Erratum

Korean J Health Promot 2026;26(1):41-44
pISSN: 2234-2141 • eISSN: 2093-5676
https://doi.org/10.15384/kjhp.2025.00164.e

Korean Journal of Health Promotion
KJHP

Correction to "Field Applicability of Cognitive–Motor Dual-Task Assessment in Anterior Cruciate Ligament Rehabilitation: A Systematic Review of Psychometric, Physiological, and Translational Frameworks"

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The author noted that the published article (Korean J Health Promot 2025;25(4):111-126; https://doi.org/10.15384/kjhp.2025.00164) contained wording that may be overgeneralized or imply broader representativeness than supported by the data, including certain expressions in Table 2 and related descriptions in the text.

The author apologizes for any confusion or inconvenience this may have caused and appreciates your understanding.

First of all, three changes were made in the main text, in the Results section and the Discussion section.

In the Results section, replace "(ICC≥0.8–0.96, SRM ≈ 0.9, setup<20 min)" with "(ICC≥0.8–0.96)" in the 'Overview of evidence across outcome domains' item.

Before modification

Across all decades, behavioral reaction-time indices and IMU-based kinematic outcomes provided the strongest psychometric evidence (ICC≥0.8–0.96, SRM ≈ 0.9, setup<20 min).

After modification

Across all decades, behavioral reaction-time indices and IMU-based kinematic outcomes provided the strongest psychometric evidence (ICC≥0.8–0.96).

In the Discussion section, delete "(SRM ≈ 0.95)" from the 'Responsiveness' item.

Before modification

Behavioral DTC (SRM ≈ 0.95) and IMU-derived asymmetry were the most change-sensitive measures of recovery progress, whereas physiological metrics (EEG/fNIRS) lacked quantitative responsiveness.

After modification

Behavioral DTC and IMU-derived asymmetry were the most change-sensitive measures of recovery progress, whereas physiological metrics (EEG/fNIRS) lacked quantitative responsiveness.

In the Discussion section, remove "setup<20 min" from the 'Large-scale multicenter validation: most urgent and highest impact' item.

Before modification

Feasibility: Wearables are already field-ready (setup<20 min, battery ≈ 12 hr).

After modification

Feasibility: Wearables are already field-ready (battery ≈ 12 hr).

These revisions do not affect the study's core findings or overall conclusions but are made to improve academic precision and to avoid potential misinterpretation.

In Table 2 below, revised information is indicated in bold.

Table 2. Study characteristics of included ACL-related wearable and dual-task investigations (n=37)

