1 of 13 fallers (7.7%) and 5 of 36 non-fallers (13.9%) reporting a pre-injury fall ($p = 1.00$).

Fall occurrence and timing

Among the 13 fallers, the total number of falls within 30 days was 15: 11 patients fell once, and 2 fell twice. The median time from the post-brace removal assessment to the first fall was 2 days (interquartile range 1-6, range 0-16). Within 2 days, 8 of 13 patients (61.5%) had fallen; within 7 days, 11 of 13 (84.6%) had fallen. The remaining two patients fell on days 15 and 16. The distribution of days from the post-brace removal assessment to the first fall is shown in Figure 1; 11 of 13 falls (84.6%) occurred within the first week, and no falls were observed between days 8 and 14.

Gait and trunk acceleration parameters before and after brace removal

Gait and trunk acceleration parameters before and after brace removal are shown in Table 2. Before brace removal, no significant group differences were observed in gait speed, step length, RMS total, or anteroposterior RMS. Gait speed was 1.10 ± 0.16 m/s in non-fallers and 1.14 ± 0.20 m/s in fallers ($p = 0.71$).

After brace removal on the day of discharge, fallers had significantly lower gait speed (1.00 ± 0.10 m/s *vs.* 1.11 ± 0.18 m/s; $p = 0.018$), shorter step length (53.6 ± 5.1 cm *vs.* 58.6 ± 8.4 cm;

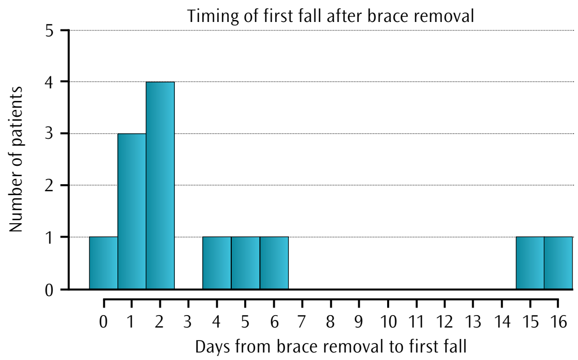

Figure 1. Timing of first fall after brace removal (n = 13). Histogram showing the distribution of days to the first fall after brace removal among the 13 fallers. Each bar represents the number of patients experiencing their first fall on that day. Falls on the day of discharge were coded as day 0. Eight patients (61.5%) fell within 2 days and 11 patients (84.6%) fell within 7 days.

Table 2. Gait and trunk acceleration parameters before and after brace removal by group

	Non-fallers (n = 36)	Fallers (n = 13)	
Time/parameter	Mean ± SD	Mean ± SD	*p*
Before brace removal			
Gait speed (m/s)	1.10 ± 0.16	1.14 ± 0.20	0.71
Step length (cm)	58.6 ± 8.9	59.0 ± 7.9	0.92
RMS total (m/s²)	1.58 ± 0.49	1.46 ± 0.25	0.68
Anteroposterior RMS (m/s²)	1.93 ± 0.67	1.97 ± 1.25	0.38
After brace removal			
Gait speed (m/s)	1.11 ± 0.18	1.00 ± 0.10	0.018
Step length (cm)	58.6 ± 8.4	53.6 ± 5.1	0.032
RMS total (m/s²)	1.52 ± 0.51	1.79 ± 0.39	0.005
Anteroposterior RMS (m/s²)	1.84 ± 0.61	2.29 ± 1.25	0.31
Acceleration toward unaffected side (g)	0.153 ± 0.076	0.110 ± 0.062	0.046
Superior-direction acceleration (g)	0.409 ± 0.189	0.286 ± 0.155	0.046

SD, standard deviation; RMS, root-mean-square of trunk acceleration. Comparisons by the Mann-Whitney U test. T3, immediately before brace removal; T4, immediately after brace removal on the day of discharge.

p = 0.032), and higher RMS total (1.79 ± 0.39 m/s² *vs.* 1.52 ± 0.51 m/s²; p = 0.005) than non-fallers. Anteroposterior RMS after brace removal did not differ significantly between groups (2.29 ± 1.25 m/s² *vs.* 1.84 ± 0.61 m/s²; p = 0.31). Among exploratory directional accelerations, acceleration toward the unaffected side and superior-direction acceleration were lower in fallers.

