Paralympic Powerlifting as a Sustainable Way to Improve Strength in Athletes with Spinal Cord Injury and Other Disabilities

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Abstract: Background: in Paralympic Powerlifting (PP), athletes with a spinal cord injury (SCI) and other disabilities (OD) compete together. However, athletes with SCI are at a disadvantage in terms of force production and transfer. Objective: to analyze the strength and the dynamic and static indicators, at different intensities, tied and untied in athletes with SCI and OD. Methods: the sample presented 10 OD (28.30 ± 4.92 years) and 10 SCI (30.00 ± 4.27 years), classified competitors, and eligible to compete in the sport (all males). Maximum isometric force (MIF); time to MIF (Time); rate of force development (RFD); impulse, variability, and fatigue index (FI); and the dynamic tests of Mean Propulsive Velocity (MPV), Velocity Maximum (Vmax), and Power with loads of 40, 60, and 80% of 1 Repetition Maximum (1 RM), respectively. Results: there were no differences between OD and SCI in dynamic and isometric strength indicators. In MPV, there was an 80% difference between tethered and untethered SCI ($p = 0.041$). In VMax, there were differences in SCI between tethered and untethered, 40% ($p = 0.004$) and 80% ($p = 0.023$), respectively. There were no differences in the other intensities. Conclusion: PP training seems to be a sustainable way to promote strength gains in SCI, since there were no differences between athletes with SCI and OD, as practitioners of Paralympic Powerlifting.

Keywords: spinal cord injury; para-athletes; muscle strength; disabled persons; athletic performance

1. Introduction

Spinal cord injury (SCI) affects about 500,000 people worldwide [1], whether of trau-matic etiology or not [1,2]. SCI is characterized by physical disability and a decreased quality of life [3]. The most indicated treatments in rehabilitation include physical exercises, among other approaches [1], where exercises and sports practices have been presented as

a sustainable practice with favorable impacts on health and general well-being [4]. SCI would have a negative impact on performance, making it difficult to maintain strength, power, and speed, among others. Added to these facts, in SCI, fatigue tends to appear prematurely, due to the physiological interactions of the deficiency [5]. That is, the absence or decrease in autonomic control would be reduced in SCI, with a negative impact on performance and fatigue [6].

In this direction, initially athletes with SCI could be harmed, in terms of strength indicators, due to the difficulty of transferring strength, in the performance of the movement when they are untied, which was not observed by our findings. Thus, SCI could be harmed, being not tied up, in view of the presented hypothesis; that is, the difficulty that SCI would have to maintain the position, which would cause damages to strength, power, speed, and, therefore, to the abilities of the specific neuromotor disorders, which would not occur in other disabilities [5].

Thus, in the Paralympic field, we have Paralympic Powerlifting (PP), which is characterized as a strength sport [7]; people with physical disabilities, especially in the lower limbs [7], are eligible, and its practice is performed through the adapted bench press, with the lower limbs extended over the bench, and athletes can be tied to the bench with bands in order to improve stabilization [7]. The sport has grown worldwide, with improvements in terms of performance [8,9]. However, research has focused on health assessment, injuries, and recovery, among others [10–13]. In this sense, it has been emphasized that SCI would impair the transfer of force [14], where this would be related to the difficulty in maintaining strength, power, and speed, when compared to other deficiencies [5].

Thus, the hypotheses were raised that SCI would have impaired strength indicators in relation to other deficiencies, and there may be some damage to sports practice [7]. Thus, the objective of this research was to evaluate the mechanical strength indicators, in Attached and Non-Attached conditions, as established by IPC rules [7], in athletes with SCI compared to OD, at different intensities, in relation to performance in Paralympic Powerlifting. Thus, as the IPC allows athletes to be tied to the bench with up to two fixation bands [7], we raised the hypothesis that this could interfere with the stabilization of the athletes; due to this stabilization, the transfer of force to the upper limbs could be potentiated and even athletes with SCI would be harmed without extra stabilization in relation to OD.

2. Materials and Methods

In the first week, the subjects were submitted to a familiarization session, 1 RM test, and definition of the biacromial distance as the base for the different amplitudes. The second and third weeks were destined to the execution of the velocity Maximum (VMax), Mean Propulsive Velocity (MPV), and Power tests on 40%, 60%, and 80% loads of 1 Repetition Maximum (1 RM), as well as Isometric tests with different disabilities, attached and not attached to the bench. Figure 1 exemplifies the experimental design of the study.