Study (year)	Sample/injury (n)	Cognitive task (type, brief)	Motor task (type)	Device/modality (make/model if reported)	Key outcomes (behavioral/physiological/kinematic—brief)	Psychometric notes (ICC, SRM)/feasibility (setup time, field)
Marques et al. (2022) [12]	11 studies (ACLR review)	-	Functional tasks (jump, gait, stairs)	IMUs (APDM, Xsens, Loadsol)	Bilateral asymmetry detected; wearables ≈ lab accuracy	ICC 0.80–0.96; field-portable
Morris et al. (2023) [13]	191 college athletes (45% injured)	Serial subtraction, fluency	Reactive balance (Push & Release)	IMUs (Opal v2, APDM Inc.)	Dual-task TTS predicted injury risk (HR=1.36/250 msec)	Reliability and test duration not reported
Li et al. (2024) [14]	60 (30 ACLR+30 controls)	-	Walk+hop tests	Flexible insole+IMU	ICC=0.91–0.98 vs. Vicon; LSI ≈ 88%	Portable system; battery life ≈ 12 hours
Nazary-Moghadam et al. (2019) [15]	22 ACLD males+22 healthy controls	Auditory Stroop test (RT+error rate)	Treadmill walking at 3 speeds (low, self-selected, high)	Vicon motion capture (5 cameras, 100 Hz); knee kinematics (LyE)	↑ Gait speed → ↓ knee flexion–extension LyE (ES=0.57); dual-task ↑ RT in ACLD; cognitive load effect ns (*P*=0.07); ACLD prioritized gait over cognitive task	Within-session reliability reported in earlier companion study; single-session treadmill test; feasible lab setup
Jiménez-Martínez et al. [16] (2025) (systematic review)	25 studies (≈ 670 healthy athletes, ACL risk context)	Dual-task/uncertainty manipulations (math subtraction, Stroop, reaction delay, visual distraction)	Jump-landing/sidestep/cutting	Motion capture+-force plate (majority studies)	↑ Knee valgus angle and vGRF under high cognitive load → elevated ACL injury risk; slower RTs reported	Review synthesis (no ICC reported); lab-based tasks; field translation recommended
Jiménez-Martínez et al. [17] (2025) (cross-sectional study)	30 ACLR+30 controls	Go/No-Go (proactive inhibitory control)	-	Computer task (SuperLab)	↑ RT, ↑ commission errors, ↓ accuracy in ACLR group (*P*<0.05)	Cross-sectional lab study; no ICC reported
Walker (2018) [18]	10 ACLR	Exergame (implicit)	Narrow-based gait	Physilog IMU+EEG/EMG	↓ Stride time variability (η^2=0.53)	Feasible
Majelan and Habibi (2022) [19]	24 youth volleyball	Visual 5-digit reading	Tuck jump	Kinovea video	↓ Jump perf (η^2=0.588)	Feasible
Avedesian (2024) [20]	Review of athlete studies (across levels)	Visual-motor RT, attention, WM	Jump-landing, cutting, gait	Smartboard, VR/AR, strobe eyewear, motion capture	↓ Knee flexion · ↑ knee load with low cognition; slower RT ↑ injury risk	Good test–retest; field-ready tools; VR setups less practical
Kacprzak et al. (2024) [21]	ACLR/review focus on neurosensory–motor integration	-	-	Narrative/theoretical	Hidden sensorimotor and cortical deficits after ACL injury; integration of sensory and motor networks emphasized	Conceptual; not quantitative
Akbari et al. (2023) [22]	24 college soccer players (18 female, 6 male; 20±1 yr)	Heading a stationary soccer ball during jump (dual-task)	Drop vertical jump (30 cm box → jump & land)	3D motion tracking+force plate	↓ Knee/hip/trunk flexion, ↓ COM; ↑ tibial shear, ↑ trunk lat. flexion, ↑ stiffness → ↑ ACL risk	Reliable (r=0.63–0.91); lab-feasible but setup complex
Lin et al. (2025) [23]	30 male division I athletes (CAI confirmed)	LED light reaction dual-task	Single-leg drop jump (30 cm)	Vicon (200 Hz), Kistler (1,000 Hz), Noraxon EMG (2,000 Hz)	↑ vGRF, ↑ ankle inversion & rotation, ↑ ROM; ↓ RF EMG → ↓ stability, ↑ sprain risk	**Lab-feasible but complex setup**
Yang et al. (2025) [24]	**22 males (11 healthy; 11 with ACL, 6+meniscus, 4+sciatic nerve dysfunction, 1)**	None (pure EMG-based computational task; no behavioral dual-task)	Lower-limb motions: sitting, standing, and stair tasks (SIT, STA, STAND)	Surface EMG (4 muscles: BF, RF, VM, SEM), 1,000 Hz sampling	Dual-branch DL model (DBWCT-EMGNet): 99.86% accuracy, R^2=0.98, RMSE=1.4°; TL improved patient performance from 85.5%→99.5% accuracy	<50 msec inference time; real-time feasible for rehab/exoskeleton applications
Song et al. (2023) [25]	Editorial	-	Various rehab	EMG, IMU, VR	Summary of 31 studies	-
Ness et al. (2020) [26]	**10 studies (review)**	Stroop, n-back	Balance, gait	Force plate, IMU	↑ DTC	-
Disegni et al. (2025) [27]	Pro soccer ACLR	Visual recognition+ACL-RSI	Hop, RSA, match sim	Isokinetic, GPS	"11 to Perf" score	Field-feasible

