biomechanics

Article

Test–Retest Reliability of a Motorized Resistance Device for Measuring Throwing Performance in Volleyball Athletes

Eleftherios Paraskevopoulos [1,2,*], Anna Christakou [2], George Plakoutsis [1], George M. Pamboris [3] and Maria Papandreou [1]

[1] Laboratory of Advanced Physiotherapy, Department of Physiotherapy, University of West Attica, 12243 Athens, Greece; mpapand@uniwa.gr (M.P.)
[2] Biomechanics Laboratory, Department of Physiotherapy, University of Peloponnese, 23100 Sparta, Greece; a.christakou@go.uop.gr
[3] Department of Health Sciences, School of Sciences, European University Cyprus, 1516 Nicosia, Cyprus; g.pamboris@euc.ac.cy
* Correspondence: elparaskevop@uniwa.gr

Abstract: Throwing performance is a critical aspect of sports, particularly in overhead activities, necessitating reliable assessment methods. This study explores the test–retest reliability of throwing performance metrics measured by the 1080 Sprint, a robotic device integrating linear position technology and an electric motor. Specifically focusing on professional volleyball athletes with scapular dyskinesis, the study draws data from a previously published investigation on the impact of mirror cross exercise. Thirty-nine athletes were recruited, aged 21.9 ± 3.6 years, height 1.79 ± 0.3 m weight 68.5 ± 19.8 kg, and body mass index 21.3 ± 3.2 kg/m^2, meeting stringent inclusion criteria. One-sample *t*-tests indicated no statistically significant differences between test–retest trials. The study revealed excellent reliability of the 1080 Sprint, with intraclass correlation coefficient (ICC) values exceeding 0.99 for all metrics, including speed, force, and power. The standard error of measurement (SEM) calculation revealed that the Sprint 1080 motorized resistance device demonstrates high precision in measuring throwing performance. Bland and Altman plots indicated minimal systematic bias across all metrics, encompassing speed, force, and power. The provision of the minimum detectable change (MDC) for each variable of the Sprint 1080 motorized resistance device offers coaches a valuable tool to identify performance improvements in volleyball athletes. In conclusion, the present study shows that the 1080 Sprint is valid and reliable for measuring throwing performance in volleyball athletes for monitoring purposes.

Keywords: Sprint 1080; reliability; overhead athletes; scapular dyskinesis; throwing performance

Citation: Paraskevopoulos, E.; Christakou, A.; Plakoutsis, G.; Pamboris, G.M.; Papandreou, M. Test–Retest Reliability of a Motorized Resistance Device for Measuring Throwing Performance in Volleyball Athletes. *Biomechanics* **2024**, *4*, 259–268. https://doi.org/10.3390/biomechanics4020015

Academic Editor: Francois Prince

Received: 25 March 2024
Revised: 21 April 2024
Accepted: 25 April 2024
Published: 28 April 2024

1. Introduction

Throwing performance (TP) is a crucial aspect of sports performance for athletes and individuals participating in overhead sports. Employing assessment methods that are reliable, valid, and easy to administer is essential, particularly when evaluating large teams of athletes. Addressing specific assessment techniques tailored to mimic the movement patterns employed in sporting activities poses a significant challenge for scientists working in this field [1].

Many studies have explored the impact of diverse training interventions, utilizing TP tests to assess their efficacy [2–4]. TP assessments can measure the capacity for generating force, speed, and/or throwing accuracy [3]. These tests are integral in overseeing an athlete's upper-body performance and the efficiency of the kinetic chain during throwing, especially for rehabilitation purposes and to track training progress [4]. Furthermore, TP tests serve as a crucial tool for talent identification and evaluating physical fitness characteristics for team selection [2,5]. Finally, scrutinizing athletes' TP can identify physical limitations that might influence their participation in sporting activities [6].

Recently, integration of linear position technology with a robotic electric motor has given rise to the development of the 1080 Sprint motorized resistance device (1080 Motion AB, Stockholm, Sweden) [7]. This apparatus, resembling a conventional pulley machine, is equipped with a cable that can be linked to either a barbell or an individual, offering the capability for independent control to introduce varying levels of electromagnetic resistance during both concentric and eccentric movement phases [8,9].