For the Attached condition, the athletes were fixed to the bench press with two bands with a width of 10 cm and a length of 3.0 m, used to fix the athletes' thighs and legs to the bench [7]. It should be noted that the bands cannot be placed on the joints, and they cannot have metallic structures being fixed through Velcro. On the other hand, Not Attached athletes simply placed their upper limbs on the bench without any type of fixation.

2.1. Sample

The sample consisted of 20 male Paralympic Powerlifting athletes, 10 with other disabilities (OD) and 10 with a spinal cord injury (SCI). The participants were classified competitors, eligible to compete in the sport [7], with at least 18 months of experience and training in the sport. Among the deficiencies in the SCI group, nine had a spinal cord injury by accident and one was due to injury caused by the parasite Schistosoma Mansoni in the spinal cord; all were with a spinal cord injury below the eight thoracic vertebrae. In the other disability group (OD), five subjects suffered from amputation, four from artogriposis,

and one from lower limb disability due to traumatic brain injury and. Athletes participated in the study voluntarily and signed an informed consent form. The study was developed in accordance with resolution 466/2012 of the National Research Ethics Commission–CONEP, of the National Health Council, in accordance with the ethical principles expressed in Helsinki Declaration (1964, reformulated in 2013), by the World Medical Association. This study was approved by the Research Ethics Committee of the Federal University of Sergipe, CAAE: 2.637.882 (date of approval: 7 May 2018). The sample characterization is shown (Table 1).
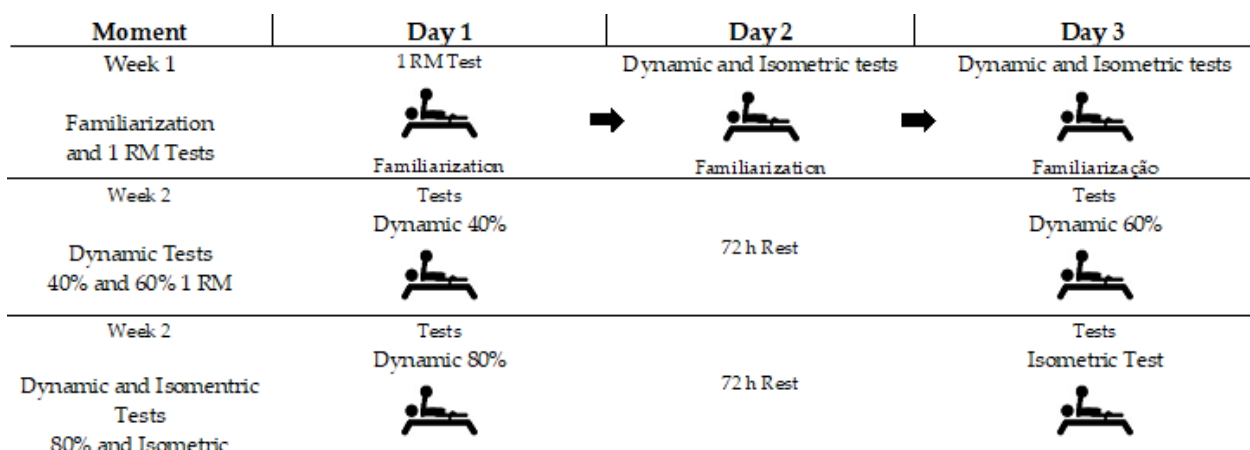
Figure 1. Experimental design. 1 RM: 1-repetition maximum; 40%: 40% 1 RM, 60%: 60% 1 RM, and 80%: 80% 1 RM.

Table 1. Sample characterization.

	Other Disabilities	Spinal Cord Injury	p	ICC	CV	⟨
Age (years)	28.30 ± 4.92	30.00 ± 4.27	0.42	0.384	5.17	0.301
Body mass (Kg)	78.80 ± 18.98	79.90 ± 18.91	0.90	0.336	3.17	0.377
Experience (years)	2.30 ± 0.75	2.81 ± 0.57	0.10	0.280	5.24	0.171
1 RM bench press test (kg)	112.40 ± 32.76	124.60 ± 26.92	0.37	0.437	7.17	0.277
1 RM/weight	1.46 ± 0.35	1.60 ± 0.37 *	0.40	0.560	10.71	0.372

# $p < 0.05$ (independent "t" test). * Values above 1.4 in the Bench Press, would be considered elite athletes, according to Ball and Weidman [15].

