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Resistance Training Using Flywheel Device Improves the Shot Precision in Senior Elite Tennis Players: A Randomized Controlled Study

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Abstract: The aim of the study was to assess the effects of 8 weeks of resistance training using a flywheel device applied to upper limbs, compared to traditional isotonic training, on strength and shot precision in tennis. Twenty-seven elite senior tennis players (age: 55.78 ± 2.69) were randomly divided into an experimental group (EG) using flywheel devices (n = 13) and a control group (CG) performing isotonic training (n = 14). The EG program included forehand, backhand, and one-handed shoulder press movements, while the CG performed seven resistance exercises on isotonic machines. A similar workout intensity was ensured using the Borg's CR-10 scale. The assessment included a 30s arm curl test, a medicine ball throw test, and forehand/backhand/overhead shot precision tests. A significant time effect was found in the 30s arm curl test for the EG ($F_{(1,25)} = 13.09$; $p = 0.001$), along with a time * group interaction ($F_{(1,25)} = 5.21$; $p = 0.031$). A significant group difference was observed in the forehand shot precision test, where the EG achieved better scores than the CG and significant interaction time * group ($F_{(1,25)} = 8.35$; $p = 0.008$). In the shot backhand precision test, a significant effect of time ($F_{(1,25)} = 5.01$; $p = 0.034$) and significant time * group interaction were found ($F_{(1,25)} = 4.50$; $p = 0.044$), but there was no significant difference between groups. Resistance training with flywheel devices has shown potential in improving tennis performance. Applying overload to specific athletic movements during both concentric and eccentric phases in the EG has shown enhanced strength and neuromuscular coordination in relation to shot precision, thereby enabling simultaneous improvements in both conditioning and the technical aspects of fundamental tennis shots.

Keywords: strength training; eccentric overload; tennis skill; tennis stroke; athletic performance

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1. Introduction

Tennis is evolving to require greater dynamism and speed, demanding players to exhibit enhanced skills and quicker game actions involving both the upper and lower limbs [1]. This requirement is due to the strong combination of abilities needed to strategically deliver a shot to a specific point in the opponent's court, such as actions performed at different speeds, acceleration and deceleration, changes in direction, and the ability to vary game plans [2].

The shot actions in tennis require the coordinated actions of both the upper and lower limbs, involving the athlete's extensor kinetic chain. These actions highlight the significance of eccentric movements, which entail alternating changes in muscle length between concentric and eccentric contractions [3]. This ability enables the development of powerful movements within a brief timeframe [4]. As a result, most tennis movements involve consecutive eccentric contractions immediately preceding the concentric phase. Consequently, both eccentric and concentric strength are crucial for optimizing the benefits of strength training [5].

Most of the studies available in the literature focus on strategies to improve lower limb actions, such as change in direction and short accelerations [6,7]. Few studies have addressed new strategies for enhancing skills and abilities related to the upper limbs [4,8,9]. Specifically, most studies on this topic have focused on the physical and technical development of young tennis players [10–14]. Tennis is a sport that can be practiced throughout one's lifetime, even into advanced age. Numerous tournaments are organized for players over 40 who are in the senior categories, thus motivating appropriate training for athletes of all ages and ensuring an active and fulfilling lifestyle [15].

The application of flywheel machines involves both eccentric and concentric load applied to specific exercises and provides the advantage of enabling maximal force development throughout the complete range of motion, with periods of higher eccentric force demands compared to concentric ones [16] using the principle of kinetic energy accumulation [17]. Resistance training using a flywheel machine leads to a more prolonged eccentric strain, which might lead to a better adaptation. It seems that prolonged exposure to eccentric training increases eccentric kinetic energy and enhances performance to a greater extent compared to traditional methodologies [18,19].

It is possible to increase the load using flywheel devices in three ways: increasing the speed of the rope, adding extra loads, or modifying the position of the pulley [20,21].

