

Validation of The DANU System During the 5-0-5 Change of Direction Test

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Background and Aim

- In multidirectional sports, change of direction (COD) speed is fundamental for performance yet is also a primary mechanism for non-contact lower limb injuries [1].
 - Laboratory-based force plates remain the criterion standard but lack ecological validity in constrained testing environments [2].
 - Wearable sensor technology offers a promising field-based alternative; however, most validation work has focused on linear gait patterns [3].
- Aim :** This study evaluated the concurrent validity of the DANU system for measuring contact time during a 5-0-5 COD task compared with force plate measures.



Methods



Participants

- 32 team sport players (17 male, 15 female)
- Completed ≥ 4 trials of the 5-0-5 COD test.



Equipment

- DANU smart sock system (in-sock pressure sensors + shank IMU, 250 Hz)
- Kistler force plates (1000 Hz)



Analysis

- Contact time extracted for deceleration, plant, and acceleration steps.
- Person correlation, ICC(2,1), MAE, RMSE, Bland-Altman



TEST SETUP

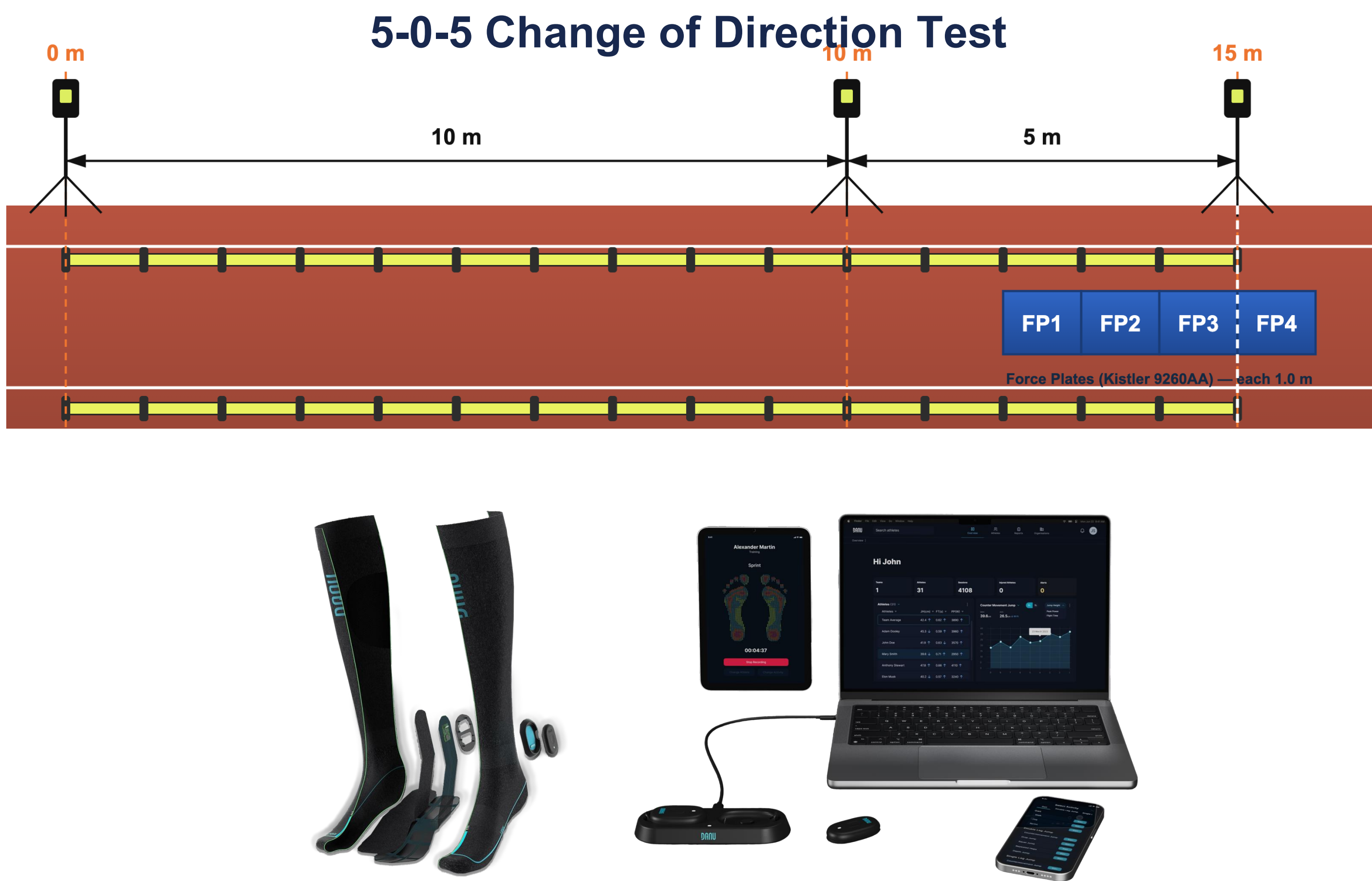
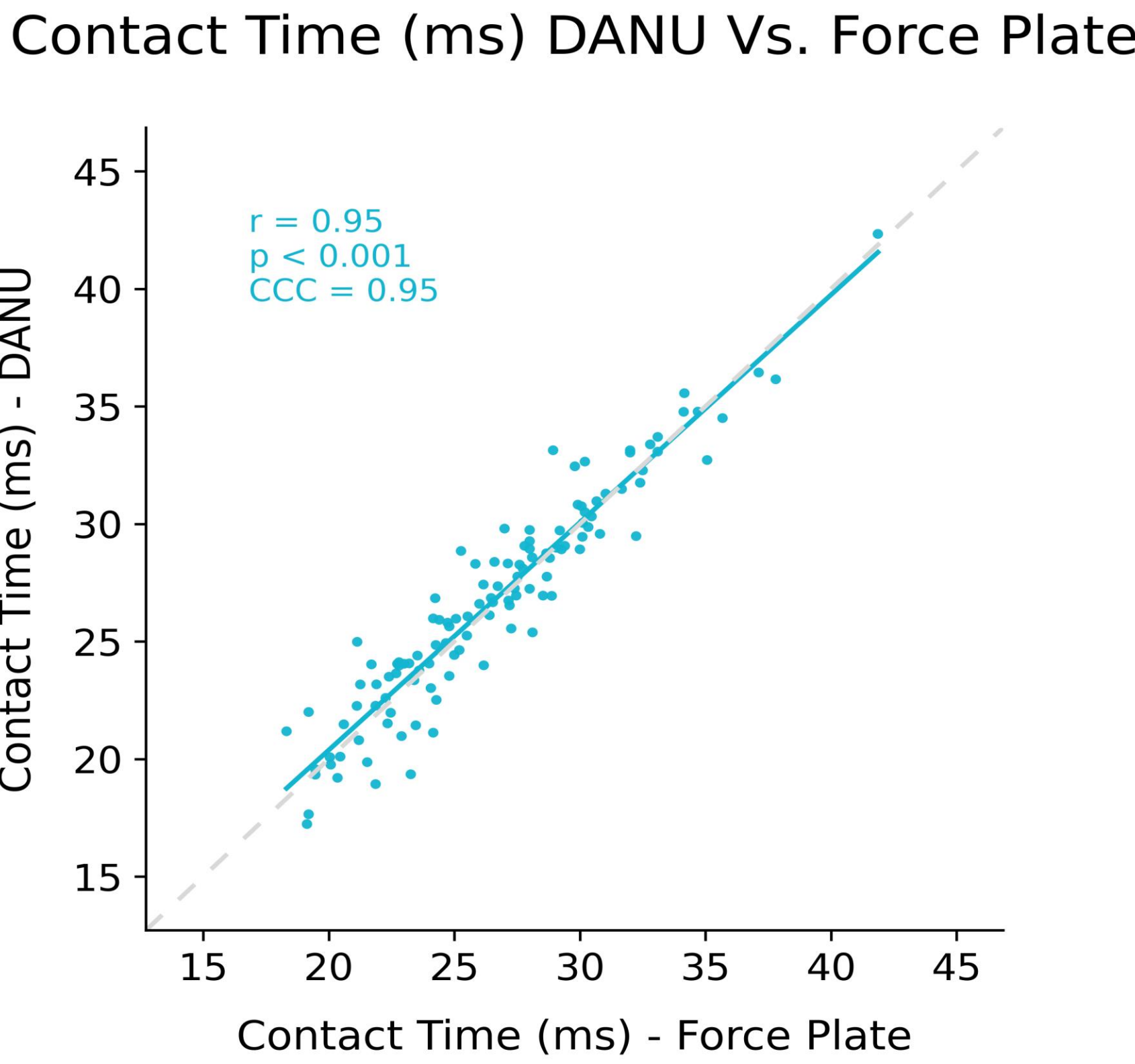
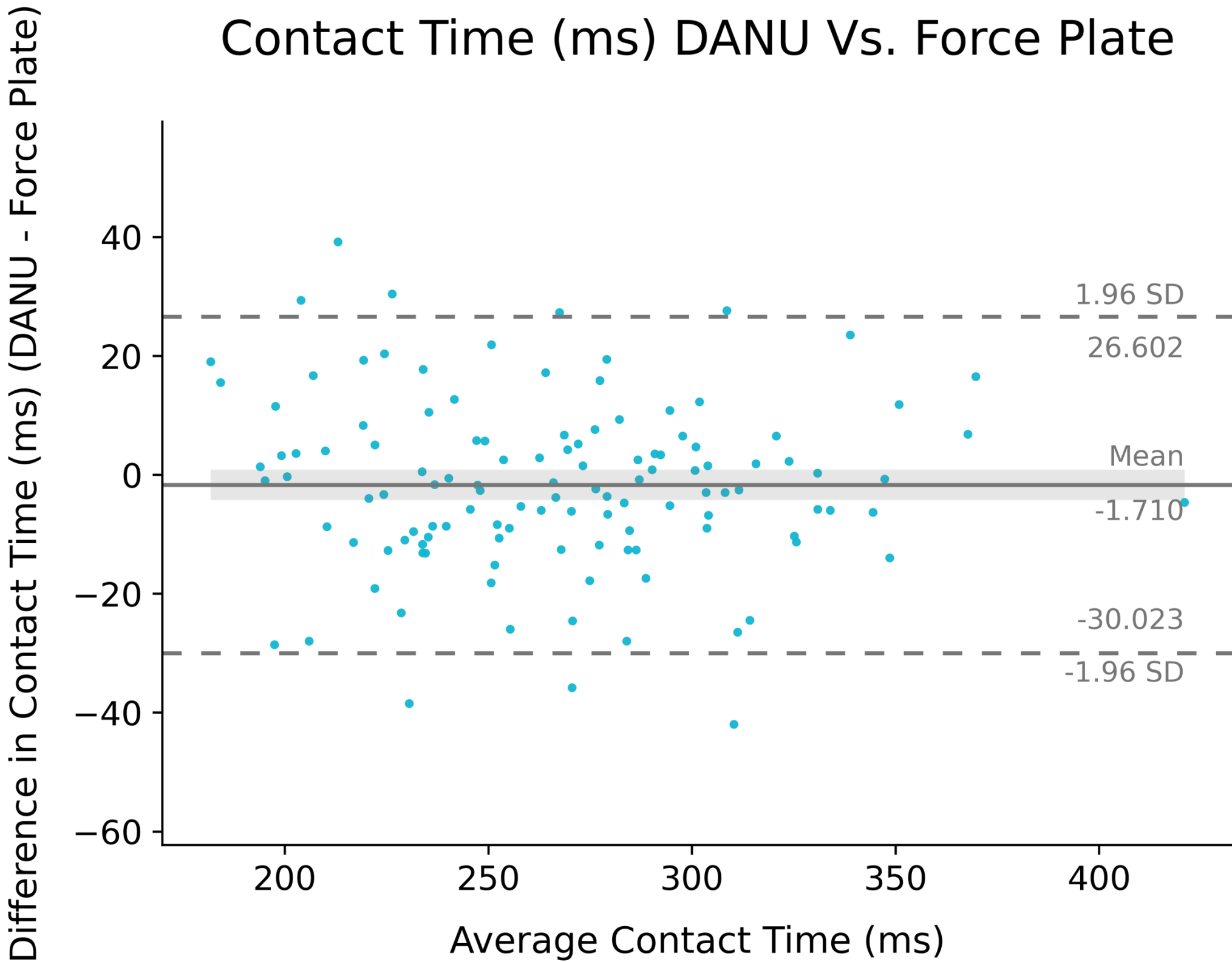


Figure 1. 5-0-5 test setup with timing gates and embedded Kistler force plates (FP1–FP4) at the turn point. DANU smart sock system with capacitive plantar pressure sensors and IMU units.

Results



 r = 0.950 Strong correlation with force plates	 ICC = 0.949 Excellent reliability (ICC 2,1)	 Bias = -1.7 ms Minimal systematic bias
95% Limits of Agreement: -30.0 to 26.6 ms	MAE: 11.0 ms	RMSE: 14.5 ms

Excellent agreement between DANU and force plates for contact time across all phases of the 5-0-5 test.

Conclusion

DANU system demonstrated excellent concurrent validity for contact time measurement across COD phases, with minimal systematic bias, strong correlation ($r = 0.950$), and excellent reliability ($ICC = 0.949$). These findings support its use as a valid field-based alternative to force plates for assessing temporal characteristics of COD performance, offering practitioners a more accessible monitoring tool in applied settings.

References

[1] Dos'Santos T, et al. Strength Cond J. 2019;41(1):87–104.
[2] Mason R, et al. Physiol Meas. 2023;44(11).
[3] Alanen AM, et al. Scand J Med Sci Sports. 2021;31(8):1332–1353.