The sampling power was calculated a priori using the open-source software G*Power® (Version 3.0; Berlin, Germany), choosing a "F family statistics (ANOVA)" considering a standard $\alpha < 0.05$, $\beta = 0.80$ and the effect size of 1.33 found for the Rate of Force Development (RFD) in Paralympic Powerlifting athletes [9]. Thus, it was possible to estimate a sample power of 0.80 ($F_{(2.0)}$: 4.73) for a minimum sample of eight subjects per group, suggesting that the sample size of the present study has statistical strength to respond to the research approach.

This study followed a static and dynamic force test, we analyzed the effects of two different classifications of disabilities (i.e., OD and SCI) (see Table 1) on the performance of Paralympic Powerlifting athletes at the national level. The study lasted three weeks. The first week aimed at familiarization with the tests of 1 Maximum Repetition (1 RM) and 72 h later with the dynamic and static tests. During week 2, the 1 RM and static tests were performed with a 72 h interval. Records in these sessions included maximum isometric force (MIF), time to MIF (Time), rate of force development (RFD), impulse, variability and fatigue index (FI). Finally, in week 3, the two sessions comprised dynamic tests at 40 and 60% 1 RM and, 72 h later at 80% 1 RM and Isometric tests. In both sessions measurements include mean propulsive velocity (MPV), maximum velocity (Vmax), and power and isometric variables. All tests were performed on different days at the same time (between

9:00 a.m. and noon) at temperatures ranging between 23 °C and 25 °C with a relative humidity of ~60%. All tests were performed on an adapted bench press, in the supine position. The study was carried out at the Federal University of Sergipe. All evaluations were carried out and monitored by an international-level coach, accredited by the Brazilian Paralympic Committee, with a Master's and a Doctorate degree in Physical Education, plus 10 years of experience in the modality.

2.2. Instruments

The body mass of the athletes was measured with the subjects in a sitting position using an appropriate Michetti digital electronic scale, Model Mic Welchair (Michetti, São Paulo, SP, Brazil). An official 210 cm long straight bench and a 220 cm long 20 kg bar were used herein (Eleiko Sport AB, Halmstad, Sweden); both pieces of equipment were approved by the International Paralympic Committee (IPC) [7].

2.3. Determination of Load

The athletes started the testing with a self-selected load estimated to be the maximal load. Weight was then added until the maximum load was attained. If the participant overestimated the initial load, 2.5% of the load was subtracted before a new attempt [8,9]. A rest of 3 to 5 min was provided between attempts, according to the participants' perception of recovery [11,12]. The coefficient of variation between the two measures was at least 94%.

2.4. Warm Up

The participants performed a standardized warm-up for the upper limbs, using three exercises (abduction of the shoulders with dumbbells, military press with dumbbells, and medial and lateral rotation of the arm to warm up the rotator cuff with dumbbells). The warm-up was performed for the upper limbs, using three exercises (shoulder abduction with dumbbells, elbow extension on the pulley, and shoulder rotation with dumbbells) with three sets of 10 to 20 repetitions [11]. Afterwards, a specific warm-up was performed on the bench press with a load of 30% of 1 RM, 10 slow repetitions (3:1 s, eccentric:concentric), and 10 fast repetitions (1:1 s, eccentric:concentric) [11], for approximately 15 min.

2.5. Dynamic Evaluation

The athletes were evaluated during the competitive phase of the season and were familiar with the testing procedures due to their constant training and testing routines. To measure the velocity of movement, a valid and reliable linear position transducer [16], Force Measurement System Speed4Lift SL$^®$ (Mostoles, Madrid, Spain) was attached to the bar. The MPV and VMax were collected for analysis purposes with loads of 100% 1 RM [9,12,17–19].

2.6. Isometric Force Measurements

The measures of muscle strength, Maximum Isometric Force—MIF (N), Time to MIF (μs), RFD (N.s^{-1}), Impulse (N.s), Variability (N), and Fatigue Index—FI (%), were determined by a Chronojump force sensor (Chronojump, BoscoSystem, Barcelona, Spain). The perpendicular distance between the force sensor and the center of the joint was determined and used to calculate joint torques and FI [9,11,12,20]. FIM was measured by the maximum isometric force generated by the muscles of the upper limbs. The MIF, Time, RFD, Impulse, Variability, and FI were calculated, as explained in another study by our group, and were performed with all subjects not tethered to the bench [12,21].

The Maximum Isometric Strength (FIM) was determined by the maximum strength of the upper limbs, and an elbow angle close to 90° was maintained, at a distance of 15 cm from the bar to the chest. Athletes were instructed to make a single maximum movement (as fast as possible). The fatigue index (FI) was determined in the same way as the FIM, where the athletes maintained the maximum contraction for 5.0 s. The FI was calculated by

the formula: FI = ((FINAL END—initial END/final END) X100). The RFD was calculated by the force/time ratio (RFD = Δ force/Δ time) [12,21].