The flywheel device applies resistance within the same plane as the technical movements, enabling athletes to perform overloaded multidirectional movements in various joint angles and sport-specific conditions [22–24]. These advantages have led to increased utilization of these devices to achieve immediate responses and long-term adaptations in strength, hypertrophy, power, injury prevention, and rehabilitation in both amateur and professional sporting contexts [23,25]. Flywheel technology provides the flexibility to adjust the resistance loads for each repetition, allowing for maximum effort from the first repetition [19]. This unique feature allows individuals to perform personalized load repetitions as the force decreases with fatigue, causing the inertial resistance to decrease accordingly [26]. Consequently, the exercise can essentially continue indefinitely until exhaustion, even with reduced force [27]. Therefore, as a result, the gains in terms of strength are significant while maintaining the training in a state of highest safety [28]. The lack of understanding about the eccentric overload induced by the device stimulates adaptations such as coordination within and between muscles [29]. Deng [6] indicated that both agonist and antagonist muscles increase their activity in response to uncertain stimuli, potentially as a result of a neural adaptation that enhances joint stability through increased muscle co-contraction.

Furthermore, the improvement in explosive strength is also influenced by the increased time under tension experienced by the muscles in both concentric and eccentric conditions [29].

The hypothesis of this study was that resistance training with flywheel devices would result in greater improvements compared to a conventional resistance training regimen. This hypothesis is based on the understanding that the contraction patterns involved in fundamental tennis movements heavily rely on the tension-shortening cycle.

The aim of this study was to assess the impact of an 8-week resistance training program using a flywheel device, compared with an isotonic resistance training program, on strength and shot precision in elite senior tennis players.

2. Methods

2.1. Study Design

The study is a Randomized Controlled Trial (RCT) designed to evaluate the effect of 8 weeks of EG training compared to traditional isotonic weight training on physical performance and shot precision in adult elite tennis players.

2.2. Participants

Twenty-seven male tennis players (age = 55.78 ± 2.69) were recruited from a tennis association and were randomly assigned to the EG (*n* = 13) and to an isotonic training group that served as the CG (*n* = 14). The participants were elite players with at least 10 years of experience and a training frequency of 3–4 days per week. The athletes had no prior experience with training with the flywheel device. The sample characteristics are shown in Table 1.

Table 1. Sample characteristics.

Variable	Mean ± SD
Experimental group (*n* = 13)	
Age	56.46 ± 2.14
Training experience (years)	12.85 ± 2.54
Training volume (h/week)	3.40 ± 0.44
Experience with resistance training (years)	15.24 ± 5.45
Control group (*n* = 14)	
Age	55.14 ± 3.06
Training experience (years)	13.21 ± 2.33
Training volume (h/week)	3.35 ± 0.47
Experience with resistance training (years)	14.91 ± 5.82

The inclusion criteria were (1) aged between 50 and 70 years; (2) male gender; and (3) to have practiced tennis for at least 10 years. Exclusion criteria were (1) injuries that occurred in the previous 3 months; (2) participation in other training protocols; and (3) use of drugs or medications that could influence the test results and training exercises.

All participants were informed about the objective and procedures of the study and signed the informed consent. The study was designed and conducted in accordance with the Declaration of Helsinki and approved by the Scientific Technical Committee of the Department of Medicine and Health Sciences, University of Molise (Prot. n. 04/2022).

2.3. Experimental Procedures

After the baseline assessment, participants were randomized in the EG and CG as follows: Each of the 27 enrolled and eligible participants received a progressive number. Then, a random number list was generated using online software (https://www.random.org/sequences/ (accessed on 2 October 2023) Dublin, Ireland), which contained numbers from 1 to 27 with no repetition. The list was used to rearrange the participants in a random order and allocate them into different groups in blocks of two participants per group, following the order of CG and EG. After randomization, the homogeneity of the two groups was assessed in terms of all the primary and secondary outcomes.

A familiarization session was performed one week before the intervention in order to allow participants to learn the correct exercise technique.

The training protocols were performed two days per week on nonconsecutive days, with 72 h of rest between them. Both groups performed 10–15 min of a moderate-intensity warm-up, including skips, push-ups, squats, and crunches and mobility exercises for hips, shoulders, arms, and trunk. such as.

The EG program consisted of 3 sets of 6–12 repetitions of 7 exercises, all performed with the device positioned behind the athlete (see Table 2). The Flyconpower conical machine was employed in this study (Flyconpower SRL, Cuneo, Italy).

Table 2. Training interventions.