Additionally, this device can synchronously capture assessments of velocity and displacement regarding the starting point and the force applied through the cord of the machine under diverse loading conditions [8]. This eliminates the necessity of combining sledges with photocells, laser guns, or radars. The data obtained, whether in distance–time or velocity–time during running, can subsequently be utilized for computing macroscopic mechanical outputs, providing a foundation for individualized training prescriptions [7–10]. However, the realization of these potential benefits relies on the robotic device's accurate assessment of velocity–time data. While the reliability of this device has been examined in athletes when measuring sprint performance [11], to the best of our knowledge, no study has examined its reliability in assessing throwing performance using the 1080 Sprint. Thus, the aim of this study was to evaluate the test–retest reliability of throwing performance metrics obtained from the 1080 Sprint robotic device.

The rationale behind the study lies in the importance of accurately assessing TP in athletes, particularly in overhead sports. TP assessments are crucial for various purposes such as monitoring training progress, evaluating physical fitness characteristics for team selection, talent identification, and identifying physical limitations that may affect an athlete's participation in sports. However, traditional assessment methods may have limitations in terms of reliability and ease of administration, especially when evaluating large teams of athletes.

The emergence of new technology, such as the 1080 Sprint, offers potential advantages in assessing TP. This device integrates linear position technology with a robotic electric motor, providing the capability to independently control resistance levels during both concentric and eccentric movement phases. Additionally, it can capture assessments of velocity and displacement synchronously, eliminating the need for additional equipment like sledges with photocells, laser guns, or radars. This device holds promise for providing accurate and detailed data on TP, which can be used for individualized training prescriptions.

However, despite the potential benefits, the reliability of the 1080 Sprint device in assessing TP has not been thoroughly examined. Therefore, the aim of the study is to evaluate the test–retest reliability of TP metrics obtained from the 1080 Sprint robotic device. Our research hypothesis is that TP metrics obtained from the 1080 Sprint robotic device will demonstrate high test–retest reliability, indicating consistent and reproducible measurements of throwing performance over multiple trials.

2. Materials and Methods

The data utilized in this reliability study were derived from a previously published investigation that examined the impact of mirror cross exercise on enhancing TP in professional volleyball athletes with scapular dyskinesis [12]. In this study, TP metrics (speed, force, power) were calculated by the Sprint 1080.

For this study, 39 professional volleyball athletes (Age: mean $\pm$ SD: 21.9 $\pm$ 3.6 years; height: 1.79 $\pm$ 0.3 m; weight: 68.5 $\pm$ 19.8 kg; BMI: 21.3 $\pm$ 3.2 kg/m^2; 17 male and 22 female) with scapular dyskinesis were recruited. Athletes were selected from the National Athletic Association division, explicitly targeting in-season competitive individuals participating in team training sessions lasting a minimum of 60 min at least three times per week over the past five years in the Hellenic Volleyball League. All athletes had to exhibit no symptoms, and the dyskinetic shoulder had to be the dominant one, determined by the arm used for hitting the ball. Exclusion criteria included the absence of scapular dyskinesis or difficulty identifying its presence, history of shoulder, low back, extremity surgery or fracture, pain exceeding 3/10 on the visual analog scale within the last 6 months, or any existing neurological conditions. Participants provided verbal and written informed consent before participating in the study. The initial study protocol was approved by the Ethics Committee of the University of West Attica (Approval number: 9230/27 May 2020), and the study adhered to the guidelines outlined in the Declaration of Helsinki.

Two physiotherapists, who were trained for a minimum of 5 h to assess scapular dyskinesis in athletes, conducted an evaluation independently while being blinded to each other's assessments. The assessment involved observing the movement of the scapulae during arm elevation using dumbbells in both the sagittal and frontal planes. The weight of the dumbbell used was determined based on the athlete's body weight, with a 1.5-kg dumbbell for those weighing less than 68.1 kg and a 2.5-kg dumbbell for those weighing more. Twenty athletes used the 2.5-kg dumbbell based on their body weight [12]. Athletes were instructed to perform bilateral shoulder abduction and flexion to a 3-s count in a thumb-up position, followed by returning to the anatomical position again to a 3-s count, all with the assistance of a metronome. Each athlete completed 5 repetitions in both flexion and abduction, with data collected from their dominant shoulder.

The diagnosis of scapular dyskinesis was determined using a Yes or No classification method, which has demonstrated high reliability (>0.81) [12]. A positive test result indicated obvious winging or asymmetry of the scapulae during arm movement. If the dyskinetic side was not the dominant one, the athlete was excluded from the study. An external rater was available in case of disagreement between the two physiotherapists. Cohen's kappa coefficient was calculated to assess the agreement between the two raters, showing very good agreement ($\kappa = 0.82$).