2.7. Statistics

Descriptive statistics were performed using measures of central tendency, mean (X) ± Standard Deviation (SD), and 95% confidence interval (95% CI). To verify the normality of the variables, the Shapiro–Wilk test was used. The data for all variables was homogeneous and normally distributed. To compare conditions of exercise (SCI × OD) and conditions (Attached × Not Attached) of measurement, the ANOVA (Two Way) test was performed with Bonferroni's Post Hoc. To check the effect size, the partial Eta squared (η2p) was used, adopting values of low effect (≤0.05), medium effect (0.05 to 0.25), high effect (0.25 to 0.50), and very high effect (>0.50) [22]. In comparisons between groups (SCI x OD), Student's *t*-test was used. For the t-test, an effect size (Cohen's d) was calculated, adopting values of low effect (≤0.20), medium effect (0.20 to 0.80), high effect (0.80 to 1.20), and very high effect (>1.20) [23,24]. The variation coefficient (CV%) was calculated by the formula: CV% = (standard deviation (SD)/mean) × 100. In addition, we calculated the intraclass correlation coefficient (ICC), whose magnitudes were determined as [25]: absence: <0; bad: 0–0.19; weak: 0.20–0.39; moderate: 0.30–0.59; substantial: 0.60–0.79; and almost complete: ≥0.80. Statistical analyses were performed using the Statistical Package for the Social Science (SPSS) version 22.0 software (SPSS, IBM Corp., Armonk, NY, USA). The level of significance was set at $p < 0.05$.