Experimental Group Training				
Weeks	**Volume**	**Intensity (n. of overloads) ***	**Target RPE**	**Exercises**
1–2	3 × 12	6	5	Low forehand movement; Middle forehand movement; High forehand movement; Low backhand movement; Middle backhand movement; High backhand movement; One-handed shoulder press
3–4	3 × 10	8	6	
5–6	3 × 8	10	7	
7–8	3 × 6	12	8	
Control group training				
Weeks	**Volume**	**Intensity (%1RM)**	**Target RPE**	**Exercises**
1–2	3 × 12	50	5	Chest press in standing position; Chest butterfly in standing position; Reverse butterfly in standing position; Lateral raises in standing position; Lat machine; Cable rotation; Shoulder press in standing position reproducing the service loading stage
3–4	3 × 10	60	6	
5–6	3 × 8	70	7	
7–8	3 × 6	75	8	

* Each overload applied on the inertial had a weight = 0.650 kg.

The EG participants were asked to reproduce the proposed technical movements; in particular, they were encouraged to execute the concentric phase as quickly as possible, resist the inertial force during the initial third of the eccentric action, and conclude the movement at the maximum range of motion with maximal effort. The requirement for maximum effort, maximum execution speed, and adherence to the joint angles applied during the concentric phase of the movement was in accordance with procedures used in a recent previous study [30]. It was recommended to the athletes to delay the braking action during the eccentric phase. The method used to vary the intensity involved in increasing the speed of the cord release, which was managed by the athlete based on their level of fatigue and fitness. Moreover, the number of overloads was incrementally raised while the volume was reduced.

The EG protocol exercises are shown in Figure 1.

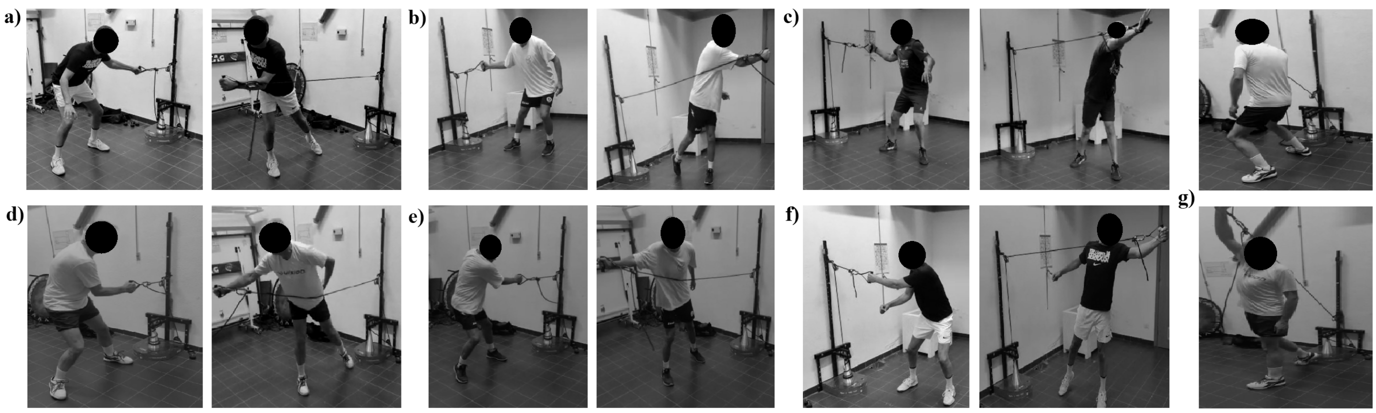

Figure 1. Resistance training with flywheel protocol. (**a**) Low forehand movement; (**b**) middle forehand movement; (**c**) high forehand movement; (**d**) low backhand movement; (**e**) middle backhand movement; (**f**) high backhand movement; (**g**) one-handed shoulder press.

The CG protocol consisted of 3 sets of 6–12 repetitions of 7 exercises executed using isotonic machines (Technogym Element line machines; Technogym SPA, Cesena, Italy) with an intensity that increased every 2 weeks (see Table 2). The one repetition maximum (1 RM) was previously estimated in a preliminary session using an indirect method of up to 8 repetitions maximum (70–75% 1RM).

The Borg's Rate of Perceived Exertion scale CR-10 (RPE) [31] was used in order to ensure a similar workout intensity between the two protocols.

2.4. Testing Procedures

After the familiarization session, all participants underwent a two-day nonconsecutive testing session. On the first day, the 30s arm curl test and medicine ball throw tests (MBT) were performed, and, on the second day, the shot precision tests (SP) were performed.