2.1. Sample Size

While the sample size had been previously estimated in our previous study [12], we reassessed its adequacy for the current study. To determine the appropriate sample size, we conducted a thorough literature search to identify previous estimates of the intraclass correlation coefficient (ICC). Only one relevant study was found [11], and based on their pooled ICC range of 0.86 to 0.95, we set our expected reliability at 0.90 using a two-tailed sample size calculation. With a desired power of 95%, a minimum acceptable reliability of 0.70, and a significance level of 5%, our calculations indicated that a minimum of 37 participants would be required for this study. Since our previous study included 39 athletes, we ensured the adequacy of our sample size.

2.2. Procedures

This study was a reliability study and all procedures were conducted in 2021. The throwing force (newtons), velocity (m/s), and power (watts) were measured using the Sprint 1080 device, which is a variable resistance system allowing for measurement under controlled conditions (Figure 1). Athletes were instructed to perform throws simulating the spike technique. Through the 1080 Sprint, throwing force data (in newtons) were calculated from the tension in the electric motor, while throwing velocity (m/s) was derived from the time and distance covered by the rope connected to the motor, which can reach up to 90 m. The application of the system (1080 motion web app, 1080 Motion, Lidingö, Sweden), using a computer, recorded all performance kinematic data with a sampling frequency of 333 Hz.

For this study, resistance was set at 0.3 kg, similar to the weight of a volleyball, while the velocity recording limit was set at 14 m/s. The reason for choosing 0.3 kg was related to the standardization of the resistance across participants and trials, aiming for consistency and comparability in the measurements. Additionally, the choice of 0.3 kg was influenced by practical considerations, such as need to balance resistance level with participant safety and comfort during testing. Before the final measurement, all athletes were asked to perform 3 practice repetitions without resistance for familiarization. Subsequently, two repetitions were recorded with a 24-h rest between trials. Every throw began from a standing, split-stance posture, with the front foot's toe positioned forward. All starts originated from a static position, meaning athletes were not permitted to "lean backwards before rolling forward" (Figure 1). Following a readiness signal from the investigator, athletes initiated the throwing trial at their own discretion. Each trial was videotaped to ensure that all measurements were accurate.

Figure 1. Throwing performance trial.

2.3. Statistical Analysis

Mean and standard deviation values were calculated using descriptive statistics. The normality assumption for all data was examined using the Shapiro–Wilk test. Z-scores were subsequently computed and examined for both skewness and kurtosis. The intraclass correlation coefficient (ICC) was calculated to evaluate test–retest reliability. Estimated ICC was interpreted as poor (<0.5), moderate (0.5–0.74), good (0.75–0.9), or excellent (>0.9), as previously suggested [13]. These values are important to be considered as higher ICC values suggest that stronger agreement exists and may boost confidence in the data's reliability. In contrast, lower ICC values may suggest higher variability, leading to concerns in relation to the consistency and reproducibility of the results.

One sample *t*-test was performed to examine whether the difference between each test–retest trial and for each metric was statistically different. Systematic bias was examined through Bland–Altman plots [13]. The standard error of measurement and the minimum detectable change were calculated. The standard error of measurement (SEM) was determined by dividing the standard deviation of scores for each metric of the Sprint 1080 (speed, force, power) by the square root of the reliability coefficient (ICC) using the formula $SEM = standard\ deviation\ of\ scores/\sqrt{ICC}$. Subsequently, the minimal detectable change (MDC) was calculated by multiplying the SEM by 1.96, representing the 95% confidence interval using the formula $MDC = SEM \times 1.96$. All analyses were conducted using SPSS version 25.0 (IBM Corp., Armonk, NY, USA), with the alpha level set at $p \leq 0.05$.

3. Results

The results showed that the Sprint 1080 has excellent reliability with ICC values for all metrics above 0.99 (Table 1). One sample t-test showed that test–retest trials for all metrics were not statistically significantly different from each other ($p > 0.05$). The SEM ranged from 0.023 to 0.039 and the MDC from 0.04 to 1.98, indicating that the Sprint 1080 is very precise in measuring throwing performance and that even small differences in performance will be captured by this device. Values ranged from 5.6–13.6 m/s for speed, 38.1–82 newtons for force and 197–964 watts for power.

Bland and Altman plots were designed to demonstrate low systematic bias for all metrics, including speed, force, and power (Figures 2–4).

Table 1. Test–retest reliability values.