3. Results

The results found in MPV (m.s^{-1}) (Figure 2), Vmax (m.s^{-1}) (Figure 3) and Power (W) (Figure 4), in subjects SCI and OD are in the percentages of 40% to 90% of 1 RM.
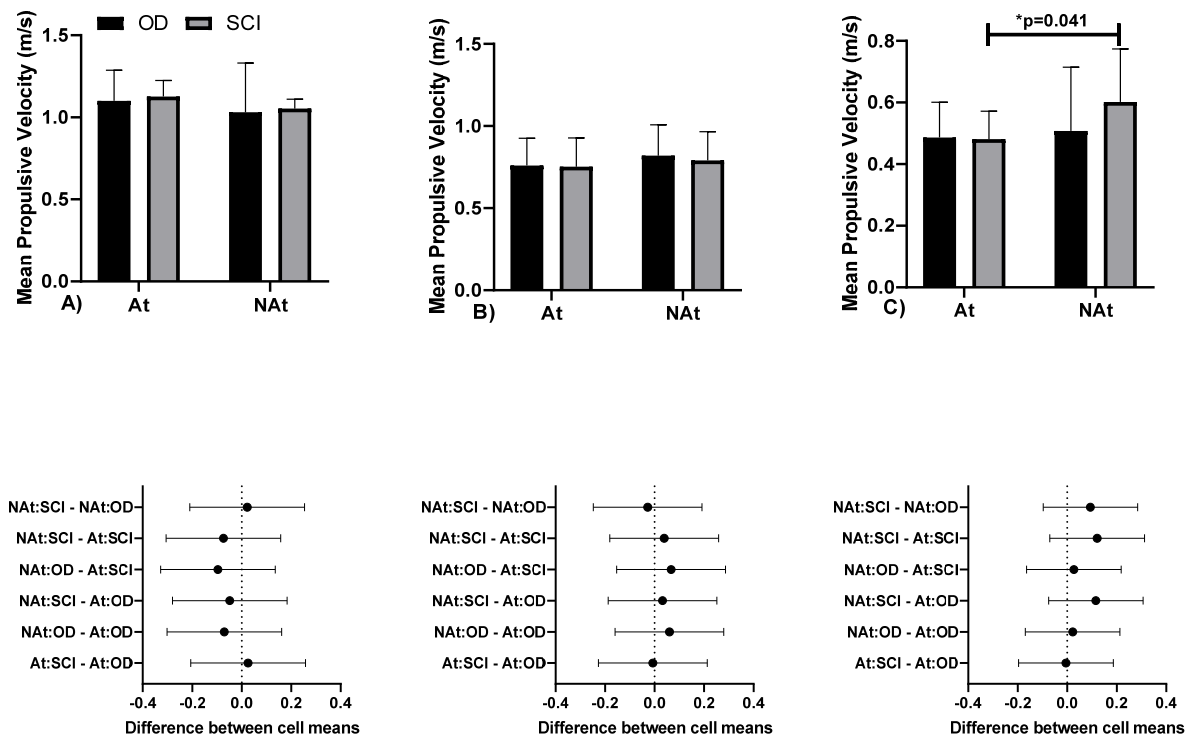
Figure 2. Analysis of dynamic force indicators, mean propulsive velocity (m/s) measured from (**A**) 40%, (**B**) 60%, and (**C**) 80% of 1 RM in OD and SCI groups Attached and Not Attached, at 95% Confidence Intervals (CI). * $p < 0.05$ (two-way ANOVA, and Bonferroni's Post Hoc). CI "-"indicates move away from the value to the left and unsigned away from the value to the right. **Legend:** SCI: Spinal Cord Injury; OD: Other Disability; At: Attached; Nat: Not Attached; and 1 RM: 1 Repetition Maximum.
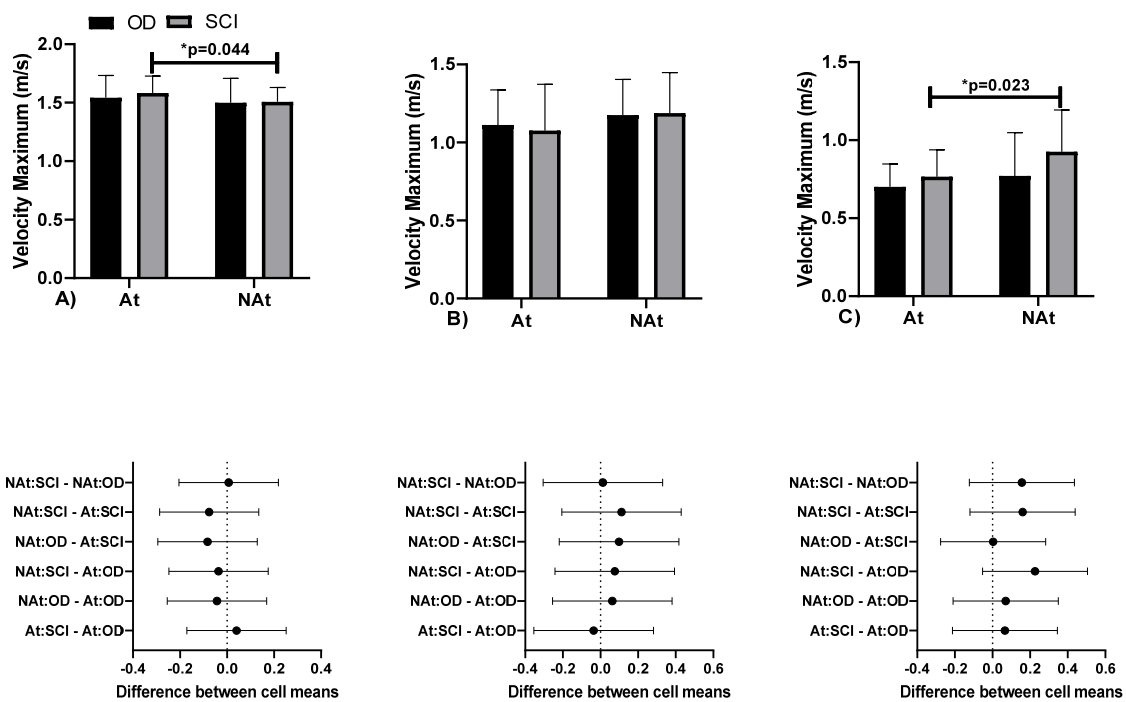
Figure 3. Analysis of dynamic force indicators, velocity maximum (m/s) measured from (**A**) 40%, (**B**) 60%, and (**C**) 80% of 1 RM in OD and SCI groups, Attached and Not Attached, at 95% Confidence Intervals. * $p < 0.05$ (two-way ANOVA, and Bonferroni's Post Hoc). CI "-"indicates move away from the value to the left and unsigned away from the value to the right. **Legend:** SCI: Spinal Cord Injury; OD: Other Disability; At: Attached; Nat: Not Attached; and 1 RM: 1 Repetition Maximum.
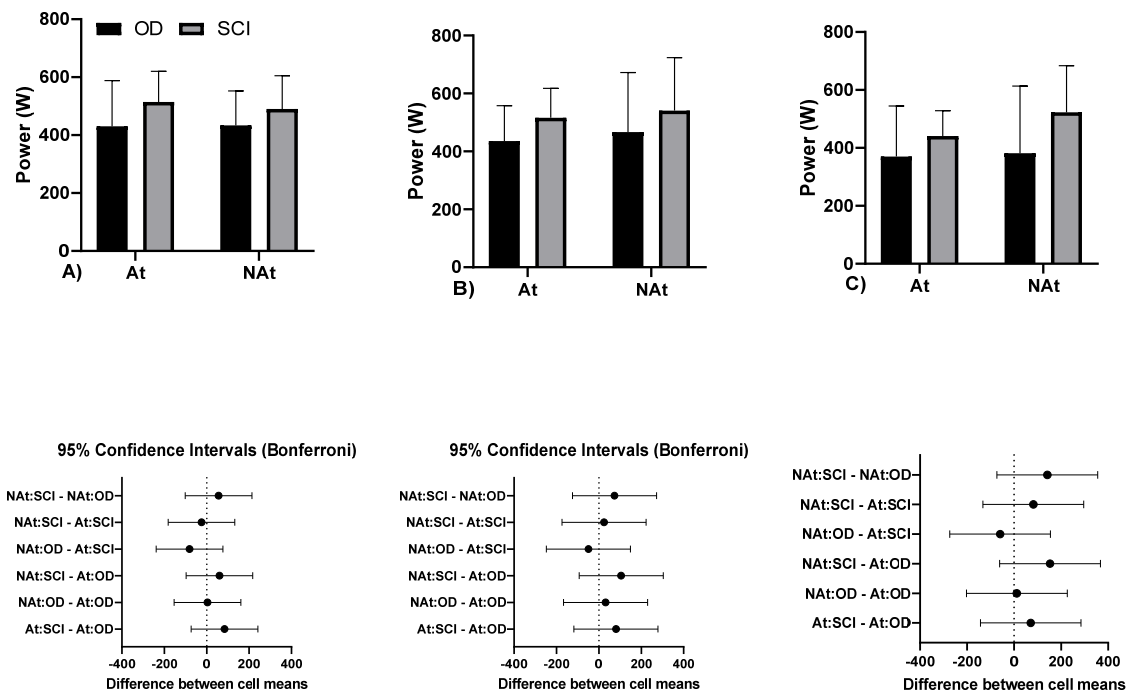
Figure 4. Analysis of dynamic force indicators, Power (W) measured from (**A**) 40%, (**B**) 60%, and (**C**) 80% of 1 RM in OD and SCI groups, Attached and Not Attached, at 95% Confidence Intervals. * $p < 0.05$ (two-way ANOVA, and Bonferroni's Post Hoc). CI "-"indicates move away from the value to the left and unsigned away from the value to the right. **Legend:** SCI: Spinal Cord Injury; OD: Other Disability; At: Attached; Nat: Not Attached; and 1 RM: 1 Repetition Maximum.