30s arm curl test: The 30s arm curl test was used to assess upper extremity muscle strength [32]. During the test, participants used a 3-kg dumbbell. The participants were instructed to sit on a chair with a straight backrest with their feet on the ground. The weight was placed in the dominant hand with a neutral wrist position and extended elbow. After a brief demonstration and practice, the participant performed as many arm curl movements as possible within 30 s. The total number of completed movements was considered for the analysis.

Medicine ball throw test (MBT): Participants were instructed to throw the medicine ball as far as possible, using overhead, forehand, and backhand, simulating tennis movements [33]. A 2-kg medicine ball was used for all participants. During each throw, subjects were allowed to flex and bend their legs but had to maintain contact with the ground without crossing the line during each attempt. Players were given specific instructions on their stance for overhead and forehand/backhand throws. An open stance was recommended for overhead throws, while a closed stance was suggested for forehand/backhand throws. The distance from the starting line to the landing point was calculated using a tape measure (Stanley 34106 Longtape; Stanley Black & Decker Inc., New Britain, CT, USA). Moreover, each trial was recorded using one GoPro HERO4 Black camera (240 Hz, 1280 $\times$ 720 pixels; GoPro Inc., San Mateo, CA, USA). The best result of 2 attempts was considered for analysis.

Shot precision test (SP): Forehand and backhand shot precision was evaluated according to Wiebe [34]. The participant was positioned behind the baseline and hit the ball sent by a tennis feeding ball (Spinfire Pro 2; Spinfire Sport, Melbourne, VIC, Australia). The tennis feeding ball was positioned centrally, one meter away from the baseline of the field, and ejected in a predefined direction with a velocity of 20 m/s. The field was divided into graded zones with a score from 0 to 9. The athlete had to perform 10 forehand and 10 backhand attempts, hitting a specific target in the opposite field in order to achieve the highest score, depending on the area where the ball landed. If the ball did not hit the target or the athlete failed the shot, a score of 0 points was assigned. The test score was obtained by the sum of the points achieved after 10 forehand and backhand attempts. To count points, we recorded each trial using GoPro HERO4 Black cameras set at 240 Hz, 1280 $\times$ 720 pixels (GoPro Inc.; San Mateo, CA, USA) placed behind the tennis ball machine at a height of 10 m. The SP test is shown in Figure 2.

2.5. Statistical Analysis

The normal distribution of continuous variables was verified using the Shapiro–Wilk test. Descriptive statistics are presented as mean and standard deviations. Analysis of variance for repeated measures with between factors (RM-ANOVA) was used to evaluate differences among arm curl, MBT, and SP. When performing the analysis, the two groups (*group* factor: EG vs. CG) were considered between factors of the analysis, while the two time-point assessments (*time* factor: pre-test vs. post-test) were considered within factors of the analysis. The interaction *time* * *group* was also calculated. The scores obtained with each test were instead considered independent variables. In particular, the 6 independent variables were the scores obtained in the arm curl, MBT forehand, MBT backhand, MBT overhead, SP forehand, and SP backhand tests, respectively. When significant differences between pre-test vs. post-test results were detected, and significant differences between groups and/or in the interaction time * group were also detected, Student's paired t-test was used to assess the differences between pre-test vs. post-test results for the two groups separately. Finally, the partial eta square (η^2_p) was also calculated as an indicator of the effect size of the analysis. A partial eta-squared value between 0.01 and 0.06 indicates a small effect size, a partial eta-squared between 0.06 and 0.13 indicates a medium effect size, and a value equal to or higher than 0.14 indicates a large effect size [35]. The alpha test level for statistical significance for all variables was set at 0.05. Data analysis was performed using SPSS Statistics 21 software (IBM, Armonk, NY, USA).