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Table 2. Continued

Study (year)	Sample/injury (n)	Cognitive task (type, brief)	Motor task (type)	Device/modality (make/model if reported)	Key outcomes (behavioral/physiological/kinematic—brief)	Psychometric notes (ICC, SRM)/feasibility (setup time, field)
Ghai et al. (2018) [28]	Healthy participants; Exp I: 15, Exp II: 20, Controls: 15 (age ≈ 23–27 yr)	Real-time auditory feedback (pitch–angle, amp–velocity)	Knee repositioning (40°, 75°)	XSENS IMU, headphones	↓ Error with sound; transient adaptation	45 minutes; non-invasive; high compliance
Johnson et al. (2021) [29]	20 healthy	-	SLS (perturbed)	Vicon+EMG	Flexed trunk ↑ co-contraction	ICC>0.8
Davidoviča et al. (2025) [30]	32 youth football players (16 male/16 female; age 14.6±0.5 yr)	-	SLS+3 variations (front/middle/back; 60° knee flexion)	DAid smart socks, NOTCH IMUs, PLUX EMG	Strong correlations: hip adduction ↔ medial COP; knee flexion ↔ GM/GMx ($\rho \approx 0.84$); COP2W ↔ GMx ($\rho=-0.592$); multiple moderate correlations between joint angles, COP and EMG	In-field feasible; non-invasive; session ≈ 45 minutes; high compliance
Lu et al. (2025) [31]	16 healthy older adults (68.4±4.4 yr)	Serial subtraction (counting down by threes from random number 90–100; verbal dual task)	Obstacle crossing on 10 m walkway; obstacle height=10%, 20%, 30% of leg length	8 camera motion system; 3 force plates	↓ Crossing speed (P=0.003); ↑ leading & trailing toe-obstacle clearance (P<0.001); ↑ pelvic anterior/posterior tilt, ↑ swing hip abduction & knee flexion; ↓ stance hip/knee adduction during dual-task	Normality (Shapiro–Wilk), homogeneity (Levene); two-way repeated ANOVA (task×height, α=0.05); power analysis lab setup feasible for older adults
Ptaszyk et al. (2025) [32] (scoping review)	ACL injury/ACLR	-	Pivot-shift, Lachman, hop/jump, gait, JPS	IMUs, accelerometers, force insoles, EM/inductive sensors	Accurate knee angle, load, and symmetry metrics	Easy to implement on-site, but standardization is needed
Lu et al. (2025) [33]	ACLR (n=20)+healthy (n=20)	-	Level walking gait at 3, 6, 12, 24 months post-op	3D motion capture (Vicon MX, UK)+dual force plates (AMTI, USA)	Gradual gait symmetry recovery over 24 months; all angles & GRF normalized except persistent knee extension moment (pKEM) asymmetry	High validity; repeated-measures design; lab-based; feasible for longitudinal tracking
Kuroda et al. (2021) [34]	Narrative review	-	Various rehab	Robotics, IMU, VR	Improved ROM, motivation, adherence	No ICC or SRM; qualitative feasibility only
Baldazzi et al. (2022) [35]	17 healthy male soccer players (21.5±3.2 yr)	-	SLS, CHT; 3 reps per limb (randomized order)	MIMU Gyko & foot; AMTI force plate	Angular velocity>acceleration metrics; dominant>nondominant limb; LSI within 85%–115%	Two-way mixed ICC (absolute agreement); MDC=SEM×1.96×$\sqrt{2}$; standardized 5-minute warm-up; 3 trials per task; field-feasible protocol
Aditya et al. (2025) [36]	23 studies (MCI/dementia)	Subtraction, recall	Gait	IMU, fNIRS, MRI	↓ Speed, ↑ variability, ↑ PFC HbO$_2$	**Removed**
Kiminski et al. (2025) [37]	31 female athletes	Catch/fake throw	Drop landing+drill	Force plates+IMU	↓ vGRF 25%, ↑ K:A ratio	ICC=0.90–0.91
Kimura et al. (2017) [38]	45 healthy adults	Visuospatial WM training	Elbow+knee torque tasks	EMG (Delsys)+torque chair	↓ FE2 errors (P<0.01), ↑ WM capacity	15 minutes×2 weeks feasible
Calisti et al. (2025) [39]	43 (21 ACL-injured, 22 healthy; 19–36 yr)	-	Six jump-landings (single/bilateral) under fatigued & non-fatigued states	10-camera Vicon, 2 force plates, OpenSim 4.3	Fatigue ↓ jump height (P=0.001) ↑ Borg CR10; dataset supports analysis of joint kinematics & ACL deficits	Normality (Shapiro–Wilk), ANOVA; 2,199 valid trials; standardized lab setup