	ICC	95% CI (Lower–Upper)	*p*-Value	SEM	MDC
Speed	0.99	0.99–1.00	0.001 *	0.039	0.07
Force	0.99	0.99–1.00	0.001 *	0.023	0.04
Power	0.99	0.99–1.00	0.001 *	1.01	1.98

Abbreviations: ICC: intraclass correlation coefficient, CI: confidence interval, SEM: standard error of measurement, MDC: minimum detectable change, *: statistically significant.

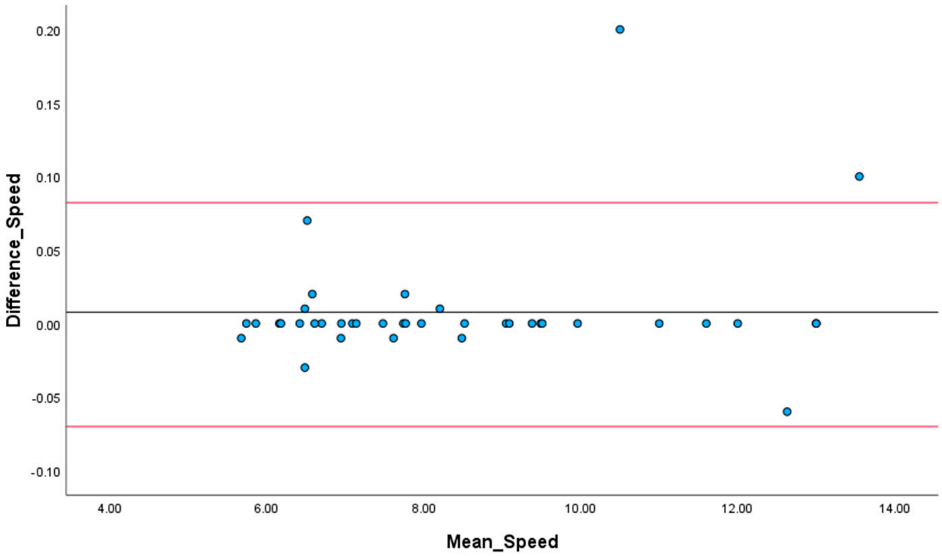

Figure 2. Bland–Altman plots of test–retest for speed. *Black line*: Mean difference between test and retest scores. *Red lines*: 95% limits of agreement (upper and lower limits).

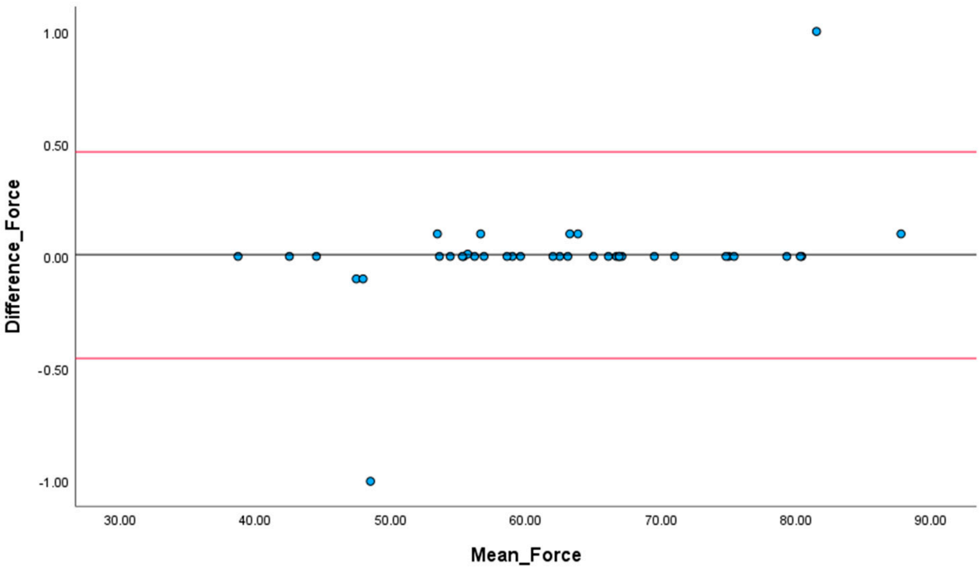

Figure 3. Bland–Altman plots of test–retest for force. *Black line*: Mean difference between test and retest scores. *Red lines*: 95% limits of agreement (upper and lower limits).