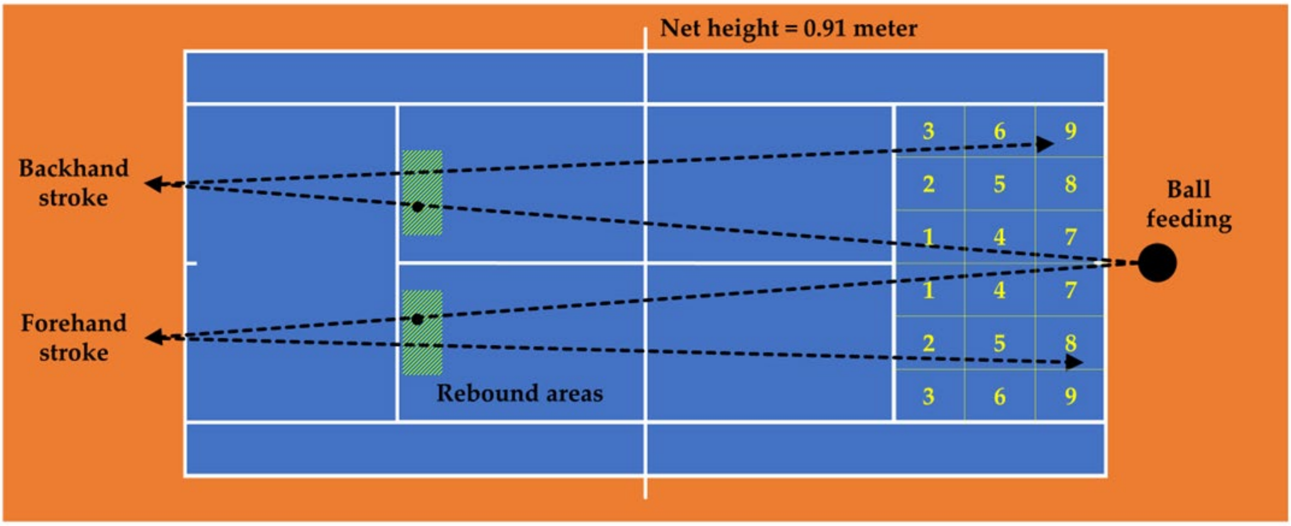

Figure 2. Precision shooting test with score assignment.

The sample size was calculated using G * Power (version 3.1.9.7; written by Franz Faul, University of Kiel, Kiel, Germany). The following design specifications were considered: test family = F tests; statistical test = analysis of variance (ANOVA) repeated measures between factors; $\alpha = 0.05$; $(1-\beta) = 0.95$; effect size f = 0.4; number of groups = 2; and number of measurements = 2. The sample size estimation indicated 24 total participants with a critical F value of 4.301.

3. Results

All the results are shown in Table 3 as means ± standard deviation.

Table 3. Physical performance variables. Data are reported as means ± standard deviations.

Variable	Experimental Group			Control Group			Significance
	Pre	Post	Δ	Pre	Post	Δ	
Arm curl test	24.85 ± 3.67	31.15 ± 8.30	+6.30	27.93 ± 5.16	29.36 ± 7.41	+1.43	**Time factor: $F_{(1,25)} = 13.09$; $p = 0.001$** **Interaction: $F_{(1,25)} = 5.21$; $p = 0.031$** Groups factor: $F_{(1,25)} = 0.084$; $p = 0.775$
MBT forehand	9.27 ± 1.25	10.09 ± 1.24	+0.82	9.31 ± 1.67	9.67 ± 1.55	+0.36	**Time factor: $F_{(1,25)} = 8.92$; $p = 0.006$** Interaction: $F_{(1,25)} = 1.40$; $p = 0.248$ Groups factor: $F_{(1,25)} = 0.13$; $p = 0.716$

Table 3. *Cont.*

Variable	Experimental Group			Control Group			Significance
	Pre	Post	Δ	Pre	Post	Δ	
MBT backhand	9.06 ± 1.00	9.91 ± 1.35	+0.85	9.34 ± 1.41	9.67 ± 1.36	+0.33	**Time factor: $F_{(1,25)}$ = 15.35; p = 0.001** Interaction: $F_{(1,25)}$ = 2.97; p = 0.097 Groups factor: $F_{(1,25)}$ = 0.002; p = 0.965
MBT overhead	8.20 ± 1.52	8.35 ± 1.45	+0.15	8.69 ± 1.36	8.59 ± 1.17	−0.10	Time factor: $F_{(1,25)}$ = 0.06; p = 0.812 Interaction: $F_{(1,25)}$ = 1.13; p = 0.297 Groups factor: $F_{(1,25)}$ = 0.50; p = 0.484
SP forehand	32.23 ± 8.02	***40.46 ± 8.83***	+8.23	27.28 ± 9.13	27.00 ± 9.69	−0.28	**Time factor: $F_{(1,25)}$ = 7.27; p = 0.012** **Interaction: $F_{(1,25)}$ = 8.35; p = 0.008** **Groups factor: $F_{(1,25)}$ = 8.70; p = 0.007**
SP backhand	31.61 ± 10.70	39.61 ± 15.55	+8.00	28.36 ± 11.21	28.57 ± 11.40	+0.21	**Time factor: $F_{(1,25)}$ = 5.01; p = 0.034** **Interaction: $F_{(1,25)}$ = 4.50; p = 0.044** Groups factor: $F_{(1,25)}$ = 2.66; p = 0.115