Change across brace removal

The most pronounced between-group differences were observed in changes across brace removal, as shown in Table 3 and Figure 2. Compared with non-fallers, fallers showed a greater decrease in gait speed (–0.139 ± 0.156 m/s *vs.* +0.015 ± 0.118 m/s; p = 0.003; Cohen's d = –1.20, 95% CI, –1.88 to –0.52), a greater decrease in step length (–5.34 ± 5.62 cm *vs.* –0.05 ± 4.18 cm; p = 0.003; d = –1.15, 95% CI, –1.83 to –0.47), a greater increase in RMS total (+0.340 ± 0.288 m/s² *vs.* –0.061 ± 0.277 m/s²; p < 0.001; d = +1.44, 95% CI, 0.74 to 2.14), and a greater increase in anteroposterior RMS (+0.322 ± 0.573 m/s² *vs.* –0.092 ± 0.483 m/s²; p = 0.010; d = +0.82, 95% CI, 0.16 to 1.48). The change in superior-direction acceleration was also greater, in the negative direction, in fallers (p = 0.039).

Sensitivity analysis excluding participants with diabetes mellitus

To explore whether the observed associations were primarily explained by diabetes, we conducted a descriptive sensitivity analysis

Table 3. Change across brace removal in gait and trunk acceleration parameters by group

	Non-fallers (n = 36)	Fallers (n = 13)			
	Mean ± SD	Mean ± SD	Cohen's d	95% CI	*p*
Gait speed (m/s)	+0.015 ± 0.118	−0.139 ± 0.156	−1.20	−1.88 to −0.52	0.003
Step length (cm)	−0.05 ± 4.18	−5.34 ± 5.62	−1.15	−1.83 to −0.48	0.003
RMS total (m/s²)	−0.061 ± 0.277	+0.340 ± 0.288	+1.44	0.74 to 2.13	< 0.001
Anteroposterior RMS (m/s²)	−0.092 ± 0.483	+0.322 ± 0.573	+0.82	0.16 to 1.47	0.010
Superior-direction acceleration (g)	−0.024 ± 0.174	−0.193 ± 0.260	−0.85	−1.50 to −0.19	0.039
Acceleration toward unaffected side (g)	+0.029 ± 0.069	−0.017 ± 0.075	−0.65	−1.30 to 0.00	0.052

SD, standard deviation; CI, confidence interval; RMS, root-mean-square of trunk acceleration. Δ values are calculated as T4-T3 for each participant. Comparisons by the Mann-Whitney U test. Cohen's d > 0 indicates that fallers have a more positive Δ than non-fallers; Cohen's d < 0 indicates the opposite. The first four rows are the primary variables of interest.