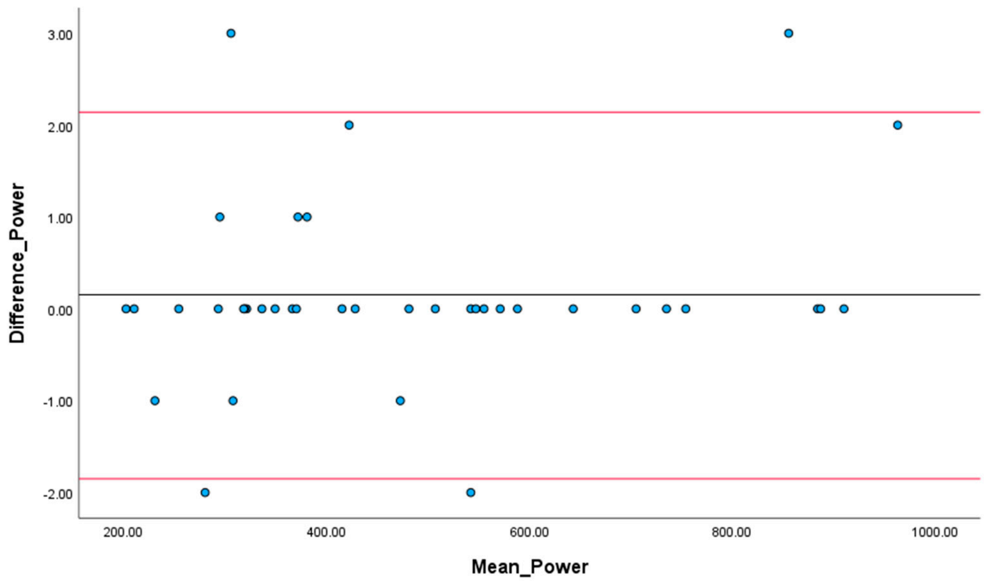

Figure 4. Bland–Altman plots of test–retest for power. *Black line*: Mean difference between test and retest scores. *Red lines*: 95% limits of agreement (upper and lower limits).

4. Discussion

The aim of this study was to investigate the test–retest reliability of a robotic device during resisted throwing performance. This was motivated by the need for reliable and valid assessment methods for measuring throwing performance in athletes, especially in overhead sports. The study aimed to address the lack of thorough examination regarding the reliability of the 1080 Sprint device in assessing throwing performance. Evaluating TP is a crucial component of an athlete's monitoring program. Consequently, athletes and strength and conditioning professionals need to have confidence in the reliability of the tools they employ. In general, the 1080 Sprint device showed excellent reliability values.

Findings from the study indicated that the 1080 Sprint device demonstrated excellent reliability, with ICC values for all metrics exceeding 0.99. Additionally, the results of the one sample *t*-test revealed that test–retest trials for all metrics were not statistically significantly different from each other ($p > 0.05$). The SEM ranged from 0.023 to 0.039, and the MDC ranged from 0.04 to 1.98. These findings suggest that the 1080 Sprint device is very precise in measuring throwing performance, and even small differences in performance can be captured reliably.

4.1. Implications of Findings

The excellent test–retest reliability demonstrated by the 1080 Sprint in measuring throwing performance metrics carries significant implications for athletes and sports performance practitioners. Athletes can now place increased confidence in the consistency and accuracy of the 1080 Sprint as a tool for assessing their throwing performance abilities. This heightened reliability can lead to more targeted and effective training programs, allowing athletes to address specific aspects of their performance with greater precision [14].

Coaches and strength and conditioning practitioners can utilize the 1080 Sprint with assurance, knowing that the obtained metrics are consistently reliable. This reliability is especially crucial in sports where throwing accuracy, force generation, and kinetic chain efficiency play pivotal role [15,16]. Additionally, the device's reliability opens avenues for enhanced rehabilitation strategies, enabling rehabilitation practitioners to monitor recovery progress accurately. Furthermore, talent identification processes can benefit from the reliable metrics provided by the 1080 Sprint, offering a valuable tool for selecting athletes based on their physical capabilities [17,18]. In essence, the study's findings underscore the practical implications of the 1080 Sprint's reliability, shaping its potential impact on individualized training, rehabilitation, and talent development within throwing sports.

4.2. Comparison with Previous Research

Our findings align with a study by Rakovic et al. that examined the reliability of the 1080 Sprint during resisted sprinting performance [11]. Indeed, in their study, they demonstrated that the 1080 Spring is reliable (ICC ranged from 0.86 to 0.95) and valid for sprinting evaluation. Although there was a systematic bias of ~0.34 ± 0.01 s, this was not the case in our study. Of course, this is related to the difference between running and throwing when using the Sprint 1080. At the start of running, the pelvis (attachment site of the pulley) demonstrated a delay in comparison with the upper body, which is placed forward, which may explain this bias [11]. Unfortunately, no other studies have used this device, and we were unable to further compare our findings.