MBT = Medicine ball throw test; SP = Shoot precision test. **Bold** indicates significant values obtained by the RM-ANOVA. ***Bold and italic*** indicated that this post score is significantly higher ($p < 0.05$) than the pre score when the 2 groups were analyzed separately using the paired *t*-test due to the significant differences between groups of RM-ANOVA.

The RM-ANOVA performed on the arm curl test showed a significant effect of time ($F_{(1,25)} = 13.09$; $p = 0.001$; $\eta^2_p = 0.344$); in addition, a significant interaction for time * group was found ($F_{(1,25)} = 5.21$; $p = 0.031$; $\eta^2_p = 0.172$). No significant difference was found between groups ($F_{(1,25)} = 0.084$; $p = 0.775$; $\eta^2_p = 0.003$). The paired t-test performed on the two groups separately showed that the EG significantly improved the number of repetitions in comparison with pre-intervention ($p < 0.001$).

The RM-ANOVA performed on the MBT test forehand shot showed a significant effect of time ($F_{(1,25)} = 8.92$; $p = 0.006$; $\eta^2_p = 0.263$). No significant results were found for time interaction ($F_{(1,25)} = 1.40$; $p = 0.248$; $\eta^2_p = 0.053$) and between groups ($F_{(1,25)} = 0.13$; $p = 0.716$; $\eta^2_p = 0.005$).

The RM-ANOVA performed on the MBT test backhand shot showed a significant effect of time ($F_{(1,25)} = 15.35$; $p = 0.001$; $\eta^2_p = 0.380$). No significant results were found for time interaction ($F_{(1,25)} = 2.97$; $p = 0.097$; $\eta^2_p = 0.106$) and between groups ($F_{(1,25)} = 0.002$; $p = 0.965$; $\eta^2_p < 0.001$).

The RM-ANOVA performed on the MBT test overhead shot showed no significant effect of intervention, time, or interaction effects (all *p*-values > 0.05).

The RM-ANOVA performed on the forehand shot of the SP test showed a significant effect of time ($F_{(1,25)} = 7.27$; $p = 0.012$; $\eta^2_p = 0.225$). In addition, a significant interaction for time * group was found ($F_{(1,25)} = 8.35$; $p = 0.008$; $\eta^2_p = 0.250$). Finally, a significant difference was found between groups ($F_{(1,25)} = 8.70$; $p = 0.007$; $\eta^2_p = 0.258$), where the EG achieved better scores in comparison with the control group. The paired t-test performed on the two groups separately showed that the EG significantly improved precision scores in the SP test for forehand in comparison to pre- vs. post-intervention scores ($p < 0.001$).

The RM-ANOVA performed on the backhand shot of the SP test showed a significant effect of time ($F_{(1,25)} = 5.01$; $p = 0.034$; $\eta^2_p = 0.167$). In addition, a significant interaction for time * group was found ($F_{(1,25)} = 4.50$; $p = 0.044$; $\eta^2_p = 0.153$). No significant difference was found between groups ($F_{(1,25)} = 2.66$; $p = 0.115$; $\eta^2_p = 0.096$). The t-test performed on the two groups separately showed that the EG significantly improved precision scores in the SP test backhand in comparison to pre- vs. post-intervention scores ($p = 0.006$).

4. Discussion

The main result of this study was that the experimental group, who performed resistance training with a flywheel device, significantly improved the forehand shot test in terms of precision and depth of shot. These results provided significant information regarding the effectiveness of this type of resistance training on tennis performance as they validated enhancements in precision and efficacy. We hypothesized that targeted resistance training with a flywheel device would result in greater improvements compared to a conventional training regimen, ensuring effectiveness and safety for senior athletes.