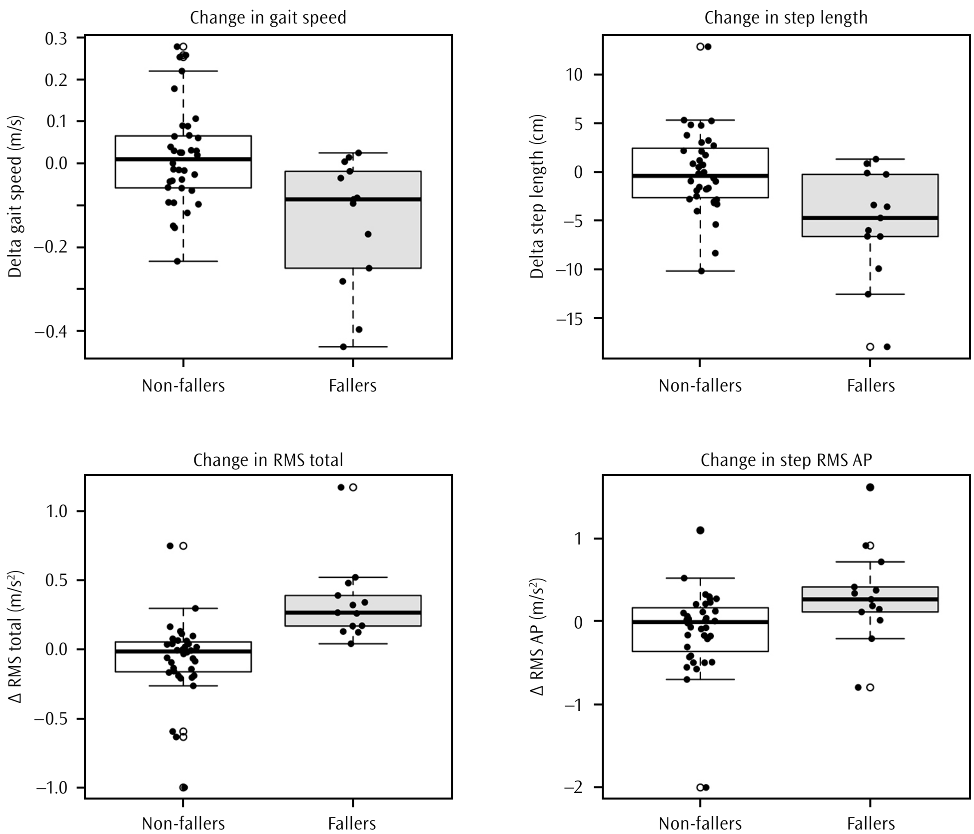

Figure 2. Changes in gait and trunk acceleration parameters from before to after brace removal (change across brace removal) according to faller status. Box plots with individual participant data points showing changes in the four primary variables of interest: gait speed (m/s), step length (cm), total trunk acceleration root-mean-square (RMS; m/s²), and anteroposterior trunk acceleration RMS (m/s²). The horizontal line represents the median, the box represents the interquartile range, and the whiskers extend to 1.5 × IQR. *p*-values are from Mann-Whitney U tests comparing fallers and non-fallers.

RMS, root-mean-square of trunk acceleration; AP, anteroposterior.

restricted to the 38 participants without diabetes mellitus (non-diabetic non-fallers: n = 31; non-diabetic fallers: n = 7). Between-group differences in gait speed change (p = 0.001), step length change (p < 0.001), and RMS total change (p < 0.001) remained statistically significant and directionally consistent with the main analysis. The anteroposterior RMS change did not reach statistical significance (p = 0.137), likely reflecting the reduced sample size; however, the direction was consistent.

DISCUSSION

This exploratory observational study examined whether gait and trunk acceleration changes around brace removal were associated with falls within 30 days after discharge in patients who underwent ARCR. We found that 26.5% of patients fell within 30 days, and most falls (84.6%) occurred within the first week. Before brace removal, gait and trunk acceleration parameters did not differ between fallers and non-fallers. After brace removal on the day of discharge, fallers showed lower gait speed, shorter step length, and higher trunk acceleration RMS. Changes across brace removal showed the largest between-group differences, with effect sizes ranging from 0.82 to 1.44 (95% CIs, 0.16-1.48 to 0.74-2.14). These findings suggest that the risk of falling after ARCR is more closely associated with the magnitude of gait and trunk-control changes that occur across brace removal than with gait performance measured during brace immobilization.

The present findings highlight the importance of distinguishing between gait performance while the shoulder abduction brace is still worn and gait adaptation after brace removal. The absence of significant between-group differences before brace removal suggests that conventional pre-discharge observation during brace use may not be sufficient to identify patients who later experience falls. In contrast, the emergence of group differences after brace removal and in changes across brace removal indicates that the transition itself may reveal gait-control difficulties that are not apparent during immobilized walking. This distinction is clinically relevant since brace removal is often regarded as a routine milestone in postoperative recovery, whereas our findings suggest that it may represent a short period of neuromotor readaptation.

The differences emerged after brace removal, when upper-limb and trunk contributions to gait had to be reorganized. The combination of slower gait, shorter steps, and increased trunk acceleration RMS in fallers after brace removal suggests that some patients experienced difficulty adapting to brace-free movement. Since trunk acceleration generally increases with faster walking, the observation of increased RMS total despite slower walking in fallers may indicate poorer trunk control rather than a simple speed effect. This pattern may reflect difficulty adapting gait and trunk control after brace removal.

The present findings extend prior work on ARCR and falls. Sonoda et al.[5] showed that patients using a shoulder abduction brace after ARCR experienced postoperative falls and that shoulder brace use was associated with impaired gait performance. Ayas et al.[13] further demonstrated that postural balance is impaired in the early postoperative period following ARCR, with patients showing reduced stability through the first six weeks after surgery. Familiari et al.[14] reported that a shoulder abduction brace affected gait speed and propulsion only in the acute phase (24 h postoperatively), with no detrimental effects observed at later time points. These findings suggest that brace-related gait changes during immobilization may be transient and that the brace-removal transition itself may represent a distinct and undercharacterized challenge to gait adaptation. The present study focused specifically on this transition, assessing trunk accelerometry immediately before and after brace removal. The finding that 11 of 13 fallers experienced their first fall within 7 days after discharge suggests that the immediate post-discharge period is a clinically relevant time for mobility reassessment and patient education.