4.3. Limitations

Despite the notable findings highlighting the excellent reliability of the 1080 Sprint in measuring throwing performance metrics, it is crucial to acknowledge several limitations inherent in the study. Firstly, the study focused specifically on professional volleyball athletes with scapular dyskinesis, potentially limiting the generalizability of the results to athletes in other sports or with different physiological profiles. Additionally, the exclusivity of the sample population raises questions about the applicability of the 1080 Sprint across different sports. Furthermore, the study design concentrated on a single day, providing valuable insights into within-day reliability but leaving the device's performance over an extended period unexplored.

While the study's focus on reliability is vital, it does not address the validity of the 1080 Sprint in accurately reflecting an athlete's actual throwing performance. However, examination of validity required additional resources, including access to gold standard measures. These resources were not available for this study. Future research studies should consider expanding the participant pool to encompass different type of athletes, sports, and skill levels, enabling a more comprehensive understanding of the device's applicability and reliability across varied contexts. Despite these limitations, the study serves as a foundational exploration of the 1080 Sprint reliability, paving the way for further investigations that can address these constraints and refine our understanding of this innovative performance assessment tool.

Moreover, it should be mentioned that when the task under evaluation or the tested population changes, several factors may alter the reliability of the equipment used for measurement. Different movement patterns, force exertions, or coordination requirements may affect the reliability of this device. Also, different characteristics of the population under study or other demographic characteristics (e.g., age, gender, or physical condition) may also affects reliability due to significant alterations in biomechanics and muscle activation characteristics. Furthermore, calibrations and proper maintenance of the Sprint 1080 is necessary in order to ensure reliability, as changes in calibration settings may lead to wear over time, leading to measurement errors. Lastly, users' familiarity with the device and the task under study (e.g., TP) may also influence reliability. Thus, emphasis should be placed on standardized protocols and adequate task familiarization.

4.4. Practical Applications

The demonstrated excellent reliability of the 1080 Sprint in measuring throwing performance metrics presents several practical applications for athletes, coaches, and practitioners. Firstly, athletes engaged in sports with significant throwing components, such as baseball, softball, or javelin throwing, can utilize the 1080 Sprint for precise and consistent assessments of their performance. This reliability enables athletes to track their progress over time, identify areas for improvement, and tailor their training programs with a focus on sport-specific aspects like force generation and throwing accuracy [19,20].

It is crucial to acknowledge that overhead athletes heavily depend on precision and throwing power for successful competition [12]. The unique mechanics associated with rapid shoulder elevation, abduction, and external rotation expose these athletes, particularly in professional volleyball, to a heightened risk of injury [20]. Deficits in TP have been identified as a significant risk factor for future upper limb injuries [20], a concern exacerbated in professional volleyball athletes with scapular dyskinesis, who are already predisposed to an increased risk of shoulder injuries [12]. This underscores the importance of our choice to utilize data from professional volleyball athletes with scapular dyskinesis to assess test–retest reliability, SEM, and MDC. Given the elevated risk within this population for performance deficits and shoulder injuries, a reliable measurement device for throwing performance becomes imperative for effective injury prevention and performance optimization in professional volleyball clubs.

Coaches and strength and conditioning professionals can incorporate the 1080 Sprint into training regimens with confidence, knowing that the data obtained are reliable and consistent [21,22]. The device's ability to capture velocity, force, and power metrics in a synchronized manner provides a comprehensive understanding of an athlete's throwing capabilities. This information, in turn, allows for more targeted and individualized training prescriptions, optimizing performance gains [18,23]. Moreover, the 1080 Sprint's reliability makes it a valuable tool in rehabilitation settings, where practitioners can use consistent metrics to monitor an athlete's recovery and adjust interventions accordingly [24]. Overall, the practical applications of the 1080 Sprint extend to enhancing training precision, facilitating performance improvements, and aiding in the rehabilitation process for athletes engaged in throwing sports.

4.5. Implications for Rehabilitation

Deficits in TP can signify significant issues and predispose athletes to further injuries. This is especially important in upper limb rehabilitation, and thus, reliability of the Sprint 1080 becomes very important. The ability of this device to identify changes in performance, based on low SEM and MDC values, may allow clinicians to monitor recovery progress accurately and adjust interventions accordingly [20]. Moreover, providing real-time feedback can improve neuromuscular re-education and aid optimal throwing mechanics, while also preventing compensatory patterns that may exacerbate existing injuries or lead to new ones [12].