The shot precision test allows for the evaluation of technical skills while monitoring improvements in physical skills [36]. The strength improvements were comparable to those obtained after the resistance training performed with isotonic machines, as no differences in upper limb strength (evaluated with the arm curl test) were observed between the groups. Nevertheless, resistance training using a flywheel device effectively improves the athlete's shot efficacy. This improvement probably stems from enhanced neuromuscular coordination, which reinforces and stabilizes the motor patterns of the shot [37], making athletes more skilled in preparing for it and ensuring better management of force delivery during the execution of shot precision [38]. Flywheel technology offers different overloads during the eccentric phase based on the strength applied in the concentric phase [19]. This particular characteristic enables athletes to engage in personalized load repetitions when the force diminishes with fatigue, leading to a corresponding decrease in inertial resistance [26,27]. Therefore, as a result, the gains in terms of strength are significant while maintaining the training in a state of highest safety.

As evident in Table 3, the CG demonstrated more limited changes in scores over time, while the EG showed higher improvements in performance during the same period. However, these improvements do not attain statistical significance in RM-ANOVA between groups. The lack of significant differences between groups, but the significant interaction for time * group, suggests that a longer intervention duration using a flywheel device could likely be required to achieve a significant improvement.

Forehand is typically used as a key shot and is often employed as a decisive shot during gameplay, while the backhand shot is less effective and requires greater coordination skills [39]. Therefore, the player possesses significantly more expertise in forehand. Given that the forehand is a shot used much more frequently by tennis players, compared to the backhand, as statistically, it leads to winning points [40,41], the improvement in forehand precision can be considered a valuable result.

The lack of significant differences between groups but the significant interaction for time * group were also found in the arm curl test, emphasizing the effectiveness of resistance training programs using flywheel devices in enhancing upper limb strength as comparable with traditional resistance training, potentially leading to better results over a longer period.

MBT tests are the prevalent methods used to assess and monitor the power, ability, and speed of tennis players. Involving coordinated, multidirectional movements and targeting specific characteristics, this test simulates the movement patterns required in tennis shots [10,42]. Both groups significantly improved forehand MBT and backhand MBT, indicating substantial equality between the two training methods.

The overhead MBT did not show significant improvements, probably because the training load applied on overhead movement was substantially lower compared to that performed for forehand and backhand in terms of volume. Moreover, the overhead movement indicates the final activation of the extensor kinetic chain and effective coordination of different joint movements in succession, with greater technical and coordination effort [43]. The fact that our protocol only partially engaged the entire kinetic chain involved in the serve (only the upper limbs) may have compromised the overhead MBT in terms of its efficacy.

Considering these findings, it appears useful to incorporate resistance training programs using flywheel devices into tennis strength programs.

The limitations of the study are as follows:

1. The effectiveness of the protocol in terms of strength was evaluated through validated tests that simulated the technical movements but not directly on tennis shots (overhead, forehand, and backhand).
2. The fact that eccentric loading with a flywheel device is induced by the individual's voluntary effort during the concentric phase highlights its limitations in providing accentuated eccentric resistance training.
3. The results can only be attributed to a sample of senior tennis players. In other populations, such as young individuals and/or adult athletes, further studies are needed to confirm our findings.

5. Conclusions

In conclusion, significantly greater improvements in forehand precision were found using flywheel devices compared to the effects of traditional resistance training with isotonic machines, along with significant interactions among groups even in the backhand precision. It is important to note that both of these shots are crucial technical movements to achieve optimal results and enhance game strategies. The obtained results prove to be particularly significant, especially when considering that the participants are elite athletes with a minimum of 10 years of training.

Resistance training using flywheel devices is particularly advisable for tennis players, given its specificity, allowing simultaneous improvements in both conditioning and technical aspects of some fundamental tennis shots [44].

While the outcomes of this training approach may be comparable to those of traditional methods [45], protocols employing a flywheel device as an innovative approach offer a wider range of training methods. Introducing variability in training methods could be particularly beneficial for senior elite athletes [46], promoting increased athlete adherence [47].

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Data Availability Statement: Data are available under request to the corresponding author. The data are not publicly available due to privacy.

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

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