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Table 2. Continued

Study (year)	Sample/injury (n)	Cognitive task (type, brief)	Motor task (type)	Device/modality (make/model if reported)	Key outcomes (behavioral/physiological/kinematic—brief)	Psychometric notes (ICC, SRM)/feasibility (setup time, field)
Detherage et al. (2021) [40]	1 injured vs. 7 controls	Vision RT task	Training drills	Zephyr sensor+GPS	↑ BMI, slower RT, ↓ HR recovery; ANS dysregulation	Feasible; single case
Forelli et al. (2025) [41]	Narrative review (ACLR population; no N reported)	Dual-task, neurocognitive drills	Quadriceps activation, gait, hop, strength	EMG, TMS, H-reflex, dynamometer, motion capture	Persistent AMI (↓ cortical excitability, ↓ CAR, asymmetry<90%), improved with NMES, BFR, dual-task rehab	No ICC reported; clinically feasible phase-based rehab; supports neurocognitive RTS framework
Krishnakumar et al. (2024) [42]	71 studies (4 ACL groups)	-	Multi-tasks (walk, run, jump)	IMUs (Xsens, APDM, etc.)	ML-based models RMSE 0.02–0.04 BW; reliable across sagittal tasks	ICC variably reported; no pooled data; setup ~15–30 minutes typical
Calabrò et al. (2025) [43]	Narrative review (ACLR athletes/patients)	Dual-task (counting, reaction, decision)	Gait, balance, proprioceptive, neuromuscular training	Robotics, VR, biofeedback, wearable sensors, neuromodulation (TMS/TENS)	Neuroplasticity-based rehab ↓ reinjury risk (9%–29%), ↑ coordination & confidence	No ICC; qualitative; feasible but expert setup & cost limit
Ricupito et al. (2025) [44]	17 ACLR	Reverse number recall	Triple hop distance	iPad+iPhones	↓ THD, DTC (full sample): healthy 6.49%–6.66%, post-op 4.32%–4.80%;	Time: NR; low-cost, single-session feasible
Rikken et al. (2024) [45]	15 male basketball players (22.1±2.3 yr)	Visual-attention dual task - FitLights	90° near-full-speed sidestep cut (energy-absorption phase: IC → peak knee flexion)	Xsens MVN IMU system (on-court); FitLights stimulus	↓ Hip flexion (IC & peak), ↓ peak knee flexion, ↑ peak hip external rotation; no ankle changes	No ICC/SRM reported; a-priori G*Power; SPM used; on-court IMU=higher ecological validity
Schwartz et al. (2025) [46]	26 healthy adults	Visual-cognitive (go, inhibit, recall)	5-10-5 & T-test	Dashr timing gates+FitLight	ICC: 0.75–0.99; DTE: −13%; no bias	Laboratory-based setup; no test-duration reported
Sherman et al. (2023) [47]	20 ACLR vs. 20 controls	Go/No-Go visuomotor (virtual soccer)	Foot response	EEG (64ch LRP)+TMS	↓ LRP area, ↑ error, ↑ AMT, ↑ effort	Lab-based EEG/TMS setup; no duration or cost reported
Strong and Markström (2025) [48]	40 ACLR (8–59 months after ACL injury, the gender ratio is 1:1)	Cognitive-motor (decision, inhibition, WM)	Drop vertical jump	8-cam Vicon+FP	↓ flexion, ↑ vGRF, ↓ injured load	Lab-based biomechanical assessment; no explicit ICC or duration reported in text

This table summarizes study design elements, sensor modalities, and outcome domains across ACL injury, ACLR, or risk contexts. Each entry details cognitive and motor task types, wearable or laboratory measurement systems, and reported psychometric and feasibility information.

ACL, anterior cruciate ligament; ACLD, anterior cruciate ligament deficient; ACLR, anterior cruciate ligament reconstruction; AMI, arthrogenic muscle inhibition; AMT, active motor threshold; ANS, autonomic nervous system; AR, augmented reality; BF, biceps femoris; BFR, blood flow restriction; BMI, body mass index; BW, body weight; CAI, chronic ankle instability; CAR, central activation ratio; CHT, crossover hop test; COM, center of mass; COP, center of pressure; COP2W, two-dimensional center of pressure width; DL, deep learning; DTC, dual-task cost; DTE, dual-task effect; EEG, electroencephalography; EM, electromagnetic; EMG, electromyography; ES, effect size; Exp, experimental group; fNIRS, functional near-infrared spectroscopy; FP, force plate; GM, gluteus maximus; GMx, gluteus maximus; GPS, global positioning system; GRF, ground reaction force; HbO_2, oxyhemoglobin; HR, hazard ratio; IC, initial contact; ICC, intraclass correlation coefficient; IMU, inertial measurement unit; JPS, joint position sense; K:A, knee-to-ankle ratio; lat., lateral; LED, light emitting diode; LRP, lateralized readiness potential; LSI, limb-symmetry index; LyE, Lyapunov exponent; MCI, mild cognitive impairment; MDC, minimal detectable change; MIMU, magnetic-inertial measurement unit; ML, machine learning; MRI, magnetic resonance imaging; NMES, neuromuscular electrical stimulation; NR, not reported; ns, not significant; PFC, prefrontal cortex; pKEM, peak knee extension moment; post-op, postoperative; rehab, rehabilitation; RF, rectus femoris; RMSE, root mean square error; ROM, range of motion; RSA, repeated sprint ability; RSI, return to sport after injury scale; RT, reaction time; RTS, return-to-sport; SEM, standard error of measurement; SIT, sit task; SLS, single-leg squat; SPM, statistical parametric mapping; SRM, standardized response mean; STA, stair task; STAND, stand task; TENS, transcutaneous electrical nerve stimulation; THD, triple hop for distance; TL, transfer learning; TMS, transcranial magnetic stimulation; TTS, time-to-stability; vGRF, vertical ground reaction force; VM, vastus medialis; VR, virtual reality; WM, working memory; η^2, eta-squared effect size.

Revised elements are indicated in bold. “Removed” indicates information deleted in this erratum.