Also, the reliability of the Sprint 1080 opens avenues for improved talent identification processes, enabling coaches to select athletes based on their physical capabilities with greater confidence. Longitudinal monitoring using reliable devices can certainly improve insights into the athletes' progression [20]. Although the study has focused on volleyball athletes with scapular dyskinesis, the implications of the findings may apply to other overhead populations in other sports and in athletes with different physiological profiles.

4.6. Future Research

In this study we decided to standardize the starting position of the athletes to minimize the effects of other factors, such as differences in techniques or training interventions, in TP. Allowing athletes to change their starting position could increase the variability that better reflects the unpredictability of game conditions, enhancing the ecological validity of the study. It should be recognized, though, that this approach can also bring in additional confounding variables that could complicate the analysis of the results. Thus, future reliability studies of this device should ensure that other positions are used. Moreover, 3D analysis of movement may be also used to ensure consistency of throwing technique.

5. Conclusions

This study sheds light on the remarkable test–retest reliability SEM and MDC of the 1080 Sprint in measuring throwing performance metrics, particularly among professional volleyball athletes with scapular dyskinesis. The findings hold significant implications for the field of sports performance assessment. Coaches and practitioners can confidently integrate this technology into training programs, tailoring interventions based on reliable metrics to optimize performance outcomes. While acknowledging limitations such as the specific athlete population studied, the study serves as a foundational exploration, offering valuable insights into the potential applications of the 1080 Sprint in enhancing training precision and rehabilitation strategies.

Author Contributions: Conceptualization, E.P.; methodology, E.P.; software, E.P., A.C. and M.P.; validation, G.M.P., A.C., G.P. and M.P.; formal analysis, A.C., G.P. and M.P.; investigation, E.P. and G.P.; resources, E.P. and M.P.; data curation, E.P. and M.P.; writing—original draft preparation, E.P.; writing—review and editing, G.M.P., A.C., G.P. and M.P.; visualization, E.P., G.M.P. and M.P.; supervision, M.P.; project administration, E.P. and M.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University of West Attica (protocol code: 9230).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are available upon reasonable request by the primary author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Abernethy, P.; Wilson, G.; Logan, P. Strength and power assessment. Issues, controversies and challenges. *Sports Med.* **1995**, *19*, 401–417. [CrossRef] [PubMed]
2. Harasin, D.; Dizdar, D.; Markovic, G. High reliability of tests of maximum throwing performance. *J. Hum. Mov. Stud.* **2006**, *51*, 63–76.
3. van den Tillaar, R.; Marques, M.C. Reliability of seated and standing throwing velocity using differently weighted medicine balls. *J. Strength Cond. Res.* **2013**, *27*, 1234–1238. [CrossRef] [PubMed]
4. van den Tillaar, R. Effect of different training programs on the velocity of overarm throwing: A brief review. *J. Strength Cond. Res.* **2004**, *18*, 388–396. [CrossRef] [PubMed]
5. Gorostiaga, E.M.; Granados, C.; Ibáñez, J.; Izquierdo, M. Differences in physical fitness and throwing velocity among elite and amateur male handball players. *Int. J. Sports Med.* **2005**, *26*, 225–232. [CrossRef] [PubMed]
6. Manske, R.; Reiman, M. Functional performance testing for power and return to sports. *Sports Health* **2013**, *5*, 244–250. [CrossRef] [PubMed]
7. Mangine, G.T.; Huet, K.; Williamson, C.; Bechke, E.; Serafini, P.; Bender, D.; Hudy, J.; Townsend, J. A Resisted Sprint Improves Rate of Force Development During a 20-m Sprint in Athletes. *J. Strength Cond. Res.* **2018**, *32*, 1531–1537. [CrossRef] [PubMed]
8. Cross, M.R.; Lahti, J.; Brown, S.R.; Chedati, M.; Jimenez-Reyes, P.; Samozino, P.; Eriksrud, O.; Morin, J.B. Training at maximal power in resisted sprinting: Optimal load determination methodology and pilot results in team sport athletes. *PLoS ONE* **2018**, *13*, e0195477. [CrossRef] [PubMed]
9. Rakovic, E.; Paulsen, G.; Helland, C.; Eriksrud, O.; Haugen, T. The effect of individualised sprint training in elite female team sport athletes: A pilot study. *J. Sports Sci.* **2018**, *36*, 2802–2808. [CrossRef]
10. Samozino, P.; Rabita, G.; Dorel, S.; Slawinski, J.; Peyrot, N.; Saez de Villarreal, E.; Morin, J.B. A simple method for measuring power, force, velocity properties, and mechanical effectiveness in sprint running. *Scand. J. Med. Sci. Sports* **2016**, *26*, 648–658. [CrossRef]
11. Rakovic, E.; Paulsen, G.; Helland, C.; Haugen, T.; Eriksrud, O. Validity and reliability of a motorized sprint resistance device. *J. Strength Cond. Res.* **2020**, *36*, 2335–2338. [CrossRef] [PubMed]
12. Paraskevopoulos, E.; Simeonidis, T.; Tsolakis, C.; Koulouvaris, P.; Papandreou, M. Mirror Cross-Exercise on a Kinetic Chain Approach Improves Throwing Performance in Professional Volleyball Athletes with Scapular Dyskinesis. *J. Sport Rehabil.* **2021**, *31*, 131–139. [CrossRef] [PubMed]
13. del-Cuerpo, I.; Jerez-Mayorga, D.; Delgado-Floody, P.; Morenas-Aguilar, M.D.; Chirosa-Ríos, L.J. Test– Retest Reliability of the Functional Electromechanical Dynamometer for Squat Exercise. *Int. J. Environ. Res. Public Health* **2023**, *20*, 1289. [CrossRef] [PubMed]
14. Stockbrugger, B.A.; Haennel, R.G. Validity and Reliability of a Medicine Ball Explosive Power Test. *J. Strength Cond. Res.* **2001**, *15*, 431–438. [PubMed]
15. Seroyer, S.T.; Nho, S.J.; Bach, B.R.; Bush-Joseph, C.A.; Nicholson, G.P.; Romeo, A.A. The Kinetic Chain in Overhand Pitching: Its Potential Role for Performance Enhancement and Injury Prevention. *Sports Health* **2010**, *2*, 135–146. [CrossRef] [PubMed]
16. Trasolini, N.A.; Nicholson, K.F.; Mylott, J.; Bullock, G.S.; Hulburt, T.C.; Waterman, B.R. Biomechanical Analysis of the Throwing Athlete and Its Impact on Return to Sport. *Arthrosc. Sports Med. Rehabil.* **2022**, *4*, e83–e91. [CrossRef] [PubMed]
17. Gabbett, T.; Georgieff, B.; Domrow, N. The use of physiological, anthropometric, and skill data to predict selection in a talent-identified junior volleyball squad. *J. Sports Sci.* **2007**, *25*, 1337–1344. [CrossRef] [PubMed]