The low frequency of documented pre-injury fall history among fallers should be interpreted carefully. Only one faller had a recorded pre-injury fall history, suggesting that the observed post-discharge falls were not simply a continuation of known pre-injury falls. However, the absence of a documented fall history does not prove that a patient was not fall-prone, and unmeasured factors such as home environment, activity level, medication use, and sensory impairment may have contributed.

Two clinical implications follow. First, brace removal should not be regarded only as the end of immobilization; it may also be a time point at which gait and trunk control should be reassessed. Pre-removal gait screening alone may miss patients who develop gait deterioration after the brace is removed. Second, the clustering of falls within the first week after discharge supports targeted patient education at the time of brace removal, including safe ambulation strategies, environmental hazard awareness, consideration of additional supervision or assistive support when clinically indicated,[15] and early outpatient follow-up focused on walking safety rather than shoulder function alone.

A further implication is that walking independence alone may be an insufficient marker of mobility safety at discharge. All participants included in this study were able to walk without a walking aid during inpatient assessment, yet a substantial proportion subsequently fell after returning home. This discrepancy underscores the potential value of quantitative gait and trunk-acceleration assessment as a complement to routine clinical observation. Wearable accelerometers cannot replace clinical judgment, but they may help identify subtle instability patterns, such as increased trunk acceleration despite reduced walking speed, that are difficult to detect visually during a brief ward-based walking assessment.

Diabetes mellitus was more frequent among fallers, and this finding should not be ignored. Diabetes-related sensory impairment, reduced balance function, or delayed motor adaptation may have contributed to falls independently of brace-removal-related gait changes. Therefore, the present results should not be interpreted as evidence that brace removal itself caused falls. Rather, the findings suggest that the brace-removal period may expose vulnerability in patients with limited capacity to adapt gait and trunk control after the sudden release of upper-limb immobilization.

This study has several limitations. First, the sample size, particularly the number of fallers (n = 13), was small. This limited the analysis to univariable comparisons; we did not perform multivariable modeling, calculate cut-off values, or build predictive models, all of which would require a larger event count to avoid overfitting. Second, this was a single-center Japanese study using a specific institutional brace-removal and discharge protocol, which limits generalizability to other postoperative pathways, brace durations, and health care systems. Third, diabetes mellitus was significantly more common in fallers, and we could not adjust for this potential confounder due to the limited number of fall events; diabetes-related sensory or balance impairments may contribute to falls independently of brace-related changes.[4] Although the sensitivity analysis excluding participants with diabetes mellitus yielded findings generally consistent with the main analysis, a formally adjusted analysis in a larger sample remains necessary. Fourth, lower directional accelerations after brace removal in fallers may partly reflect lower walking speed rather than independent postural-control features, and we could not separate these effects with the available sample. Fifth, fall ascertainment was based on patient self-report during routine outpatient rehabilitation visits and documentation in the medical record; therefore, minor falls that patients did not report may have been missed. Fall-related injuries were not systematically recorded, and the circumstances of each fall, including the environmental setting and activity at the time of the event, were not systematically recorded. This limits further characterization of the fall events and prevents the determination of whether falls were related to walking or to other activities. Sixth, no formal correction for multiple comparisons was applied. However, for the four primary variables of interest, all p-values remained below a conservative Bonferroni-adjusted threshold of 0.0125, and effect sizes are reported alongside p-values to facilitate transparent interpretation. Seventh, gait parameters were based on device-derived AYUMI EYE outputs; the internal proprietary algorithm, including the full details of filtering and signal processing, is not publicly disclosed, which may limit independent reproduction of the raw signal-processing procedure. Finally, this exploratory observational study cannot establish causation. Although the post-brace removal assessment preceded most falls, the temporal sequence is consistent with, but does not prove, a causal relationship.

In conclusion, in this exploratory observational study of 49 patients who underwent ARCR, falls within 30 days after discharge were associated with gait and trunk acceleration changes across brace removal rather than with pre-removal gait performance itself. Most falls occurred within the first week after brace removal. These findings suggest that brace removal may be a clinically important time point for gait reassessment, targeted patient education, and consideration of supportive measures at discharge. Larger multicenter studies are needed to confirm these findings and to identify clinically modifiable peri-discharge factors that may reduce early post-discharge falls after ARCR.