The results found in the static mechanical variables (isometric) (FIM, Time, RFD, Impulse, Variability, FI) of the subjects OD and SCI are shown in Table 2.

Table 2. Indicators of dynamic and isometric strength with 100% of 1 RM (mean ± standard deviation) in spinal-cord-injured and other disabled individuals.

	OD	SCI	*p*	Cohen's d
1 RM (kg)				
MIF (N)	761.46 ± 252.17	869.46 ± 152.78	0.08 *	0.61 [b]
Time (μs)	2567.58 ± 1292.28	2528.71 ± 1311.88	0.90	0.04 [a]
RFD (N.s^{-1})	2553.16 ± 1319.00	2508.30 ± 923.85	0.88	0.49 [b]
Impulse (N.s)	3392.48 ± 1214.40	3984.80 ± 707.02	0.06 *	0.69 [b]
Variability (N)	41.62 ± 17.88	43.20 ± 22.21	0.75	0.10 [a]
FI (%)	12.34 ± 5.64	9.11 ± 2.83	0.03 *	0.79 [b]

* $p < 0.05$ (two-way ANOVA, and Bonferroni's Post Hoc). [a]: Small Effect (≤0.20), [b]: Medium Effect (0.20 to 0.80), [c]: High Effect (0.80 to 1.20), [d]: Very High Effect (>1.20); 1 RM: 1 Repetition Maximum; MIF: Maximum Isometric Force; Time; Time to MIF; RFD: Rate of Force Development; FI: fatigue index; OD: Other Deficiencies and SCI: Spinal cord injury.

The results found in MPV (m/s) (Figure 2), Vmax (m/s) (Figure 3), and Power (W) (Figure 3), in subjects OD and SCI, are in the percentages of 40, 60, and 80% of 1 RM, Attached and Not Attached.