18. Serrien, B.; Baeyens, J.-P. Systematic review and meta-analysis on proximal-to-distal sequencing in team handball: Prospects for talent detection? *J. Hum. Kinet.* **2018**, *63*, 9–21. [CrossRef] [PubMed]
19. Paraskevopoulos, E.; Pamboris, G.M.; Papandreou, M. The Changing Landscape in Upper Limb Sports Rehabilitation and Injury Prevention. *Sports* **2023**, *11*, 80. [CrossRef]
20. Paraskevopoulos, E.; Pamboris, G.M.; Plakoutsis, G.; Papandreou, M. Reliability and measurement error of tests used for the assessment of throwing performance in overhead athletes: A systematic review. *J. Bodyw. Mov. Ther.* **2023**, *35*, 284–297. [CrossRef]
21. Freeston, J.; Rooney, K.; Smith, S.; O'Meara, D. Throwing performance and test-retest reliability in Olympic female water polo players. *J. Strength Cond. Res.* **2014**, *28*, 2359–2365. [CrossRef] [PubMed]
22. Rios, L.J.C.; Cuevas-Aburto, J.; Martínez-García, D.; Ulloa-Diaz, D.; Ramírez, O.A.A.; Martin, I.M.; Ramos, A.G. Reliability of Throwing Velocity during Non-specific and Specific Handball Throwing Tests. *Int. J. Sports Med.* **2021**, *42*, 825–832. [CrossRef] [PubMed]
23. Bartlett, R. Principles of Throwing. In *Biomechanics in Sport: Performance Enhancement and Injury Prevention*; Wiley-Blackwell: Hoboken, NJ, USA, 2000; pp. 365–380.
24. Clark, K.; Cahill, M.; Korfist, C.; Whitacre, T. Acute kinematic effects of sprinting with motorized assistance. *J. Strength Cond. Res.* **2021**, *35*, 1856–1864. [CrossRef] [PubMed]