Declaration of Conflicting Interests

The authors declare that there are no conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contributions

A.K.: Conceived and designed the study, collected the data, performed the statistical analyses, and drafted the manuscript; K.T.: Supervised the surgical and clinical aspects of the study and critically revised the manuscript for important intellectual content. Both authors approved the final version of the manuscript and accept accountability for all aspects of the work.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Acknowledgments

The authors thank the rehabilitation and orthopaedic staff of Mabi Memorial Hospital for their assistance with data collection, and the participants for their cooperation.

AI Disclosure

The authors declare that artificial intelligence (AI) tools were not used, or were used solely for language editing, and had no role in data analysis, interpretation, or the formulation of conclusions. All scientific content, data interpretation, and conclusions are the sole responsibility of the authors. The authors further confirm that AI tools were not used to generate, fabricate, or 'hallucinate' references, and that all references have been carefully verified for accuracy.

REFERENCES

1. van der Meijden OA, Westgard P, Chandler Z, Gaskill TR, Kokmeyer D, Millett PJ. Rehabilitation after arthroscopic rotator cuff repair: Current concepts review and evidence-based guidelines. Int J Sports Phys Ther 2012;7:197-218.
2. Bruijn SM, Meijer OG, Beek PJ, van Dieën JH. The effects of arm swing on human gait stability. J Exp Biol 2010;213:3945-52. doi: 10.1242/jeb.045112.
3. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. N Engl J Med 1988;319:1701-7. doi: 10.1056/NEJM198812293192604.
4. Schwartz AV, Hillier TA, Sellmeyer DE, Resnick HE, Gregg E, Ensrud KE, et al. Older women with diabetes have a higher risk of falls: A prospective study. Diabetes Care 2002;25:1749-54. doi: 10.2337/diacare.25.10.1749.
5. Sonoda Y, Nishioka T, Nakajima R, Imai S, Vigers P, Kawasaki T. Use of a shoulder abduction brace after arthroscopic rotator cuff repair: A study on gait performance and falls. Prosthet Orthot Int 2018;42:136-43. doi: 10.1177/0309364617695882.
6. Senden R, Savelberg HH, Grimm B, Heyligers IC, Meijer K. Accelerometry-based gait analysis, an additional objective approach to screen subjects at risk for falling. Gait Posture 2012;36:296-300. doi: 10.1016/j.gaitpost.2012.03.015.
7. van Schooten KS, Pijnappels M, Rispens SM, Elders PJ, Lips P, van Dieën JH. Ambulatory fall-risk assessment: amount and quality of daily-life gait predict falls in older adults. J Gerontol A Biol Sci Med Sci 2015;70:608-15. doi: 10.1093/gerona/glu225.
8. Iosa M, Picerno P, Paolucci S, Morone G. Wearable inertial sensors for human movement analysis. Expert Rev Med Devices 2016;13:641-59. doi: 10.1080/17434440.2016.1198694.
9. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. Lancet 2007;370:1453-7. doi: 10.1016/S0140-6736(07)61602-X.
10. Lamb SE, Jørstad-Stein EC, Hauer K, Becker C; Prevention of Falls Network Europe and Outcomes Consensus Group. Development of a common outcome data set for fall injury prevention trials: The Prevention of Falls Network Europe consensus. J Am Geriatr Soc 2005;53:1618-22. doi: 10.1111/j.1532-5415.2005.53455.x.
11. Cohen J. Statistical Power analysis for the behavioral sciences. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.
12. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. Bone Marrow Transplant 2013;48:452-8. doi: 10.1038/bmt.2012.244.
13. Ayas İH, Çıtaker S, Kanatlı U. Postural balance impairment following arthroscopic rotator cuff repair in the early postoperative period: A prospective cohort study. BMC Sports Sci Med Rehabil 2025;17:1. doi: 10.1186/s13102-024-01022-0.
14. Familiari F, Mercurio M, Arenas-Miquelez A, Barone A, Greco F, Emerenziani GP, et al. Shoulder brace has no detrimental effect on basic spatio-temporal gait parameters and functional mobility after arthroscopic rotator cuff repair. Gait Posture 2024;107:207-11. doi: 10.1016/j.gaitpost.2023.10.005.
15. Panel on Prevention of Falls in Older Persons, American Geriatrics Society and British Geriatrics Society. Summary of the Updated American Geriatrics Society/British Geriatrics Society clinical practice guideline for prevention of falls in older persons. J Am Geriatr Soc 2011;59:148-57. doi: 10.1111/j.1532-5415.2010.03234.x.