Mean Propulsive Velocity (m/s) measured from 40 %to 80% of 1 RM in OD and SCI. (A) 40% 1 RM, and (B) 60 1 RM, no differences were found. (C) 80% 1 RM indicates difference in SCI between Attached and Not Attached ($p = 0.044$; F = 5.161; and η2p = 0.364, high effect).

Velocity Maximum (m/s) measured from 40% to 80% of 1 RM in OD and SCI; (A) 40% 1 RM; (B) 60% 1 RM, no differences were found; and (C) 80% 1 RM, indicates difference in SCI between Attached and Not Attached ($p = 0.023$; F = 8.475; and η2p = 0.485, high effect).

Power (W) measured from 40% to 80% of 1 RM in OD and SCI; (A) 40% 1 RM, (B) 60% 1 RM, and (C) 80% 1 RM, no differences were found.

4. Discussion

The objective of this study was to evaluate dynamic and static indicators of strength, at different intensity levels as well as tethered and untethered, in relation to performance in Paralympic Powerlifting, in athletes with and without SCI. As main results, we obtained: (i) in the dynamic evaluation, the fact that the athletes were tied up or not did not promote differences; (ii) athletes with SCI obtained similar results to athletes without spinal cord injury and even with better numerical results in relation to average propulsive velocity, regardless of being tied up or not; (iii) in terms of speed, athletes with SCI and OD did not show differences between them, with differences in relation to athletes with SCI tied and not tied; (iv) there were no differences between athletes with SCI and OD in terms of power, regardless of whether they were tied up or not, or indifferent to intensity; and (v) there were no differences in static strength indicators when comparing SCI and OD.

The results showed an inverse relationship between speed and load. These findings were already expected and agree with other studies [18,26], while still other studies showed differences in terms of positioning on the bench, arched or flat, and that these could interfere with the speed of execution from the bench press [27]. Thus, performing the bench press in an arched way would allow a more vertical displacement of the bar, providing a better transfer of force [28]. Our findings contradict this hypothesis, and SCI obtained similar results to athletes with other disabilities, demonstrating that the practice of PP can be a sustainable practice that tends to improve the condition of athletes with SCI.

It should be noted that in Paralympic Powerlifting (PP), the lifts are performed with legs extended over the bench, with the athletes being strapped or not. This position, by itself, tends to reduce the transfer of force in the PP [14]. As mentioned, this lack of strength was not observed in our study, emphasizing that the practice of PP could be an indicated

practice to sustain this improvement in terms of strength generation in the SCI, where the results indicate that there are no differences in strength indicators, static and dynamic, between SCI and OD, whether or not they are tied. However, our findings, at maximum speed, found differences between whether SCI was tied or not, in loads of 40% and 80% of 1 RM, with no differences in the load of 60% of 1 RM. On the other hand, SCI, whether tied or tied, did not present numerically higher speeds than OD, a fact that was observed in relation to a higher speed in less-trained subjects compared to more-trained ones [17], although there were no significant differences. Still, in the same direction, a study with PP found extremely low execution speed in the adapted bench press [19]. An explanation for this fact would be that PP athletes tend to train with higher loads, which would bring an adaptation in relation to the speed of the bar. Perhaps this is explained by sport-specific adaptations, not mentioned in other studies, in which athletes with lower-limb deficiency tend to produce more strength in the upper limbs [29–31], and this should be the subject of more studies; however, there may be a relationship with the greater use of the upper limbs to get around, especially in the use of wheelchairs and of crutches [32].

In PP, athletes usually have lower limb impairment. Thus, the deficiency in the lower limbs would cause a decrease in the systemic response, considering the smaller muscle mass involved in activities with the use of the lower limbs, which would promote a reduced cardiorespiratory response [33]. The same author described that in the cycle ergometer for upper limbs, the maximum power and VO2 peak of subjects without SCI would be lower by 40% and 25%, respectively, when compared to the cycle ergometer performed with lower limbs. In the same direction, the pattern of muscle response in the bench press with loads from 60% to 100% 1 RM, showed differences in muscle activation in the deltoid, triceps, and pectoralis major muscles between athletes with SCI and conventional athletes [29]. From what is expected of subjects with disabilities, when opposing greater loads, this would lead to an increase in muscle activity [30], and these activations would be related to muscle control [31]. On the other hand, a study that evaluated the bench press rather than the flat and arched position showed that there were no differences between the two, regarding the trajectory and average speed of the bar, emphasizing that the increased support with the use of a fixation band, as in the case of the PP, can provide greater stability to the athletes [34]. However, in terms of bar speed and power, our study did not indicate differences notably for OD athletes, with differences for SCI between tethered and untethered: with higher loads the untethered condition presented itself as better, and with smaller loads the tether was better. However, there were no differences between SCI and OD, both for tethered and untethered.

For our results on potency, no differences were found between SCI and OD, nor tethered and untethered conditions. Contrary to this, one study found differences in OD at 90% intensity compared to 60% and 80% of 1 RM; there was no difference in SCI and OD [26]. An explanation for the SCI result would be linked to diaphragmatic fatigue due to training. In the case of SCI, the diaphragm would contract and expand the rib cage during inspiration; now, it would oppose the mechanical forces transmitted by the thorax, still combined with the supine position, as this would tend to influence the respiratory dynamics and make it difficult to express force in SCI [35,36], emphasizing that these aspects were not observed in our findings.

SCI and OD athletes showed no differences in terms of age, 1 RM, technical index (lifted load/body weight), and training time. In this sense, a study that evaluated experienced and beginner athletes did not observe differences in speed between the groups [37].

In the evaluation of isometric strength indicators, no differences were found between SCI and OD, in relation to MIF, Time to MIF, RFD, Impulse, Variability, and FI. Perhaps this is explained by the fact that PP athletes can exert more force against higher loads and, consequently, at lower speeds. This fact would be a specific adaptation of the training [38–40]. A similar result was found in another study in which the static variables also tended not to show differences between athletes with SCI and OD, notably in national level athletes [26].

These findings corroborate ours and this would be an adaptation in relation to training aiming at maximum strength, that is, Paralympic Powerlifting [41].

On the other hand, it has been proposed that improvements in the quality of functional movements in athletes would be subject to additional training aimed at improving specific points. However, the results with specific and traditional training showed similar improvements, which corroborates our findings that PP training would have been enough to improve deficiencies of differentiated etiologies, SCI or OD [42].

With regard to physiological aspects, there is evidence that spinal dysfunction has interfered with neuromuscular control. A review of central segmental motor control would interfere with neuromuscular function and how spinal adjustments (high velocity, low amplitude or impulses) and manipulation (impulses) tend to alter neuromuscular function. Spinal adjustments have been shown to tend to increase strength and decrease fatigue, which would occur due to altered supraspinal excitability and multimodal integration. Thus, initially, it has been mentioned that physical injury, pain, inflammation, and acute or chronic physiological or psychological stress can alter spinal central neural motor control [43]. However, once again our findings are contrary, indicating that strength training, of the PP type, can be beneficial for athletes with SCI, when compared to OD.

The present study has some limitations. Among them, we highlight the sample size, where other studies with a greater number of athletes would be important. One limitation was because the study included only male athletes. Another limitation refers to the fact that the analyzes were performed only on the PP bench, which does not allow an extrapolation to other situations, muscle groups or other movements related to activities of daily living. Thus, we suggest that other studies be carried out to evaluate the interference of experience and training time on the variables studied. No covariates that could interfere with the findings were observed. Other surveys could also assess strength related to activities of daily living and other types of disabilities.

5. Conclusions

From the findings, we conclude that PP athletes with SCI present the same strength pattern, or even higher, when compared with OD. Thus, the static and dynamic strength indicators in PP were similar for athletes with SCI and RE. In this sense, it seems that strength training for PP tends to be a sustainable practice allowing the supply and adaptation in terms of strength in athletes with SCI and OD.

In view of the above, the rules issued by the International Paralympic Committee of functional classification, with a single classification for PP, have support in the scientific sphere, where athletes with SCI and OD presented similar strength levels.

Finally, coaches who are going to train athletes with SCI or OD could use the findings as a way of justifying training aimed at PP to promote a similar and sustainable development for athletes with OD and with SCI, where the difficulty of force generation for SCI seems not to be present in PP athletes. On the other hand, even with no differences, athletes with SCI tend to produce more strength, speed, and static strength, especially at higher loads, and PP may be an important approach for this follow-up. Thus, it seems that strength training, focused on PP, seems to be enough to provide a strength gain for SCI when compared to OD, and these findings should be explored by coaches.

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

Funding: This research was funded by Fundação para a Ciência e Tecnologia/Ministério da Ciência, Tecnologia e Ensino Superior through national funds and, when applicable, co-funded by EU funds under the project UIDB/EEA/50008/2020.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Research Ethics Committee of the Federal University of Sergipe, CAAE: 2.637.882 (date of approval: 7 May 2018).

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

Data Availability Statement: The data that support this study can be obtained from the address: www.ufs.br/Department of Physical Education. Accessed on 15 December 2021.

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

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